

Youth Unemployment in the Countries of Central and Eastern Europe. Is Okun's Law Applicable?

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Abstract

This article investigates the empirical validity of Okun's law regarding youth unemployment in 11 Central and Eastern European countries between 2000 and 2023. Using panel data disaggregated by age cohorts and gender, the study employs robust linear regression models (RLM) with Huber loss functions and two-way fixed effects models (TWFE). Focusing primarily on the 15–24 age cohort, the results confirm a statistically significant, negative relationship between economic growth and youth unemployment, with considerable heterogeneity across countries and gender groups. While Okun's law holds strongly in the Baltic states and Poland, the relationship is notably weaker in Hungary and Romania. The study also shows that higher shares of temporary employment and higher Employment Protection Legislation (EPL) indices for regular employment reduce the sensitivity of youth unemployment to changes in GDP, whereas higher youth enrolment rates and higher EPL indices for temporary employment increase this sensitivity.

Keywords: youth unemployment, Okun's law, Central and Eastern Europe, panel regression

JEL: C23, E24, J21, J64, P52

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Introduction

Labour markets in Central and Eastern European (CEE) countries have undergone a series of transformations in the 21st century. Although unemployment rates have generally trended downward over the past two decades, relatively high levels persist in specific segments of the labour force. In many CEE countries, the unemployment rate among youth aged 15–24 remains significantly higher than that of the total population.

In the economic literature, several factors have been identified that contribute to this situation. First of all, young people entering the labour market may have qualifications that are not well matched to employers' requirements, which results in quick job dismissals (Blanchard 1997). Secondly, the relatively high mobility of young people contributes to more frequent job changes, which can sometimes lead to unemployment (O'Reilly et al. 2015). Thirdly, in the event of an economic downturn, employers are more likely to lay off young people than older ones, as the costs of employment adjustments are lower for young people (Kwiatkowski and Włodarczyk 2014).

The scale of unemployment, including youth unemployment, depends on various economic, social, demographic, and institutional factors. The literature on this topic is vast, particularly on macroeconomic determinants. Economic theory highlights the crucial role of the level and change in economic output. The importance of output dynamics for shaping unemployment, including youth unemployment, was emphasised in Keynes' theory. He argued that increasing aggregate demand for goods boosts production volumes and employment levels, ultimately reducing unemployment. Conversely, a fall in aggregate demand reduces production and increases unemployment (Keynes 1985:51). This idea was later extended by Okun, who estimated a statistical relationship between changes in unemployment rates and the output growth rate in the U.S. His findings suggested that each additional percentage point (p.p.) of unemployment above 4% was associated with a three p.p. reduction in real GNP growth (Okun 1962). This relationship is known in the economic literature as Okun's Law.

This article analyses the phenomenon of youth unemployment in CEE countries over the period 2000–2023. The countries included in the analysis are Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia. The study aims to illustrate the differences in youth unemployment rates between these countries and determine the impact of GDP growth on the development of this phenomenon, thus determining whether Okun's Law applies to youth unemployment. We attempt to answer the question of whether this relationship, formulated in the 1960s, is confirmed for youth unemployment in the 21st century.

This article contributes to the empirical literature examining Okun's law in CEE countries, taking into account the development of this law among youth and other age cohorts, as well as the roles of factors such as temporary employment, employment protection legislation, and the enrolment rate.

The article is structured as follows. Section 2 reviews studies on unemployment in CEE countries, with particular attention paid to youth unemployment. Section 3 outlines the data sources and the research methods employed. Section 4 presents trends in youth unemployment and its determinants

in the countries under study. Section 5 introduces econometric models, indicating the role of GDP changes and other factors in shaping youth unemployment and unemployment in other age cohorts. The results of the analysis are discussed in Section 6, while Section 7 presents the main conclusions drawn from the analysis.

Literature Review

Labour market analyses in CEE countries have been conducted by researchers from the region and Western countries, who turned their attention to this group of economies as far back as the early stages of the systemic transformation.

The unemployment problem in CEE countries in the 1990s was addressed by Nesporova and Cazes (Nesporova 2002; Cazes and Nesporova 2004). Observing the persistently high unemployment rate in the transformation countries, they identified the causes of this situation and its countermeasures. They rejected the view of neoliberal economists, who saw the cause of this situation as the excessive rigidity of labour markets. Based on collected data and information, they demonstrated that in the 1990s, labour markets in the transformation countries became more flexible, as evidenced by the growing share of temporary employment and rising rates of flows of people on the labour market, as well as decreasing indices of employment protection legislation in many countries. They further claimed that high persistent unemployment results from the model adopted in CEE countries, where the responsibility for supporting people laid off from work was transferred from enterprises to public institutions dealing with job placement, active labour market programs, and financial support for the unemployed. This model should increase both the flexibility of adjustments in the labour market and the effectiveness of sectoral allocation of the labour force and overall labour productivity. However, the effectiveness of financial assistance to the unemployed and the speed of finding a new job depend on the quality and efficiency of public institutions, which do not always perform their tasks properly.

Labour market issues in transitional economies were also addressed by Guzikowski (2016), who focused on the interactions between labour market institutions in CEE countries. One chapter, in particular, presents findings and tendencies relevant to this study regarding unemployment and its determinants in the region. Based on statistical data from 1994–2011, he revealed several key patterns in transitional countries: adverse effects of migration on domestic labour supply, low labour force participation among working-age populations (especially youth), relatively high youth unemployment rates, a large share of long-term unemployment, unfavourable changes in the educational structure of the unemployed, relatively low spending on active labour market policies, and relatively high though declining employment protection legislation (EPL) indices.

Gozgor (2013) examined the causes of high unemployment in CEE countries by testing whether labor markets follow the NAIRU (Non-Accelerating Inflation Rate of Unemployment) hypothesis – where unemployment rates are cyclical deviations from the natural rate of unemployment – or the unemployment hysteresis hypothesis, which suggests that adverse shocks lead to permanently higher unemployment levels. By analyzing monthly data from 1998 to 2012, the author concluded

that unemployment persistence is indeed present in CEE countries, supporting the hysteresis hypothesis.

Hutengs and Stadtmann (2013) calculated age-specific Okun coefficients for some CEE countries and EU15 countries, revealing that economic growth has a more pronounced effect on youth unemployment (ages 15–24) than on the elderly population. Similarly, Zanin (2014) analyzed OECD data for 1998–2012 to show that Okun coefficients vary by age and gender, with the youngest generations proving most vulnerable to business cycle fluctuations. His study confirmed that economic growth strongly reduces youth unemployment.

Using 1992–2014 panel data for Eastern European countries, Soylu, Çakmak, and Okur (2018) established the validity of Okun's law, demonstrating that economic growth negatively affects unemployment. This relationship was further explored by Butkus and Seputiene (2019), who applied Okun's law to 28 EU member countries, for the period 2000–2018. They found that youth unemployment is more sensitive to changes in economic growth than total unemployment, and emphasised that youth cohorts are notably more sensitive to adverse output shocks than to positive ones.

