Chapter 2

Exploring Common Equilbrium in Youth Unemployment Through Club Convergence Analysis: The Case of European Union Countries And Türkiye

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Abstract

This study aims to analyze the dynamics and convergence processes of youth unemployment rates in 27 European Union member countries and Türkiye for the period 1991-2023. Using the Phillips and Sul (2007) club convergence method, the study examines whether countries converge to a common equilibrium level in terms of youth unemployment rates. This method allows for identifying heterogeneous dynamics and analyzing how countries behave within different groups (clubs).

The findings reveal that while countries generally do not converge to a common equilibrium level, they form three distinct clubs. In Club 1, youth unemployment rates have increased notably after 2010. In contrast, countries in Club 2 have demonstrated significant improvements in reducing youth unemployment rates, moving closer to the panel average. The countries in Club 3 have distinguished themselves from other groups with low youth unemployment rates and have consistently maintained this success. These results underscore the pivotal role of economic crises, structural reforms, and labor market policies in shaping youth unemployment rates.

1. Introduction

Youth unemployment, defined as the inability of individuals in the 15-24 age group to find employment despite their willingness to participate in the labor market, is a critical issue that directly impacts both economic growth and social welfare. This age group is in a transitional phase from

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education to the labor market, making youth unemployment rates significant indicators of the overall health of the economy and the efficiency of labor markets. In societies with high youth unemployment, social and economic costs tend to escalate, leading to productivity losses, income inequality, and societal unrest. The underlying causes of youth unemployment include the mismatch between education systems and labor market needs, economic recessions, structural issues in labor markets, and inadequate job-seeking skills. Additionally, regional disparities and economic integration processes are significant determinants of youth unemployment (ILO, 2020). The patterns and underlying causes of unemployment differ significantly between developed and developing countries (Taş & Bozkaya, 2012: 161). Globally, youth unemployment rates have shown an upward trend during economic crises, with the COVID-19 pandemic further exacerbating this issue. According to the ILO (2020) report, the global youth unemployment rate rose to 14.6% following the pandemic, with even higher rates observed in developing countries. In Europe, youth unemployment rates vary regionally, with Southern European countries generally exhibiting higher rates (Eurostat, 2021).

The long-term effects of youth unemployment include delayed career progression due to late entry into the labor market, social exclusion, low income levels, and psychological challenges. These consequences negatively affect not only individuals but also economic growth and social cohesion (Bell & Blanchflower, 2011). Integrating youth into the labor market is thus of paramount importance for achieving countries' long-term development goals. However, significant differences in youth unemployment rates across countries and regions highlight the existence of convergence or divergence processes within labor markets. This raises the critical question of whether unemployment rates are moving toward a common equilibrium level over time, a subject of considerable interest to economic policymakers and academics.

The primary priority of economic policies, regardless of the economic system implemented, is to reduce unemployment or maintain it at the lowest possible level (Apaydın, 2019: 1002). Various methodologies have been developed to examine the impacts of economic integration and structural reform processes on unemployment rates. The *club convergence* method proposed by Phillips and Sul (2007) offers a robust tool for analyzing heterogeneous dynamics among countries or regions. This method not only assesses the presence of general convergence trends but also identifies distinct subgroups with different equilibrium levels and examines the dynamics within these groups. Research on youth unemployment rates has

demonstrated that factors such as the effects of economic crises, structural reforms, and policy alignment processes significantly shape these dynamics (Phillips & Sul, 2007; Panopoulou & Pantelidis, 2012).

The aim of this study is to analyze the convergence trends in youth unemployment rates for 27 European Union member states and . Differences in youth unemployment rates reflect structural challenges and the effectiveness of labor market policies across countries, making such analyses valuable for policymakers. The study employs a long-term panel dataset spanning 1991-2023, sourced from the World Bank's official website. The analysis is based on the *club convergence* method developed by Phillips and Sul (2007), which allows for a detailed examination of heterogeneous dynamics across countries.

The study focuses on determining whether there is a general convergence trend toward a common equilibrium in youth unemployment rates. In the absence of panel-wide convergence, the study evaluates the presence of distinct convergence clubs among countries and the characteristics of these clubs. This approach aims to deepen understanding of the causes and consequences of heterogeneity in youth unemployment rates.

Analyzing youth unemployment convergence is a relatively underexplored area, and the unique contribution of this study lies in its focus on the specific dynamics of youth unemployment. By examining the heterogeneous dynamics of youth unemployment across countries, the study evaluates the impacts of economic crises, structural reforms, and policy differences. The use of advanced convergence methodologies facilitates the analysis of not only general convergence trends but also the similarities and differences among various groups (clubs). This approach provides policymakers with targeted solutions for reducing youth unemployment while offering a more comprehensive understanding of its economic and social implications. The study aims to make a unique contribution to the literature by evaluating the structural factors and global trends influencing youth unemployment in EU countries and Türkiye.

2. LİTERATURE REVİEW

Labor market dynamics are crucial determinants of economic performance and social welfare. In particular, regional and national unemployment convergence trends are significant indicators of reducing economic inequalities between countries and regions and achieving an integrated labor market. The literature on unemployment convergence aims to understand the dynamics of this process through various methodologies applied across

different geographical regions and time periods. Below are chronological examples of studies analyzing labor market convergence.