Regarding the Polish economy, Bartosik (2020) verified Okun's law and examined the impact of temporary employment on this relationship using data from 1996–2018. Through various OLS regression models, he established a negative link between changes in GDP and the unemployment rate, with unemployment sensitivity to production changes increasing over the period – a trend directly associated with the rise in temporary employment.

Gajderowicz et al. (2014) investigated the sensitivity of unemployment rates to changes in GDP in Polish voivodeships using annual average data from 1995 to 2011. These estimates were based on two models: model 1 relied on changes in unemployment rates and GDP growth rates, while model 2 known as the gap model was based on deviations of these variables from their long-term values. Estimates in the model based on differences were around -0.4 , while in the gap model, they were slightly higher, at approximately -0.6 and -0.7 .

Dunsch (2016) performed a comparative analysis of unemployment in Poland and Germany, focusing on whether youth unemployment is more sensitive to economic fluctuations than adult unemployment. She estimated Okun's coefficients across five different age groups, using a difference model and data from 1992 to 2014. The results confirmed that youth unemployment is more sensitive to economic fluctuations than adult unemployment, although the differences were smaller in Germany than in Poland. Moreover, the sensitivity of youth unemployment to changes in the economic cycle has proven to be higher in Poland than in Germany. To explain these differences, Dunsch attributed them to variations in employment protection legislation, minimum wages, sectoral employment structures, and the education systems (Dunsch 2016).

Unemployment's sensitivity to GDP changes has been analysed many times in the literature, including in CEE countries (Hutengs and Stadtmann 2013; Soylu, Çakmak, and Okur 2018). However, only Hutengs and Stadtmann utilized age-cohort analysis to isolate the specific vulnerabilities of young workers. While most models relied solely on GDP growth rates to explain

changes in unemployment, only Bartosik (2020) identified temporary employment as a key driver of this sensitivity.

This article contributes to the literature by combining these approaches: we conduct a multi-cohort sensitivity analysis to assess sensitivity in the youth population while simultaneously evaluating the role of temporary employment, enrolment, and employment protection legislation in moderating these effects.

Data and Methodology

The empirical study analyzes 11 CEE countries from 2000–2023 using annual statistical data from the OECD and Eurostat. The dataset comprises unemployment rates by age cohort, GDP growth rates, and structural variables including GDP *per capita*, the share of temporary employment, EPL indices, and school enrolment rates in the 15–24 age group. The unemployment data are structured as a cohort–time panel, where cross-sectional units are age cohorts disaggregated by gender, and the time dimension is the calendar year. For the eight OECD countries (Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia), the analysis uses six age cohorts (15–24, 25–34, 35–44, 45–54, 55–64, and 65–74), disaggregated by gender (OECD Database 2025). For the non-OECD countries (Bulgaria, Croatia, and Romania), data include four simplified cohorts (15–24, 15–29, 25–54, and 55–74) for the period 2009–2023 (Eurostat Database 2025).

The study was conducted in two stages. The first stage involved an analysis of stylised empirical facts to identify the heterogeneity of youth unemployment and its structural and cyclical context across the examined countries. This phase employed a descriptive, exploratory approach based on panel data, without using regression models. Comparative analyses, rankings, and data visualisations were applied.

In the second stage, three types of econometric models were applied to describe the relationship between the change in the unemployment rate (ΔU) and the annual GDP growth rate (ΔY):

- robust linear model (RLM),
- two-way fixed effects panel model (TWFE),
- extended interactive TWFE model with structural and institutional factors.

The robust linear model (RLM) was based on the following regression function:

$$\Delta U_{ikt} = \alpha + \sum_k \gamma_k \cdot (\Delta Y_{it} \cdot D_k) + \varepsilon_{ikt}, \quad (1)$$

where:

ΔU_{ikt} – annual change in unemployment rate for cohort k in year t , country i , defined as the year-to-year difference for the given cohort and gender (in p.p.),

D_k – dummy variable for cohort k ,

γ_k – Okun's coefficient for cohort k (elasticity of unemployment in relation to GDP),

ΔY_{it} – annual GDP growth rate (in %),

α – intercept,

ε_{ikt} – error term.

The estimation was conducted using the robust model with the Huber loss function (Huber 1964; Verardi and Croux 2009), which does not require assumptions of homoskedasticity or normality of residuals. To improve the precision of inference, a bootstrap procedure with 400 replications was applied (Efron and Tibshirani 1994).

To improve the reliability of the results obtained from the RLM model, panel models with two-way fixed effects (TWFE) were also estimated, with the following regression function:

$$\Delta U_{ikt} = \alpha_i + \tau_t + \gamma \Delta Y_{it} + \varepsilon_{ikt}, \quad (2)$$

where:

ΔU_{ikt} – annual change in the unemployment rate in cohort k (in p.p.),

ΔY_{it} – annual change in real GDP (in %),

α_i – country fixed effect,

τ_t – year fixed effects,

γ – Okun's coefficient,

ε_{ikt} – error term.

Standard errors were clustered by country (Arellano 1987) to ensure robustness to heteroskedasticity and within-unit autocorrelation. To verify gender and spatial differences, Wald tests were conducted.

Finally, models were estimated for three cyclical periods: pre-global financial crisis (GFC) (≤ 2008), post-GFC (2009–2019), and post-COVID-19 pandemic (≥ 2020). To account for structural and institutional labour market factors, the baseline TWFE model was extended with interaction variables:

$$\Delta U_{it} = \alpha_i + \tau_t + \beta_1 \Delta Y_{it} + \beta_2 (\Delta v Y_{it} \cdot Z_{it}) + \varepsilon_{it}, \quad (3)$$

where:

ΔU_{it} – annual change in the unemployment rate in the 15–24 age cohort (in p.p.),

Z_{it} – interactive variable,

β_1 – Okun's coefficient at the mean level of Z_{it} ,

β_2 – modifier of Okun's coefficient (change in the strength of the $\Delta Y \rightarrow \Delta U$ relationship depending on the level of Z).

Interactive variables were mean-centred to reduce multicollinearity and allow interpretation of β_1 as the effect at the typical level of the variable. Model estimations were performed in R (R Core Team 2025) using RStudio (Croissant and Millo 2008).

Stylized Facts

The analysis examined labour markets in 11 CEE countries that transitioned from centrally planned to market economies during the 1990s. While all 11 countries are currently European Union members, their institutional frameworks varied: Estonia, Lithuania, Latvia, Slovakia,

and Slovenia joined both the eurozone and the OECD, while Czechia, Hungary, and Poland became OECD members but remain outside the eurozone. The remaining countries Bulgaria, Croatia, and Romania maintained independent currencies and were not OECD members during the study period.

These CEE countries fall into the category of middle-income economies, with GDP *per capita* levels in 2023 ranging between €7,900 (Bulgaria) and €22,100 (Slovenia). Economic development was accompanied by significant structural transformations, consistent with the three-sector theory of the economy. The relative importance of the agricultural sector decreased, while the relative importance of the service sector increased.

Figure 1 illustrates the trends in total and youth unemployment rates (age 15–24) from 2000 to 2023. Several conclusions emerge from these charts.

1. Youth unemployment rates remained significantly higher than total unemployment rates across all examined countries.
2. While the dynamics of both indicators followed similar patterns, their trajectories varied across subperiods. A substantial decline occurred between 2000 and 2008 (excluding Hungary and Romania), followed by an increase from 2009–2013 in all countries. A significant secondary decline was observed from 2014 to 2019, with a brief COVID-19-related spike in 2020. In the final years of the study, rates stabilized at low levels, except in Croatia, Estonia, Romania, and Slovakia, where youth unemployment approached 20%.
3. While both indicators exhibited considerable volatility over the entire period, fluctuations were significantly more pronounced in youth unemployment than in total unemployment.

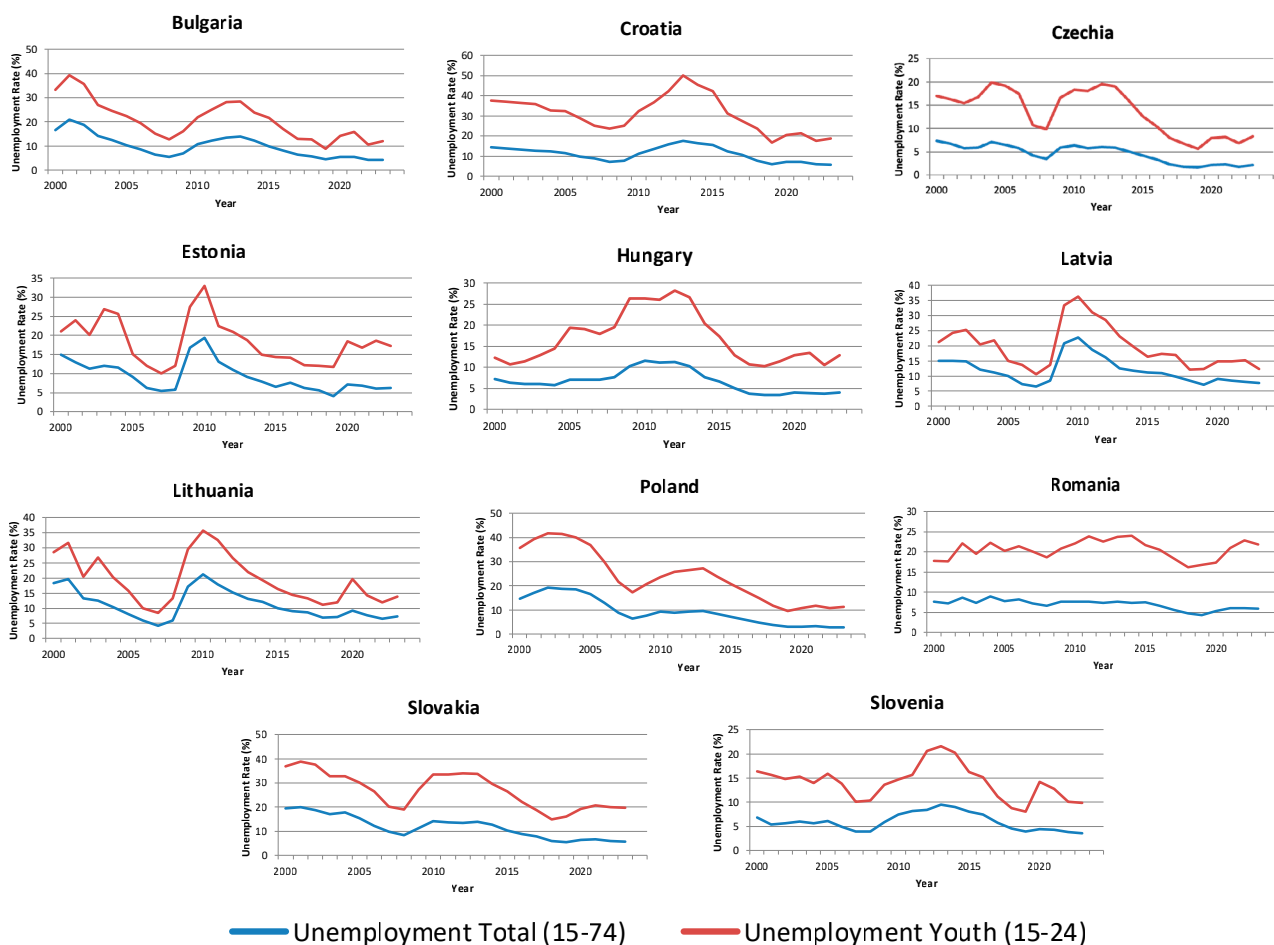


Figure 1. Trends in youth and total unemployment rates in CEE countries, 2000–2023 (in %)

Source: own study based on data from Eurostat Database 2025.

Table 1 presents youth unemployment rates and their ratios to total unemployment for 2000 and 2023. By 2023, youth unemployment rates were significantly lower in all 11 countries compared to 2000. The country ranking shows that in 2000, the highest rates were in Croatia, Poland, and Slovakia, while the lowest were observed in Czechia, Hungary, and Slovenia. By 2023, Croatia, Romania, and Slovakia reported the highest levels, whereas Czechia, Slovenia, and Poland maintained the lowest. These rankings suggest that Czechia and Slovenia consistently maintained relatively low youth unemployment rates, while Slovakia and Croatia experienced persistently high levels.

In both years, youth unemployment rates remained considerably higher than total unemployment rates. By 2023, the ratio of youth to total unemployment ranged from 1.5 to 4.07, and notably, these ratios were higher in all countries than they were in 2000. These disparities can be attributed to a greater tendency among young people to change jobs, potential mismatches between qualifications and employers’ requirements, and the relatively high shares of young people in temporary employment, where dismissals are easier and less costly for employers.

Table 1. Trends in youth and total unemployment rates in CEE countries, 2000–2023 (in %)

Rank (2000)	Country	Youth unemployment rates (%)	Ratio of youth unemployment rate to total unemployment rate in 2000	Rank (2023)	Country	Youth unemployment rates (%)	Ratio of youth unemployment rate to total unemployment rate in 2023
1	Croatia	37.5	2.14	1	Romania	21.8	3.89
2	Slovakia	36.9	1.93	2	Slovakia	19.8	3.41
3	Poland	35.7	2.17	3	Croatia	18.9	3.09
4	Bulgaria	33.3	2.05	4	Estonia	17.3	2.70
5	Lithuania	28.6	1.78	5	Lithuania	13.8	2.00
6	Latvia	21.3	1.50	6	Hungary	12.8	3.12
7	Estonia	21.1	1.57	7	Latvia	12.3	1.89
8	Romania	17.8	2.50	8	Bulgaria	12.1	2.81
9	Czechia	17.0	1.93	9	Poland	11.4	4.07
10	Slovenia	16.4	2.37	10	Slovenia	9.9	2.67
11	Hungary	12.3	1.86	11	Czechia	8.3	3.19

Source: own study based on data from Eurostat Database 2025.