Martin (1997) examined the regional dynamics of unemployment rates in the United Kingdom, which doubled every decade starting from the 1960s. The study found that regional unemployment trends exhibited a high degree of synchronicity during this period, with persistent regional disparities in unemployment rates. These persistent disparities were interpreted as evidence of equilibrium within the regional labor market system. Rowthorn and Glyn (2006) analyzed how state-level employment rates in the United States responded to regional labor market dynamics, finding that regional unemployment rates in the U.S. also demonstrated significant persistence. Costantini and Lupi (2006) analyzed regional unemployment rates in Italy, evaluating long-term disparities and convergence dynamics among regions. Using data from 1977-2003, they employed panel unit root and cointegration methods to test the stochastic convergence hypothesis. The findings indicated that regional unemployment rates did not exhibit stochastic convergence, thus demonstrating persistent disparities over time. However, the possibility of long-term equilibrium relationships among some regions was also identified. Bayer and Juessen (2007) investigated the persistence of regional unemployment disparities in West Germany from 1960 to 2002 using time-series analysis methods. Univariate unit root tests suggested that regional unemployment differences were persistent, while more robust panel unit root tests indicated that these differences were temporary, suggesting convergence of unemployment rates across regions over time. However, the pace of this convergence was limited. Unit root tests accounting for structural breaks revealed that convergence accelerated following the second oil crisis, with regional unemployment rates adapting more rapidly to a new equilibrium. Mello and Guimarães-Filho (2007) analyzed the stochastic convergence dynamics of OECD countries using per capita income data. The study employed fractional time series techniques to test the convergence hypothesis for non-stationary stochastic processes exhibiting long-term dependence. The analysis revealed significant convergence trends among OECD countries in pairwise comparisons when income shocks were characterized by long-term dependence.

Carrera and Rodríguez (2009) examined the convergence trends of unemployment rates in 13 European countries from the first quarter of 1984 to the fourth quarter of 2005. Their study utilized various unit root tests to assess both stochastic and β-convergence. The results demonstrated that, particularly after 1993, most European countries entered a convergence process for unemployment rates. Gomes and da Silva (2009) investigated

the dynamics of unemployment rates in six major metropolitan regions of Brazil (São Paulo, Rio de Janeiro, Belo Horizonte, Porto Alegre, Salvador, and Recife) as well as nationwide. Their study employed unit root tests that account for structural breaks to test the hypotheses of hysteresis and the Non-Accelerating Inflation Rate of Unemployment (NAIRU). The findings indicated the presence of a hysteresis effect in all regions except Rio de Janeiro and at the national level, demonstrating a high degree of persistence in unemployment rates. Furthermore, a stochastic convergence analysis conducted for the five metropolitan regions exhibiting hysteresis revealed that only Porto Alegre did not converge to the national unemployment rate. Tyrowicz and Wójcik (2010) analyzed the dynamics of regional unemployment in Poland using NUTS4-level data from 1999–2006. They applied β and σ convergence tests, commonly used in income convergence studies. The findings revealed that unemployment rate distributions remained relatively stable over time, with weak "club convergence" observed in regions with high unemployment rates. However, the β and σ convergence hypotheses were not generally supported. Katrencik, Tyrowicz, and Wójcik (2010) extended this analysis to transitional economies, examining unemployment convergence in the Czech Republic, Poland, and Slovakia using NUTS4-level data from 1995–2005. Applying β and σ convergence tests and time series analyses, the results indicated no evidence of unemployment rate convergence, suggesting persistent disparities across regions. De Figueiredo (2010) examined the dynamics of regional unemployment in Brazil using fractional integration, structural break analysis, and Markov switching models. This study covered monthly data from 1982–2003, focusing on five major metropolitan regions. The findings indicated that unemployment rates exhibited long memory properties and structural breaks. Additionally, Markov switching models showed that unemployment rates transitioned between different regimes, with significant persistence in these regimes, highlighting their importance for understanding regional labor market dynamics. Nyong (2013) investigated the dynamics of unemployment rates across Nigeria's 36 states and their convergence toward the national average. Using unit root tests accounting for structural breaks and an Autoregressive Fractionally Integrated Moving Average (ARFIMA) model, the findings revealed convergence in some states while others exhibited persistent disparities. Estrada, Galí, and López-Salido (2013) analyzed macroeconomic convergence and divergence dynamics among Eurozone countries from 1999 to 2012, focusing on unemployment, inflation, relative prices, and current account balances. Using advanced economies outside the Eurozone and pre-EMU data as controls, the study revealed initial convergence trends

in unemployment rates, which reversed significantly after the 2008 financial crisis, leading to pronounced disparities among countries. Bratu (2014) examined the convergence trends of unemployment rates in the European Union between 2002 and 2012, using national data. The results suggested that unemployment rates exhibited convergence among EU countries, although the speed of this convergence varied significantly between nations. Notably, new member states demonstrated faster convergence compared to older members. Dikmen and Dursun (2015) analyzed unemployment rates in 12 Latin American countries from 1980–2015, assessing hysteresis and convergence tendencies using a nonlinear panel unit root test with threshold autoregressive (TAR) specifications. The findings indicated that unemployment hysteresis was valid under one regime, while convergence trends were observed under another. Colombia exhibited the fastest convergence rate under the second regime. Cuestas, Monfort, and Ordóñez (2015) examined unemployment rate convergence dynamics and their determinants in Central and Eastern European countries from 1995–2011. Using logistic smooth transition autoregressive (LSTAR) models and β-convergence tests, the study found no complete convergence across countries but identified two distinct convergence clusters: one comprising Hungary and Poland and another including the Czech Republic and Slovakia.