The volatility of youth unemployment rates depended on various economic, social, and institutional factors, with GDP growth dynamics serving as a key driver. Real GDP growth from 2000 to 2023, presented in Figure 2, exhibited considerable business cycle fluctuations. The 2000–2008 period saw high GDP growth rates (ranging from 3.5% to 7%), which contributed to falling unemployment rates. In contrast, the 2009–2013 period saw a downturn in economic conditions due to the effects of the GFC, which resulted in negative average GDP growth rates in most countries (except for Poland, Slovakia, and Bulgaria), accompanied by rising unemployment. The 2014–2019 period marked another phase of economic expansion, with average growth rates between 2.6% and 4.4%, leading to further declines in unemployment. Meanwhile, in 2020, the consequences of the COVID-19 pandemic became evident, resulting in negative GDP growth in all countries and increased unemployment in most. More recently (2021–2023), a clear economic recovery was observed, reflected in favourable average GDP growth rates ranging from 1.1% in Estonia to 7.6% in Croatia.

Trends in youth unemployment are influenced not only by output dynamics. The significance of temporary employment for the development of unemployment, particularly youth unemployment, can be derived from the natural rate of unemployment theory (Friedman 1975) and the NAIRU theory (Layard, Nickell, and Jackman 1991). Both frameworks link unemployment levels to the degree of labour market flexibility. The share of temporary employment in total employment can serve as a proxy for this flexibility. This form of employment allows employers to adjust workforce levels more quickly to market conditions than in the case of a permanent contract. It is particularly relevant to youth unemployment, given the high prevalence of temporary contracts among young workers.

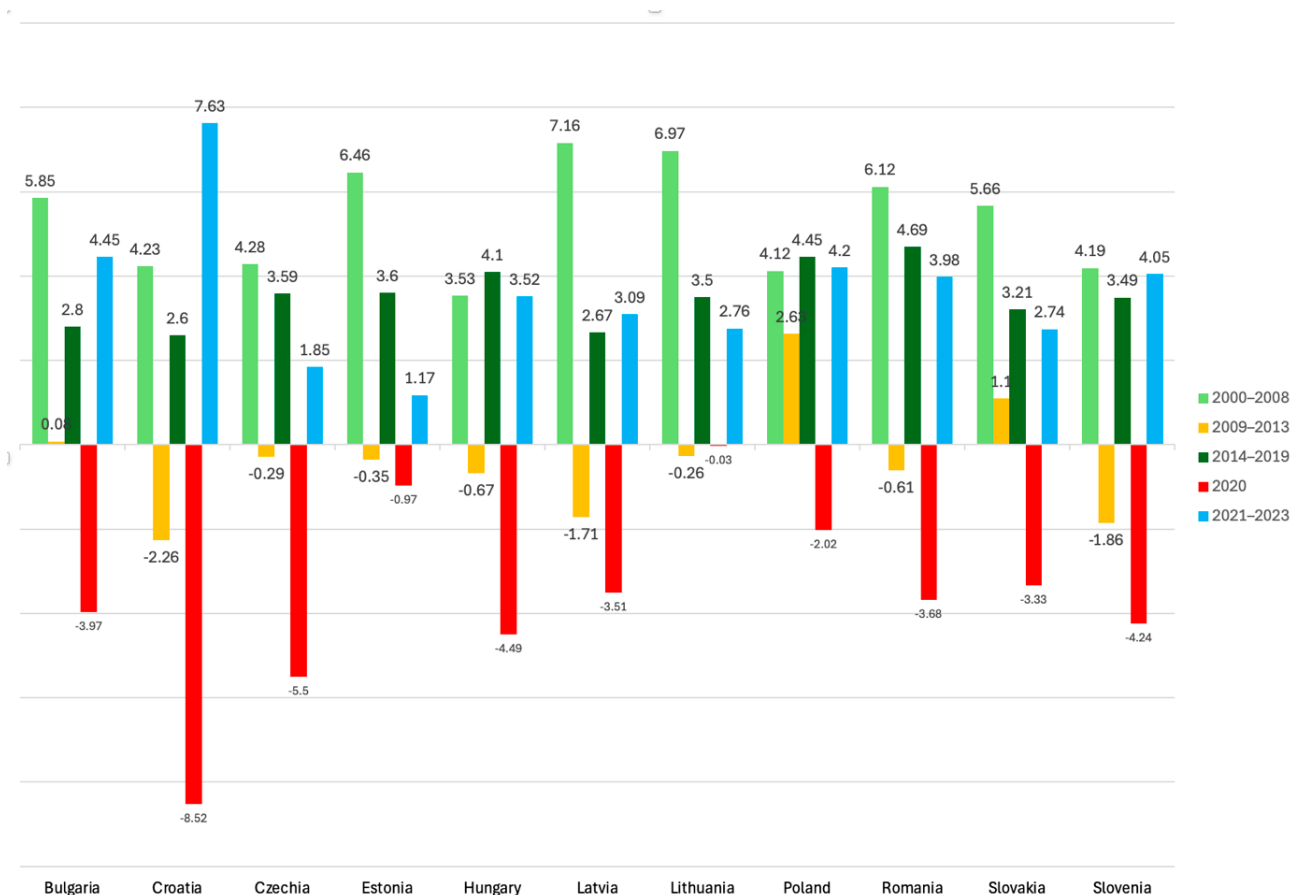


Figure 2. Average annual GDP growth rates by subperiods in CEE countries, 2000–2023 (in %)

Source: own study based on data from Eurostat Database 2025.

Figure 3 presents the average shares of temporary employment. Two main conclusions emerge. First, across all subperiods, the highest shares were recorded in Poland, Slovenia, and Croatia, while the lowest were in Romania, Estonia, and Lithuania. Second, a clear downward trend in temporary employment shares is visible in most countries, especially those with previously high rates.

The degree of legal employment protection also plays a significant role in shaping unemployment. Employment Protection Legislation (EPL) encompasses the legal regulations governing employment contracts, particularly dismissals, notice periods, and severance pay (Cahuc and Zylberberg 2004:734; Boeri and van Ours 2011:255)¹. When these regulations are more restrictive, employers incur higher costs when dismissing employees and are thus less likely to use layoffs to adjust to market conditions. Consequently, stricter EPL may reduce layoffs and unemployment. However, this effect is not unequivocal. Increasing the legal restrictiveness can lead to inefficient labour allocation and reduced business profitability, which may ultimately necessitate reductions in employment (Greenwald and Stiglitz 1995; Malul et al. 2011).

1 For a broader discussion on employment protection legislation, see Kwiatkowski and Włodarczyk 2012.

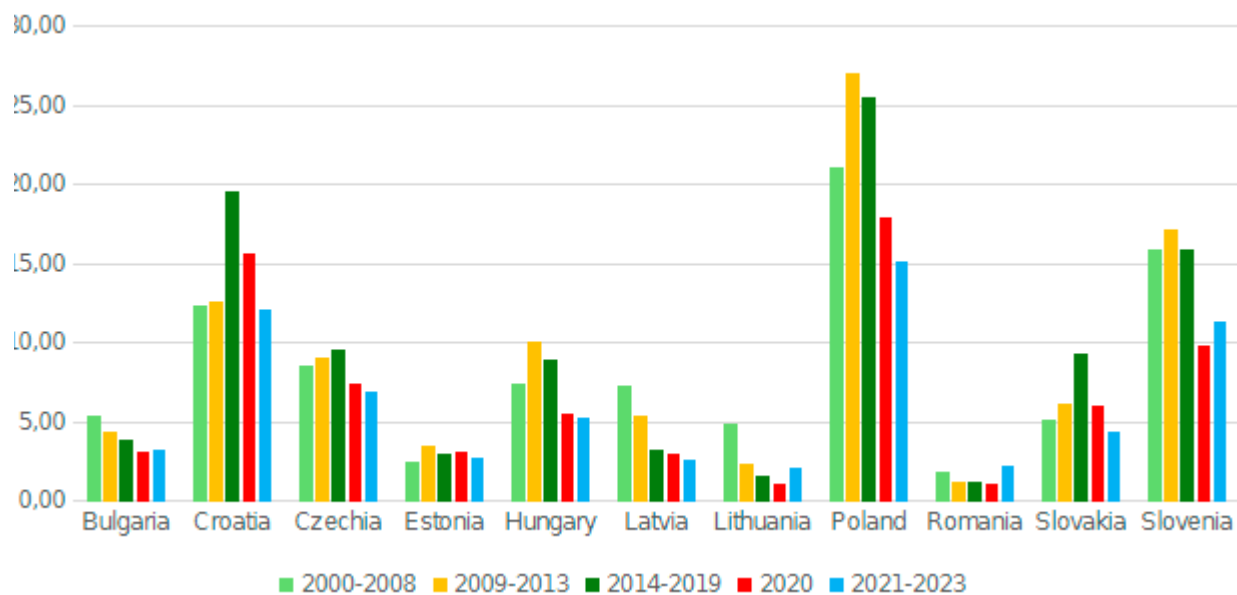


Figure 3. Average shares of temporary employment by subperiods in 2000–2023 (as % of total employment)
Source: own study based on data from Eurostat Database 2025.

Table 2. EPL indices for permanent (A) and temporary (B) employment contracts in 2008, 2014, and 2019

Country		2008	2014	2019
Czechia	A	2.99	2.90	2.90
	B	1.88	2.13	2.13
Latvia	A	-	3.10	3.10
	B	-	1.79	1.79
Lithuania	A	-	2.53	2.25
	B	-	3.21	1.92
Poland	A	2.43	2.43	2.43
	B	2.21	2.21	2.21
Slovakia	A	3.06	2.68	2.68
	B	2.17	2.42	2.75
Slovenia	A	2.77	2.41	2.41
	B	2.50	2.13	2.13

Source: own study based on data from OECD n.d., *OECD Data Explorer*.

Table 2 presents EPL indices for temporary and permanent employment contracts in the CEE countries that are OECD members. These indices, as estimated by the OECD up to 2019, range from 0 (no restrictions) to 6 (maximum restrictions). The data indicate notable differences in the employment protection restrictiveness among the countries, and these levels changed over time in some cases. For permanent contracts, Latvia and Czechia recorded relatively high index values, while Estonia and Lithuania recorded the lowest. In the case of temporary employment, Estonia and Slovakia maintained relatively high levels of protection, while Latvia and Slovenia reported relatively low levels.

Table 3. Youth enrolment rate in the 15–24 age group in 2013, 2019, and 2022 (in %)

Country	2013	2019	2022
Bulgaria	55.2	56.8	57.7
Czechia	63.2	65.0	69.7
Croatia	60.3	62.8	29.8*
Latvia	71.6	67.0	70.7
Lithuania	71.6	67.0	69.9
Hungary	63.6	56.7	60.2
Poland	71.8	68.6	69.9
Romania	58.9**	52.7	54.8
Slovenia	73.1	74.3	75.4
Slovakia	57.5	55.9	59.2

* Definition differs due to EU-LFS methodological change in 2021 (more detailed distinction between formal and non-formal learning).

** Definition differs due to the Romanian LFS methodological change in 2013 (due to the modification of the weighting procedure).

Source: own study based on data from Eurostat (n.d.).

The youth enrolment rate, which indicates the percentage of young people aged 15–24 still in education, also has some relevance for youth unemployment. Table 3 shows that Slovenia, Latvia, Poland, Lithuania, and Czechia had relatively high enrolment levels, whereas Romania and Bulgaria had relatively low levels.

Results of Econometric Analyses

Table 4 presents the estimates of Okun's coefficients for the eight OECD countries based on the RLM model with the Huber loss function, disaggregated by age cohort and gender.

Table 4. Estimation of Okun's coefficients, RLM model, 8 OECD countries, 2000–2023

Cohort	Okun's coefficients (γ)	Lower CI* (2.5%)	Upper CI (97.5%)
Total			
15–24	-0.4431	-0.5216	-0.3638
25–34	-0.2704	-0.3016	-0.2383
35–44	-0.2345	-0.2655	-0.2024
45–54	-0.2380	-0.2686	-0.2073
55–64	-0.2054	-0.2372	-0.1737
65–74	-0.0939	-0.1322	-0.0555
Male			
15–24	-0.4923	-0.5623	-0.4232
25–34	-0.3001	-0.3465	-0.2544

Cohort	Okun's coefficients (γ)	Lower CI* (2.5%)	Upper CI (97.5%)
35–44	-0.2607	-0.3072	-0.2143
45–54	-0.2654	-0.3102	-0.2203
55–64	-0.2342	-0.2821	-0.1864
65–74	-0.1012	-0.1503	-0.0521
Female			
15–24	-0.4012	-0.4661	-0.3363
25–34	-0.2503	-0.2954	-0.2052
35–44	-0.2156	-0.2621	-0.1691
45–54	-0.2191	-0.2640	-0.1742
55–64	-0.1934	-0.2398	-0.1470
65–74	-0.0851	-0.1312	-0.0390

* Lower/Upper CI – lower and upper bounds of the confidence interval.

Source: own calculations based on OECD n.d., *OECD Data Explorer*.

The RLM estimations revealed statistically significant Okun's coefficients across all age cohorts and genders, with consistently negative values. The highest absolute coefficients were recorded for the 15–24 cohort for the total population, as well as for women and men, while the lowest were observed for the older cohorts. A 1 p.p. increase in GDP growth is thus associated with an expected average decrease in the unemployment rate of 0.4431 p.p. for the 15–24 age group. In each cohort, the magnitude of the coefficients estimated for men was greater (i.e., more negative) than that for women. The bootstrap confidence interval (CI), based on 400 replications, confirmed the precision of the cohort-specific estimations.