Beyer and Stemmer (2016) analyzed the spatial distribution of regional unemployment rates in Europe from 1986–2013. Their study highlighted polarization during 1986–1996, convergence during 1996–2007, and re-polarization during the 2007–2013 financial crisis, reflecting significant regional disparities. Çifçi (2016) examined convergence tendencies in youth, adult, and total unemployment rates across NUTS2 regions in Türkiye from 2004–2014 using spatial econometric methods. The study identified spatial dependencies, with high and low unemployment regions forming distinct clusters. Baktemur and Özmen (2017) investigated unemployment rate dynamics in advanced EU countries (e.g., Germany, France, the UK, the Netherlands, and Spain) from 1995–2013 using spatial econometric methods. While spatial dependencies were evident, no significant convergence dynamics were identified, highlighting limited harmonization in labor markets. Aral and Aytaç (2018) conducted spatial analyses of unemployment rates across Türkiye's 81 provinces, identifying spatial clusters of high and low unemployment regions. Using Moran's I statistics and spatial regression models, the study emphasized the importance of regional interdependencies in explaining unemployment patterns. Krištić, Dumančić, and Arčabić (2019) analyzed unemployment persistence and stochastic convergence among Eurozone countries from 1995–2016 using

LM and RALS-LM unit root tests. Their findings highlighted that Eurozone membership alone did not guarantee unemployment rate convergence, although economic integration contributed to reduced disparities in certain cases. Kónya (2020) explored unemployment convergence in EU countries from 1991–2014, applying σ, stochastic, and β-convergence methodologies. The results indicated general convergence trends across the EU, with variations based on country groups. Demir (2021) examined unemployment dynamics in Balkan countries from 1991–2020 using spatial econometric methods. The study revealed significant spatial dependencies and interrelations among neighboring countries' unemployment rates. Hadizadeh (2021) assessed stochastic convergence of unemployment rates across 50 U.S. states from 1976–2018 using quantile unit root tests. The findings supported stochastic convergence for 41 states, with varying behaviors across quantiles. Çorakcı, Omay, and Hasanov (2022) analyzed unemployment dynamics in Eurozone countries from 2000–2020 using advanced panel unit root tests incorporating structural breaks and nonlinear adjustments. The results confirmed the stationarity of unemployment rates and stochastic convergence across Eurozone members. Demirapl and Belliler (2023) examined unemployment rates in G-20 countries from 1991–2022 using Fourier panel unit root analysis. The findings highlighted significant convergence tendencies among most countries, excluding China, South Korea, and Argentina, with variations attributed to Fourier terms.

Analyses of labor markets reveal significant disparities in the convergence processes of unemployment rates across countries and regions. In economic unions such as the European Union and the Eurozone, pre-crisis periods exhibited noticeable convergence trends in unemployment rates, while these trends reversed in the aftermath of economic crises. In contrast, unemployment rates in developing economies have shown a tendency for persistence, with strong hysteresis effects observed in certain regions. Advanced methods such as spatial analyses and nonlinear unit root tests have enhanced the understanding of unemployment dynamics at both regional and national levels, emphasizing the need for policymakers to address these differences. Overall, the convergence process of unemployment rates is closely linked to the effectiveness of economic integration, structural reforms, and crisis management policies. Addressing labor market imbalances requires more comprehensive and targeted policy interventions.

3. DATA AND EMPIRICAL METHODOLOGY

This study analyzes whether the youth unemployment rates of 28 countries, including the 27 member states of the European Union and Türkiye, exhibit convergence. The primary objective is to identify similarities and differences in youth unemployment rates among these countries, establishing models of convergence or divergence. The study aims to evaluate whether trends in youth unemployment rates reach a common equilibrium and to explore the relationships between labor markets across the countries.

The dataset used in this study comprises youth unemployment rates derived from the official World Bank (2024) website, covering the 1991–2023 period. This extensive panel dataset enables a detailed examination of labor market dynamics across countries.

The analysis applies the club convergence approach (log t-test regression) developed by Phillips and Sul (2007), which tests the hypothesis of convergence in panel datasets. This method assesses whether countries converge toward a common equilibrium over time and identifies distinct subgroups (clubs) of countries that may converge independently. It is particularly effective for analyzing convergence or divergence patterns among countries with heterogeneous dynamics. The Phillips and Sul method employs the following fundamental equation within panel datasets:

$$X_{it} = g_{it} + a_{it} \tag{1}$$

In this equation, g_{it} represents systematic components, which may create cross-sectional dependence due to their inclusion of permanent common factors. On the other hand, aitait refers to transitory components. Since the model does not impose specific parameter assumptions on the systematic or transitory components, it can encompass linear or nonlinear, stationary or non-stationary processes. Moreover, the model, in its current form, incorporates both common factors and individual (idiosyncratic) elements.

To separate these two components within the panel, the authors reorganize Equation (1) as follows:

$$X_{it} = \left(\frac{g_{it} + a_{it}}{\mu_t} \right) \mu_t = \delta_{it} \mu_t \tag{2}$$

In Equation (2), μ_t represents a common factor, while δ_{it} denotes a time-varying individual component. If μ_t reflects one of the common trends within the panel, δ_{it} measures the relative contribution of individual i to this

trend at time t. Thus δ_{it}, serves as an indicator of the individual economic divergence between the observed variable (X_{it}) and the common trend factor μ_t. Moreover, Equation (2) implies that μ_t follows a time-varying factor model, with the assumption that as t→∞, this factor dominates the transitory component (aitait) in Equation (1) (Phillips and Sul, 2007).