Table 5. Estimation of Okun's coefficients (γ), RLM model, for the 15–24 age cohort, 8 OECD countries, 2000–2023

Country	Okun's coefficients (γ)	Lower CI (2.5%)	Upper CI (97.5%)
Total			
Czechia	-0.3851	-0.5077	-0.2676
Estonia	-0.5040	-0.7022	-0.2441
Hungary	-0.1787	-0.3945	0.0026
Latvia	-0.3758	-0.5834	-0.2345
Lithuania	-0.6437	-0.8865	-0.4293
Poland	-0.5690	-0.7894	-0.3815
Slovenia	-0.3936	-0.5183	-0.3110
Slovakia	-0.6566	-0.9113	-0.1435
Male			
Czechia	-0.3924	-0.6316	-0.2291
Estonia	-0.5342	-0.9805	0.0069

Country	Okun's coefficients (γ)	Lower CI (2.5%)	Upper CI (97.5%)
Hungary	-0.1405	-0.6919	0.0775
Latvia	-0.3202	-0.8553	-0.1364
Lithuania	-0.8432	-1.3055	-0.3046
Poland	-0.5923	-0.9791	-0.1708
Slovenia	-0.3900	-0.5707	-0.2113
Slovakia	-0.8036	-0.137	-0.2358
Female			
Czechia	-0.5178	-0.7980	-0.0855
Estonia	-0.2030	-0.5100	0.1537
Hungary	-0.4939	-0.9955	-0.1978
Latvia	-0.5135	-0.7385	-0.2101
Lithuania	-0.5353	-1.0108	-0.1284
Poland	-0.3892	-0.7320	-0.2485
Slovenia	-0.5178	-0.7980	-0.0855
Slovakia	-0.5077	-0.7398	0.1386

Source: own calculations based on OECD n.d., *OECD Data Explorer*.

Table 5 presents the RLM estimation results for the 15–24 age cohort², calculated separately for each of the eight OECD countries. For the total population, significant negative Okun's coefficients were obtained for all countries except Hungary, where the confidence interval contains zero. The most substantial effect was observed in Slovakia.

Gender-disaggregated analysis confirmed the existence of substantial heterogeneity. Among men, the strongest effect was found in Lithuania, representing the highest magnitude across the entire dataset. In contrast, results for Estonia and Hungary among men exhibited high uncertainty, with confidence intervals including zero. The results for women displayed greater variation. High negative estimates were observed in Czechia, Latvia, Lithuania (-0.5353), and Poland. The estimates for women were statistically insignificant in Estonia and Slovakia.

Table 6. Estimation of Okun's coefficients (γ), RLM models for the 15–24 age cohort, 3 non-OECD countries, 2009–2023

Country	Gender	Okun's coefficients (γ)	CI (2.5%)	CI (97.5%)
Bulgaria	Female	-0.898	-1.919	-0.357
Bulgaria	Male	-0.751	-2.43	0.004
Bulgaria	Total	-0.805	-2.191	-0.18
Croatia	Female	-0.448	-2.181	0.085
Croatia	Male	-0.508	-2.363	0.056

² Full estimation results for each country and all age cohorts, for the total population, are available from the authors upon request.

Country	Gender	Okun's coefficients (γ)	CI (2.5%)	CI (97.5%)
Croatia	Total	-0.478	-2.254	0.052
Romania	Female	-0.289	-0.653	0.227
Romania	Male	-0.345	-0.456	-0.132
Romania	Total	-0.319	-0.513	-0.002

Source: own calculations based on Eurostat (n.d.).

Table 6 presents the estimation results for Bulgaria, Croatia, and Romania. In all three countries, the Okun's coefficients were negative, indicating an inverse relationship between annual GDP growth and changes in the youth unemployment rate. The effect was more substantial among women, although the confidence interval for men was wider, suggesting greater uncertainty in the estimates for this subgroup.

Table 7 presents the results of two-way fixed effects (TWFE) models for five age cohorts (15–24, 25–34, 35–44, 45–54, 55–64), disaggregated by gender, for the 2000–2023 period. The estimates for the 15–24 cohort are based on data from 11 countries, while those for the remaining cohorts are based on data from the eight OECD countries.

Table 7. Estimation of Okun's coefficients (γ), TWFE models

Cohort	Group	Okun's coefficients (γ)	SE_clustered	p	Lower CI	Upper CI	R ²
15–24	Total	-0.238	0.045	0.000	-0.303	-0.173	0.573
15–24	Men	-0.449	0.089	0.000	-0.603	-0.108	0.465
15–24	Women	-0.390	0.116	0.001	-0.586	-0.109	0.422
25–34	Total	-0.297	0.026	0.000	-0.358	-0.233	0.674
25–34	Men	-0.362	0.037	0.000	-0.464	-0.200	0.647
25–34	Women	-0.224	0.039	0.000	-0.304	-0.117	0.563
35–44	Total	-0.272	0.019	0.000	-0.324	-0.205	0.628
35–44	Men	-0.349	0.022	0.000	-0.413	-0.275	0.610
35–44	Women	-0.197	0.026	0.000	-0.258	-0.080	0.510
45–54	Total	-0.292	0.025	0.000	-0.356	-0.220	0.643
45–54	Men	-0.381	0.038	0.000	-0.460	-0.244	0.626
45–54	Women	-0.159	0.069	0.021	-0.277	-0.046	0.491
55–64	Total	-0.217	0.014	0.000	-0.268	-0.160	0.479
55–64	Men	-0.259	0.019	0.000	-0.316	-0.132	0.450
55–64	Women	-0.259	0.019	0.000	-0.320	-0.161	0.450

Source: own calculations based on Eurostat (n.d.).

The strongest unemployment response to GDP fluctuations was observed in the 25–34 age cohort for the total population, and in the 15–24 cohort for both women and men. In most cohorts,

the effect is considerably stronger among men than women. The high R^2 values confirm a good model fit.

A comparison with Table 4, which reports RLM estimates without fixed effects, indicates consistency in both the direction and hierarchy of the coefficients. In both models, the GDP – unemployment relationship is negative and strong among young people, and its intensity systematically weakens with age. The lower Okun's coefficients values in the TWFE model result from controlling for country and year effects, which remove part of the structural variability and institutional heterogeneity. Both approaches confirm that Okun's law holds consistently across the region, especially for younger cohorts and for men.

To examine whether the elasticity of Okun's law differs significantly between women and men, a Wald test for gender differences ($\Delta Y \times \text{Male}$) was conducted. The results are presented in Table 1A in the Appendix. The findings show that gender differences in Okun's elasticity are primarily evident among younger workers, whereas in older cohorts, labour markets exhibit greater stability regardless of gender. Additionally, a Wald test confirmed statistically significant cross-country differences in the strength of the Okun effect for the youngest cohorts (Table 2A in the Appendix).