Since μ_t is considered a common factor in Equation (2), its effects are neutralized through a scaling method, which allows for the computation of relative factor loadings or transition parameters. This approach, which relies on cross-sectional averages instead of differences, makes it possible to eliminate the common factor from the system and facilitates the implementation of relative convergence tests (Phillips and Sul, 2007; Panopoulou and Pantelidis, 2012; Du, 2017).

$$h_{it} = \frac{X_{it}}{\frac{1}{N}\sum_{i=1}^{N} X_{it}} = \frac{\delta_{it}}{\frac{1}{N}\sum_{i=1}^{N} \delta_{it}} \tag{3}$$

h_{it} is a variable that measures the loading coefficient in relation to the panel average and is referred to as the relative transition parameter. This parameter represents the dynamics and position of country i in its transition process at time t. By definition, the cross-sectional mean of this parameter is always equal to one, as all panel units are evaluated relative to the same common trend. If the factor loadings converge to a constant value (δ), h_{it} also converges to one, indicating that a common equilibrium level has been reached. Furthermore, during this convergence process, the cross-sectional variance of h_{it}, which measures the differences between transition paths, approaches zero. This implies that the individual units within the panel begin to share a common trend over time, thereby reflecting a decrease in the level of heterogeneity (Phillips and Sul, 2007; Phillips and Sul, 2009; Panopoulou and Pantelidis, 2012).

$$H_{it} = \frac{1}{N}\sum_{i=1}^{N}\left(h_{it} - 1\right)^2 \to 0 \ \ if \lim_{t\to\infty} \delta_{it} = \delta, for\ all\ i \tag{4}$$

Within this convergence framework, Phillips and Sul (2007) developed the log t regression model to test whether countries or cross-sectional units converge to a common equilibrium. The model tests the null hypothesis ($\mathcal{H}_0 : \delta_i = \delta,\ \alpha \geq 0$), which assumes that all units converge to a common equilibrium, against the alternative hypothesis ($\mathcal{H}_A : \delta_i \neq \delta,\ \alpha < 0$

), suggesting that some units fail to reach this equilibrium. This method provides a robust tool for analyzing heterogeneity by examining both the speed of convergence and potential subgroups. The model proposed by Phillips and Sul (2007) is expressed as follows:

$$log\left(\frac{H_1}{H_t}\right) - 2logL(t) = \hat{\alpha} + \hat{b}log(t) + \hat{u}_t \tag{5}$$

$$for\, t = [rT], [rT]+1, \ldots, T \quad with \quad r > 0$$

Here:

$t = [rT], [rT]+1, \ldots, T$ represents the time dimension, where $r > 0$ denotes the truncation parameter.

$L(t) = \log(t+1)$, is the logarithmic transformation of time.

$\hat{b} = 2\hat{\alpha}$, is the estimated coefficient of $log(t)$, representing the speed of convergence.

In this method, $\hat{\alpha}$ is interpreted as an estimate of the speed of convergence under the null hypothesis $\mathcal{H}_0$ which assumes that all units converge to a common equilibrium level. If $t_{\hat{b}} < -1.65$ (at a 5% significance level), the convergence hypothesis is rejected, indicating that not all units in the panel reach a common equilibrium. For the truncation parameter (r), Phillips and Sul (2007) propose different values depending on the length of the dataset. For datasets spanning T ≥ 100 (long periods), r = 0.20 is used, while for shorter datasets T < 50, r = 0.30 is preferred. This parameter defines the starting point of the analysis, allowing the method to capture time-varying dynamics more accurately (Phillips and Sul, 2007; Sun et al., 2020).

The methodology developed by Phillips and Sul (2007) is a flexible and robust analytical tool widely applied in the literature, offering several advantages. The approach does not rely on assumptions of stationarity or stochasticity for either the variable (X_{it}) or the common factor (μ_t), making it suitable for addressing nonlinear dynamics and cross-sectional heterogeneity. Its focus on time-varying idiosyncratic components (δ_{it}) makes it particularly effective for analyzing differences in transition paths across units. Furthermore, its emphasis on relative cross-sectional means, rather than absolute values, overcomes the limitations of traditional unit root and cointegration tests (Apergis and Payne, 2017).

This method not only conducts a general convergence test but also has the capacity to identify groups (clubs) converging to multiple equilibrium levels

and divergent units (Panopoulou and Pantelidis, 2012). It is widely applied in analyzing heterogeneous social and economic indicators such as economic growth, youth unemployment rates, and environmental performance. Particularly effective for examining policy differences and integration processes among countries, this method is critical for evaluating both general convergence and the dynamics of subgroups. Its ability to identify subgroups offers significant advantages in situations where traditional unit root tests fall short (Phillips and Sul, 2009).

Phillips and Sul (2007, 2009) developed a five-step algorithm based on the club convergence approach to test the convergence hypothesis among countries or cross-sectional units. This algorithm evaluates whether units in panel data converge to a common equilibrium level over time and identifies subgroups (clubs) reaching multiple equilibria as well as divergent units. The steps of the algorithm are outlined below:

- Panel units are ranked based on their final observations. A core group is formed from the top-ranked units, which meet the threshold of a t-statistic greater than -1.65. This indicates convergence. The process continues until the t-statistic for all pairwise combinations of units falls below -1.65. If no convergence is observed across the entire panel at this stage, it is concluded that no common equilibrium level exists for all units (Phillips and Sul, 2007).
- Units are sequentially added to the core group, and the log t-regression is applied. If the newly added units meet the critical t-statistic value (-1.65), they are included in the group. Once the group is complete, the convergence hypothesis is tested for all units. If convergence is confirmed, the group is referred to as the initial convergence club (Panopoulou and Pantelidis, 2012).
- **T**he same process is repeated for units not included in the initial club**.** These units may form a new convergence club or be classified as divergent units. If a second convergence club is identified, the algorithm concludes here. However, if no convergence is observed among the remaining units, the process restarts (Apergis and Payne, 2017).
- Units that do not belong to either the first or second club and show no convergence are classified as divergent.This step is particularly important for identifying cross-sectional units with distinct long-term equilibrium levels (Du, 2017).

- In the final stage, tests are conducted to determine whether different convergence clubs approach a common equilibrium. If convergence is observed between two or more clubs, they are merged. However, if heterogeneity persists between clubs, they remain as distinct groups with separate equilibrium levels (Tomal, 2024).

4. EMPIRICAL RESULTS

Based on our analysis of youth unemployment rates, we find that the 27 European Union member countries and Türkiye did not converge toward a common equilibrium level during the 1991–2023 period. Table 1 summarizes the regression results obtained from the club convergence analysis for the youth unemployment variable. According to the log t-test results, the computed t-statistic is -7.8047, which is below the critical value of -1.65 at the 5% significance level. This indicates the rejection of the null hypothesis ($\mathcal{H}_0$) at the 5% level, which posits that all countries converge to a common equilibrium level. This finding suggests that these countries do not exhibit a common trend in reducing youth unemployment rates, implying the absence of panel-wide convergence in youth unemployment levels. However, the club convergence analysis can identify whether subgroups (clubs) of countries exhibit convergence even when no convergence is observed across the entire panel.

Table 1. Log (t) test results for Youth unemployment (1991-2023 Period)

Variable	Coefficient	Standard Error	T-statistic
Youth unemployment	**-0.8640**	**0.1107**	**-7.8047**

In the next step, the club convergence algorithm enables the examination of convergence tendencies among countries at the group level, providing a more detailed perspective. This method is particularly useful when panel-wide convergence is not observed, as it helps identify whether countries form distinct subgroups (clubs) that converge toward separate equilibrium levels. This approach allows for a more comprehensive analysis of the heterogeneous dynamics among countries and their impact on youth unemployment rates.Table 2 presents the different convergence clubs for the youth unemployment indicator and the corresponding log t-test results. The findings reveal the existence of five initial convergence clubs among the countries. According to the table:

- Club 1 countries exhibit strong convergence with high coefficients and t-statistics. Youth unemployment rates in Cyprus, Greece, Luxembourg, Portugal, and Spain converge rapidly toward a common equilibrium.
- Club 2 countries show convergence at a slower pace compared to Club 1. Youth unemployment rates in Croatia, Ireland, Italy, Sweden, and Türkiye are moving toward a common equilibrium.
- Club 3 countries (Austria, Belgium, Denmark, Estonia, Finland, France, the Netherlands, Romania, and Slovakia) demonstrate strong convergence.
- Club 4 countries (Bulgaria, Hungary, Latvia, Lithuania, Malta, Poland, and Slovenia) exhibit a moderate rate of convergence.
- Club 5 countries**,** consisting of the Czech Republic and Germany, have the lowest convergence coefficient. However, the t-statistics exceed the critical value, indicating that the convergence is statistically significant.
- Club 3, with 9 countries, represents the largest group of converging nations, followed by Club 4 with 7 countries. Clubs 1 and 2 have equal numbers of countries, while Club 5 contains the fewest countries.

Table 2. Initial Youth Unemployment Convergence Clubs

Clubs	Countries	Coefficient	T-Statistic
Club 1 [5]	| Cyprus | Greece | Luxembourg | Portugal | Spain |	0.7763	11.3937
Club 2 [5]	Croatia | Ireland | Italy | Sweden | Turkiye |	0.6365	4.5411
Club 3 [9]	| Austria | Belgium | Denmark | Estonia | Finland | France | | Netherlands | Romania | Slovak Republic |	0.5365	29.3773
Club 4 [7]	| Bulgaria | Hungary | Latvia | Lithuania | Malta | Poland | | Slovenia |	0.5692	16.0015
Club 5 [2]	Czechia | Germany |	0.0589	0.2158

The truncation parameter is set to $r = 0.3$***, with a t-statistic of -1.65 at the 5% significance level. The number of club members is indicated in square brackets.***

Table 3 presents the club merging test results from the club convergence analysis, which assess whether convergence exists between different clubs. These results provide valuable insights into the convergence tendencies among the clubs. Strong convergence was observed between Club 1 and Club 2 as well as between Club 2 and Club 3. Similarly, statistically significant convergence was identified between Club 3 and Club 4, although this convergence occurred at a slower rate compared to the other merges. On the other hand, the results between Club 4 and Club 5 indicate a clear lack of alignment and absence of convergence tendencies between these two groups. The negative coefficient and low t-statistic suggest that the economic dynamics and youth unemployment rates of these two clubs are moving in significantly different directions.