To capture changes in the relationship between economic growth and youth unemployment across subperiods, Okun's coefficients were estimated for three periods: pre-GFC (≤ 2008), post-GFC (2009–2019), and post-COVID-19 pandemic (≥ 2020) (Table 8).

Table 8. Estimation of Okun's coefficients (γ) across structural periods, cohort 15–24, 11 countries, 2000–2023

Group	Period	Okun's coefficients (γ)	SE clustered	p
Total	≤ 2008	-0.19301	0.05504	0.000454
Total	2009–2019	-0.35429	0.08822	5.92E-05
Total	≥ 2020	0.035353	0.033421	0.290137
Male	≤ 2008	-0.21179	0.119823	0.077134
Male	2009–2019	-0.80973	0.230078	0.000433
Male	≥ 2020	0.129714	0.147548	0.379331
Female	≤ 2008	-0.25037	0.196027	0.201524
Female	2009–2019	-0.59562	0.155802	0.000132
Female	≥ 2020	-0.06966	0.184331	0.705479

Source: own calculations based on Eurostat (n.d.).

The results indicate that in the pre-GFC period, Okun's law exhibited moderate strength for the total youth population. Between 2009 and 2019, this relationship became markedly stronger, reflecting greater labour market sensitivity to economic fluctuations following the GFC. This may have been related to increased emigration of young people in some countries after EU accession, particularly in Romania and Poland. After 2020, the sign of the coefficient becomes positive but statistically insignificant. By gender, the results show that the Okun coefficient was more negative

for men from 2009 to 2019. These findings suggest that after 2020, the relationship between economic growth and youth unemployment weakened.

Table 9 presents estimates from the interactive Okun's law model, which includes an interaction with the share of temporary employment in total employment. The model was estimated for the 15–24 age cohort for the period 2000–2023, covering the eleven CEE countries.

Table 9. Estimates from the interactive Okun's law model with the share of temporary employment

Group	$\Delta Y (\beta_1)$	SE (clustered)	p	$\Delta Y \times \text{TEMP} (\beta_2)$	SE (clustered)	p	N
Total	-0.242	0.053	0.001	+0.102	0.040	0.019	253
Male	-0.305	0.069	0.000	+0.118	0.045	0.012	253
Female	-0.182	0.060	0.004	+0.027	0.041	0.511	253

Source: own calculations based on Eurostat (n.d.).

As shown in Table 9, the coefficients for $\Delta Y (\beta_1)$ are negative and statistically significant across all groups, confirming that GDP growth led to a decline in youth unemployment, in line with the classical Okun's law. The β_2 coefficients are positive, indicating that a higher share of temporary employment weakens the traditional Okun effect; the greater the proportion of workers on temporary contracts, the weaker the decline in youth unemployment in response to GDP growth. For women, however, the interaction term is not statistically significant.

The results of the interactive model with the enrolment rate (ENROL) for the 15–24 age cohort also confirm the validity of Okun's law, while showing a significant modification in the strength of this relationship based on educational enrolment levels.

Table 10. Estimates from the interactive TWFE Okun's law model with the enrolment rate, 15–24 cohort, 9 countries*, 2013–2023

Group	$\Delta Y (\beta_1)$	SE (clustered)	p	$\Delta Y \times \text{ENROL} (\beta_2)$	SE (clustered)	p	N
Total	-0.261	0.059	0.001	-0.077	0.031	0.027	99
Male	-0.315	0.071	0.000	-0.085	0.036	0.022	99
Female	-0.193	0.065	0.005	-0.049	0.040	0.226	99

* The data about enrolment rates were available for 9 countries: Bulgaria, Croatia, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia.

Source: own calculations based on Eurostat (n.d.).

The coefficient for $\Delta Y (\beta_1)$ is negative and statistically significant. The negative and significant interaction coefficient β_2 indicates that the Okun relationship strengthens with higher levels of educational enrolment; the greater the share of young people continuing education, the stronger the response of unemployment to GDP changes. This effect is particularly pronounced among men, while in the female group, the interaction does not reach statistical significance.

The results of the interactive model that incorporates the EPL index for permanent contracts (EPL A) indicate that Okun's law holds during the analysed period.

Table 11. Estimates from the interactive TWFE model with EPL A indices, cohort 15–24, 8 OECD countries, 2013–2019

Group	$\Delta Y (\beta_1)$	SE (clustered)	p	$\Delta Y \times \text{EPL A} (\beta_2)$	SE (clustered)	p	N
Total	-0.302	0.064	0.001	+0.066	0.028	0.029	56
Male	-0.349	0.071	0.001	+0.084	0.034	0.017	56
Female	-0.236	0.069	0.006	+0.047	0.037	0.188	56

Source: own calculations based on OECD n.d., *OECD Indicators*...

The coefficients for $\Delta Y (\beta_1)$ are negative and statistically significant across all groups, confirming that GDP growth is associated with a decline in youth unemployment. The positive and significant interaction coefficients (β_2) indicate that a higher level of employment protection for workers on permanent contracts weakens the classical Okun effect. In countries and years with more restrictive employment regulations (higher EPL A), GDP growth leads to a smaller decrease in youth unemployment. This effect is particularly evident among men, while in the female group it remains statistically insignificant. In the interactive Okun's law model, which includes the EPL B index (Table 12), the coefficients for $\Delta Y (\beta_1)$ are negative and statistically significant across all groups, confirming that GDP growth reduces youth unemployment.

Table 12. Estimates from the interactive TWFE model with EPL B indices, 2013–2019, 8 CEE countries, cohort 15–24

Group	$\Delta Y (\beta_1)$	SE (clustered)	p	$\Delta Y \times \text{EPL B} (\beta_2)$	SE (clustered)	p	N
Total	-0.258	0.063	0.001	-0.041	0.019	0.036	56
Male	-0.241	0.019	0.036	-0.052	0.022	0.021	56
Female	-0.197	0.067	0.007	-0.031	0.024	0.192	56

Source: own calculations based on OECD n.d., *OECD Indicators*...

Negative interaction coefficients (β_2) indicate that a higher level of regulatory strictness regarding temporary contracts (EPL B) strengthens the Okun effect; the stronger the protection of fixed-term employees, the greater the decline in youth unemployment in response to economic growth. In the female group, the interaction remains statistically insignificant.

Discussion

The analyses allow for several generalisations regarding youth unemployment and its determinants in the examined CEE countries.

In all countries, the unemployment rates for youth aged 15–24 significantly exceeded the corresponding rates for the entire labour force. This prompted an investigation into the causes of this disparity in the unique characteristics of youth in the labour market. Undoubtedly, relatively limited work experience, a high propensity to change jobs in search of suitable employment, and a relatively high share of youth in various forms of temporary employment, which is less protected

than regular employment under permanent contracts, typically held by individuals with longer work experience, all play a key role.