Table 3. Club merging test results for Youth Unemployment clubs

Clubs	Coefficient	T-statistic
Club 1+ 2	0.5301	8.6135
Club 2 +3	0.2221	9.9584
Club 3 + 4	0.3385	3.7922
Club 4 + 5	**-0.8226**	**-9.6578**

Note: The critical value for the t-statistic at the 5% significance level is -1.65.

Table 4 presents the final classification of clubs based on youth unemployment. This table demonstrates that countries are divided into three distinct clubs concerning youth unemployment. Club 1 comprises Austria, Belgium, Croatia, Cyprus, Denmark, Estonia, Finland, France, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Romania, Slovakia, Spain, Sweden, and Türkiye. This club includes the highest number of countries compared to other clubs. Club 2 consists of Bulgaria, Hungary, Latvia, Lithuania, Malta, Poland, and Slovenia. With a coefficient of 0.5692 and a high t-statistic of 16.0015, this group is shown to have converged to a common equilibrium in youth unemployment rates, with results being statistically significant. Club 3 includes Czechia and Germany, characterized by a notably low convergence coefficient (0.0589) and t-statistic (0.2158) regarding youth unemployment rates.

Table 4. Final club classifications for Youth Unemployment

Clubs	Countries	Coefficient	T-Statistic
Club 1 [19]	| Austria | Belgium | Croatia | Cyprus | Denmark | Estonia | | Finland | France | Greece | Ireland | Italy | Luxembourg | | Netherlands | Portugal | Romania | Slovak Republic | Spain | | Sweden | Turkiye |	**-0.0632**	**-1.2029**
Club 2 [7]	| Bulgaria | Hungary | Latvia | Lithuania | Malta | Poland | | Slovenia |	0.5692	16.0015
Club 3 [2]	| Czechia | Germany |	0.0589	0.2158

The truncation parameter is set to $r = 0.3$***, with a t-statistic of -1.65 at the 5% significance level. The number of club members is indicated in square brackets.***

Figure 1 illustrates the relative transition paths of three distinct clubs (Club 1, Club 2, Club 3) in terms of youth unemployment rates. Club 1 initially starts close to the panel average but moves above the panel average over time. This indicates an upward trend in youth unemployment rates for the countries in this group, with a particularly noticeable increase observed after 2010. Club 2, on the other hand, begins significantly above the panel average but shows a decline toward the panel average over time. The countries in Club 2 have made improvements in reducing youth unemployment rates, with a marked downward trend becoming evident after 2010. Club 3 starts well below the panel average, reflecting the low youth unemployment rates in the countries within this group. Over time, there is an increase in youth unemployment rates for countries in this club, but after 2005, the rates exhibit a trend toward lower levels. This suggests that the countries in Club 3 have consistently reduced youth unemployment rates, demonstrating a positive development trend.

Figure 1 also highlights the convergence processes among the clubs. Between Club 1 and Club 2, a strong convergence trend is observed until 2010; however, these two clubs diverge afterward and move away from the panel average. Club 3 distinctly separates itself from the other two clubs and gradually moves further from the panel average. This indicates that Club 3 does not fully converge with the other groups and maintains low youth unemployment rates. In conclusion, this figure reveals the differences in youth unemployment dynamics among countries and how these dynamics

evolve over time. The movement of the clubs reflects the influence of policy and economic disparities.

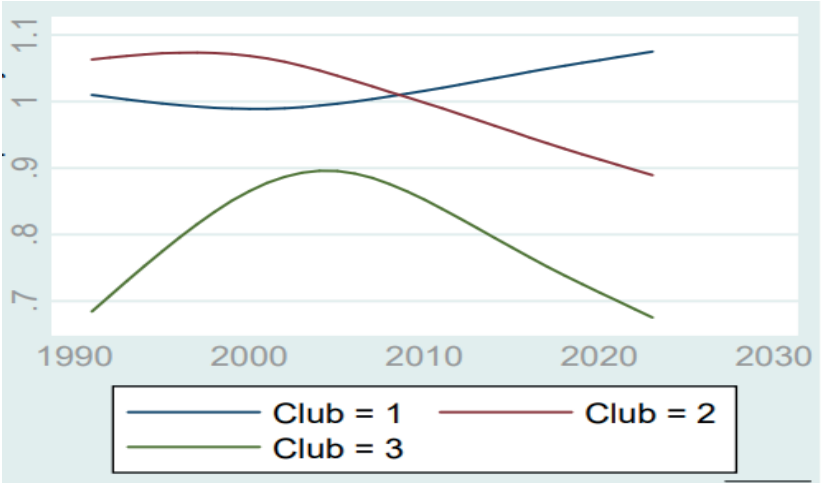

Figure 1. Relative Transition Path for Youth Unemployment, Convergence Clubs

5. CONCLUSİON

This study analyzes the dynamics of youth unemployment rates, convergence processes, and the varying impacts of these processes on 27 European Union member states and Türkiye during the period 1991–2023. It was found that youth unemployment rates exhibit significant variability among countries due to the effects of economic crises, structural reforms, and differing labor market policies. The analysis, conducted using the club convergence method developed by Phillips and Sul (2007), revealed that countries do not generally converge toward a common equilibrium level but form three distinct clubs with varying dynamics: Club 1, Club 2, and Club 3.

The results indicate that countries in Club 1 show an increasing trend in youth unemployment rates, while those in Club 2 demonstrate improvement, moving closer to the panel average. Meanwhile, Club 3 distinguishes itself with persistently low youth unemployment rates. Additionally, it was observed that Club 1 and Club 2 exhibited convergence until 2010 but diverged afterward, whereas Club 3 maintained its separation from the other groups with consistently low unemployment rates.

Countries in Club 1 (Austria, Belgium, Croatia, Cyprus, Denmark, Estonia, Finland, France, Greece, Ireland, Italy, Luxembourg, Netherlands,

Portugal, Romania, Slovakia, Spain, Sweden, and Türkiye) have experienced an increasing trend in youth unemployment rates over time, with this rise becoming more pronounced after 2010. The concentration of Southern European countries in this group highlights how economic crises and structural challenges have exacerbated youth unemployment. Recommendations for these countries include developing cross-sectoral transition policies to accelerate the integration of youth into the labor market, strengthening the link between the education system and labor market needs, and expanding technical education programs. Additionally, economic restructuring and increased employment incentives targeted at young people are essential.

Countries in Club 2 (Bulgaria, Hungary, Latvia, Lithuania, Malta, Poland and Slovenia) have successfully reduced youth unemployment rates closer to the panel average and have maintained this improvement sustainably since 2010. This positive trend indicates the effectiveness of the policies implemented. The decline in youth unemployment rates among Club 2 countries can be explained by the impact of economic and structural factors after 2010. While the 2008 Global Economic Crisis significantly increased youth unemployment in these countries, the economic recovery programs and targeted youth unemployment policies implemented after 2010 proved effective. Notably, initiatives such as the "Youth Guarantee" program in Europe and active labor market policies, including apprenticeships, internships, and entrepreneurship support, have facilitated youth participation in the workforce. Furthermore, education reforms and efforts to increase youth employment in technology-driven sectors have supported this trend. Thus, the decrease in unemployment rates in Club 2 reflects the impact of targeted policy implementation alongside economic recovery. Recommendations for these countries include expanding successful policies, ensuring sustainability, supporting youth entrepreneurship, increasing incentives to create jobs in innovative sectors, and promoting vocational education programs. Countries such as Poland and Slovenia, in particular, hold significant potential for further reducing youth unemployment through such projects.

Countries in Club 3 (Czechia and Germany) initially had low youth unemployment rates, which have steadily decreased over time. This reflects the strong labor market policies and stable economic structures of these countries. However, maintaining low levels of youth unemployment in the future will require increasing employment opportunities in digital and innovative sectors, continuing policies that encourage early youth labor

market participation, and advancing labor market reforms. This group can serve as a model for other clubs.

This study emphasizes the need to strengthen the connection between education and the labor market, increase employment incentives in innovative sectors, and expand the implementation of successful policies to reduce youth unemployment. Additionally, it highlights that Club 3 can serve as a model for other groups. These findings underscore the importance of more targeted and comprehensive policies for addressing youth unemployment effectively.

References

Apaydın, Ş. (2019). Türkiye'de İşsizliğin Kaynakları: Bir Yapısal Vektör Hata Düzeltme Modeli. MANAS Sosyal Araştırmalar Dergisi, 8(1), 1002-1016. https://doi.org/10.33206/mjss.464857

Apergis, N., & Payne, J. E. (2017). Per capita carbon dioxide emissions across US states by sector and fossil fuel source: Evidence from club convergence tests. *Energy Economics, 63*, 365-372. https://doi.org/10.1016/j.eneco.2016.11.027

Aral, N., & Aytaç, M. (2018). Türkiye'de işsizliğin mekânsal analizi. *Öneri Dergisi, 13*(49), 1-20. https://doi.org/10.14783/maruoneri.vi.364680

Baktemur, F. İ., & Özmen, M. (2017). Gelişmiş AB ülkeleri için işsizlik yakınsamasının mekansal ekonometrik analizi. *Finans Politik ve Ekonomik Yorumlar*, (626), 33–42.

Bayer, C., & Jüßen, F. (2007). Convergence in West German regional unemployment rates. *German Economic Review, 8*(4), 510–535. https://doi.org/10.1111/j.1468-0475.2007.00416.x

Bell, D. N., & Blanchflower, D. G. (2011). Young people and the Great Recession. *Oxford Review of Economic Policy, 27*(2), 241–267. https://doi.org/10.1093/oxrep/grr011

Beyer, R. C. M., & Stemmer, M. A. (2016). Polarization or convergence? An analysis of regional unemployment disparities in Europe over time. *Economic Modelling, 55*, 373–381. https://doi.org/10.1016/j.econmod.2016.02.005

Bratu, M. (2014). The convergence of unemployment rate in the European Union. *Studia Universitatis Vasile Goldiş, Arad - Seria Ştiinţe Economice, 24*(3), 62-69.

Carrera, D. R., & Rodríguez, G. (2009). Have European unemployment rates converged? *Banco Central de Reserva del Perú Working Papers, 7*. Retrieved from https://www.bcrp.gob.pe/docs/Publicaciones

Çifçi, R. (2016). Türkiye'de bölgesel işsizlik yakınsaması: Mekânsal bir yaklaşım (Yüksek lisans tezi). Uludağ Üniversitesi Sosyal Bilimler Enstitüsü, Bursa.

Costantini, M., & Lupi, C. (2006). Divergence and long-run equilibria in Italian regional unemployment. *Applied Economics Letters, 13*(14), 899–904. https://doi.org/10.1080/13504850500447586

Cuestas, J. C., Monfort, M., & Ordóñez, J. (2015). Unemployment convergence in central and eastern European countries: Driving forces and cluster behavior. *Emerging Markets Finance and Trade, 51*(1), 259–273. https://doi.org/10.1080/1540496X.2015.1011540

De Figueiredo, E. A. (2010). Dynamics of regional unemployment rates in Brazil: Fractional behavior, structural breaks and Markov switching. *Economic Modelling, 27*(5), 900–908. https://doi.org/10.1016/j.econmod.2010.01.006

Demir, Y. (2021). Balkan ülkelerine ait işsizliğin mekânsal panel ekonometri yaklaşımı ile analizi. *Balkan Sosyal Bilimler Dergisi, 10*(19), 26–35.

Demiralp, A., & Belliler, İ. S. (2023). G-20 ülkeleri arasında işsizlik yakınsamasının Fourier panel birim kök testi ile incelenmesi. *Akademik Yaklaşımlar Dergisi, 14*(2), 576–590.

Dikmen, F. C., & Dursun, G. (2018). İşsizlik histerisi ve yakınsama: Latin Amerika ülkelerinden bulgular. EconWorld2018, 23-25 January 2018, Lisbon, Portugal, 1–12.

Du, K. (2017). Econometric convergence test and club clustering using Stata. *The Stata Journal*, *17*(4), 882-900. https://doi.org/10.1177/1536867X1801700407

Estrada, Á., Galí, J., & López-Salido, D. (2013). Patterns of convergence and divergence in the Euro area. *IMF Economic Review, 61*(4), 601–663. https://doi.org/10.1057/imfer.2013.22

Eurostat. (2021). Youth unemployment rate statistics. Retrieved from https://ec.europa.eu/eurostat

Gomes, F. A. R., & da Silva, C. G. (2009). Hysteresis versus NAIRU and convergence versus divergence: The behavior of regional unemployment rates in Brazil. *The Quarterly Review of Economics and Finance, 49*(2), 308–322. https://doi.org/10.1016/j.qref.2007.03.009

Hadizadeh, A. (2021). Analyzing unemployment rates convergence across the US states: New evidence using quantile unit root test. *Iranian Economic Review, 25*(3), 453–464. https://doi.org/10.22059/IER.2021.318545.800805

International Labour Organization (ILO). (2020). *Global employment trends for youth 2020: Technology and the future of jobs.* https://www.ilo.org

Katrencik, D., Wojcik, P., & Tyrowicz, J. (2010). Unemployment convergence in transition. E. Marelli & M. Signorelli (Eds.), *Economic growth and structural features of transition* (pp. 236–259). Palgrave Macmillan. https://doi.org/10.1057/9780230277403

Kónya, L. (2020). Did the unemployment rates converge in the EU? *Empirical Economics, 59*(2), 627–657. https://doi.org/10.1007/s00181-019-01768-4

Krištić, I. R., Dumančić, L. R., & Arčabić, V. (2019). Persistence and stochastic convergence of Euro area unemployment rates. *Economic Modelling, 76*, 192–198. https://doi.org/10.1016/j.econmod.2018.06.012

Martin, R. (1997). Regional unemployment disparities and their dynamics. *Regional Studies, 31*(3), 237–252. https://doi.org/10.1080/00343409750134665

Mello, M., & Guimaraes-Filho, R. (2007). A note on fractional stochastic convergence. *Economics Bulletin, 3*(16), 1–14.

Nyong, M. O. (2013). Unemployment convergence among the 36 states in Nigeria. In *Finance and Economics Conference* (pp. 1–37).

Panopoulou, E., & Pantelidis, T. (2012). Convergence in per capita health expenditures and health outcomes in the OECD countries. *Applied Economics, 44*(30), 3909–3920. https://doi.org/10.1080/00036846.2011.583222

Phillips, P. C. B., & Sul, D. (2007). Transition modeling and econometric convergence tests. *Econometrica, 75*(6), 1771–1855. https://doi.org/10.1111/j.1468-0262.2007.00811.x

Phillips, P. C. B., & Sul, D. (2009). Economic transition and growth. *Journal of Applied Econometrics, 24*(7), 1153-1185. https://doi.org/10.1002/jae.1080

Rowthorn, R., & Glyn, A. (2006). Convergence and stability in US employment rates. *Contributions to Macroeconomics, 6*(1), Article 4, 1–45. https://doi.org/10.2202/1534-6005.1368

Sun, H., Kporsu, A. K., Taghizadeh-Hesary, F., & Edziah, B. K. (2020). Estimating environmental efficiency and convergence: 1980 to 2016. *Energy*, *208*, 118224. https://doi.org/10.1016/j.energy.2020.118224

Taş, S., & Bozkaya, G. (2012). Avrupa Birliğine Uyum Sürecinde Türkiye'de Uygulanan İstihdam Politikaları. Kahramanmaraş Sütçü İmam Üniversitesi İktisadi Ve İdari Bilimler Fakültesi Dergisi, 2(1), 151-176.

Tomal, M. (2024). A review of Phillips-Sul approach-based club convergence tests. *Journal of Economic Surveys*, *38*(3), 899-930. https://doi.org/10.1111/joes.12563

Tyrowicz, J., & Wojcik, P. (2010). Regional dynamics of unemployment in Poland: A convergence approach. In Floro Ernesto Caroleo and Francesco Pastore (Eds.), *The labour market impact of the EU enlargement: A new regional geography of Europe* (pp. 149–173). Springer-Verlag. https://doi.org/10.1007/978-3-642-11843-2

World Bank (2024). Youth unemployment rate dataset. Retrieved from https://data.worldbank.org/indicator