The analyses revealed substantial variation in youth unemployment rates across the CEE countries. These differences are undoubtedly linked to varying GDP growth dynamics and institutional frameworks. Countries with relatively high youth unemployment rates from 2000 to 2023 include Croatia, Poland, and Slovakia. In Croatia, strong fluctuations in GDP growth contributed to this with periods of expansion followed by contractions, such as between 2009 and 2013 (average annual GDP decline of -2.2%) and in 2020 (-8.5%). Moreover, a relatively high share of temporary employment supported the elevated youth unemployment rate. In Poland, despite sustained economic growth (only one GDP decline in 2020 at -2.02%) and relatively high enrolment rates, youth unemployment remained high, which can be attributed to the prevalence of temporary contracts and weaker legal protection compared to regular employment. In Slovakia, where GDP fell only in 2020 (-3.3%), low youth enrolment rates contributed to higher youth unemployment.

Countries with relatively low youth unemployment rates throughout the period included Estonia, Hungary, and Slovenia. In Estonia, relatively high GDP growth rates (1.1% to 6.4%) alternated with moderate declines (-0.3% annually from 2009–2013, and -0.9% in 2020), alongside low temporary employment shares and relatively high EPL indices for regular employment.

In Hungary and Slovenia, the drivers of low youth unemployment were more closely aligned. In Hungary, young people registered at Public Employment Service offices can receive various support under the “Youth Guarantee Plan” (including subsidized job offers, internships, and vocational training), improving their situation in the labor market (Farkas et. al. 2020: 8). In Slovenia, despite high shares of temporary employment and GDP contractions between 2009 and 2013 (-1.8% annually) and in 2020 (-4.2%), youth unemployment remained relatively low. This was due to high GDP growth in other years (ranging from 3.4% to 4.1%), high enrolment rates, and relatively strong employment protection for regular contracts.

The sensitivity of unemployment to GDP changes, estimated across various age cohorts in a pooled model for the eight OECD countries, not only confirmed a relationship consistent with Okun's Law but also revealed cohort-specific differences. The strongest negative relationship was observed in the 15–24 age group, with progressively weaker responses in older cohorts. This result aligns with the findings of Hutengs and Stadtmann (2013), Dunsch (2016), and Butkus and Seputiene (2019). For young people, characteristics such as greater labour market mobility due to job searching and insufficient work experience became evident. Moreover, early in their careers, young people are often employed under temporary contracts, which are less protected legally than permanent contracts (Kwiatkowski 2016; Kwiatkowski and Włodarczyk 2017). As a result, during economic downturns, young workers are the first to be dismissed.

The pooled model also revealed gender differences in unemployment sensitivity to GDP changes. In all age cohorts, the absolute values of Okun coefficients were higher for men than for women. Some differences between men and women with regard to the cyclical sensitivity of unemployment were also noted by Zanin (2014). This can be explained by sectoral differences in employment structures and the varying cyclical sensitivity of different sectors. Previous

studies show that industry and construction are much more cyclical than the service sector (Kwiatkowski and Kucharski 2009). As such, male-dominated sectors like industry and construction contribute to the higher cyclical sensitivity of male unemployment compared to female unemployment.

Cohort models for individual OECD countries confirmed a negative relationship between GDP growth and unemployment across all age cohorts. They also confirmed the highest cyclical sensitivity in the youngest group (15–24) and a gradually weaker, though still negative, relationship in older groups. Some cross-country differences in the absolute values of Okun coefficients in the 15–24 group were observed: the strongest negative relationship was in Slovakia (characterised by a high share of temporary employment, low enrolment rates, but relatively high EPL indices for regular jobs) and Lithuania (low EPL for regular jobs, low shares of temporary jobs, and high enrolment rates). Conversely, weaker effects were noted in Czechia (high EPL and high enrolment) and Slovenia (high EPL and high enrolment). These observations suggest that theoretical expectations regarding institutional labour market influences are not always confirmed. Slovakia is a fascinating case, where strong cyclical youth unemployment sensitivity occurred despite strong legal protection of permanent employment contracts. This may support the hypothesis that overly restrictive EPL can result in inefficient labour allocation, employment cuts, rising unemployment, and a relatively high popularity of temporary employment in that country.

Estimates for Bulgaria, Croatia, and Romania confirm the negative relationship between GDP growth and unemployment rates across all age cohorts, with the most substantial adverse effect observed in the youngest group and progressively weaker effects in older groups. Powerful negative relationships were found in Bulgaria, where, unlike other countries, the cyclical sensitivity of female unemployment exceeded that of males.

The estimates of structural and institutional factors yielded results only partially consistent with theoretical expectations. As expected, higher EPL indices for permanent contracts reduce the sensitivity of youth unemployment to changes in GDP. Stricter employment protection tends to stabilise both employment and unemployment. Similarly, the increased sensitivity of youth unemployment associated with higher enrolment rates can be explained by the fact that a higher GDP growth rate translates into a stronger reduction in youth unemployment when more young people remain in education.

However, the impact of temporary employment on youth unemployment sensitivity proved contrary to expectations. The weaker responsiveness of unemployment may be linked to the relatively small share of temporary employment compared with permanent employment, as well as its downward trend over the analysed period. Likewise, the effect of EPL indices for temporary contracts on unemployment sensitivity was opposite to theoretical assumptions. The finding that stricter legal protection of temporary employment increases the responsiveness of youth unemployment to GDP changes supports the hypothesis of Malul et al. (2011) regarding the negative labour market effects of excessive employment protection.

Conclusion

The analysis of CEE labour markets between 2000 and 2023 confirms the precarious situation that young people face within these economies. In all the analysed countries, unemployment rates among young people aged 15–24 were higher than both the total unemployment rates and the rates observed in older age groups. This trend was especially pronounced in Croatia, Poland, and Slovakia, indicating that typical characteristics of youth, such as limited work experience and relatively high labour market mobility, play an important role in job search and retention. In Croatia and Poland, the prevalence of youth unemployment was further fuelled by the extensive use of temporary employment systems that attracted many young workers. In contrast, in Slovakia, the relatively low enrolment rate among youth was a contributing factor.

The analysis also showed substantial fluctuations in youth unemployment rates throughout the studied period. These fluctuations were undoubtedly linked primarily to fluctuations in GDP growth rates and high shares of temporary employment in total employment in several countries.

Econometric results revealed a high degree of cyclical sensitivity of youth unemployment to GDP changes, confirming the validity of Okun's Law. In the pooled model for the eight CEE countries, the 15–24 age cohort exhibited the strongest negative relationship between the unemployment rate and GDP growth. This negative relationship was still present in older cohorts, but weakened progressively with age. Additionally, the relationship was stronger for men than for women, which may be attributed to the sectoral distribution of male and female employment, with men more likely to work in sectors that are more sensitive to economic fluctuations.

Cohort-based models for individual countries also confirmed a negative relationship between GDP growth and unemployment across all age groups, with the strongest relationship in the 15–24 age group. A cross-country comparison shows that the strongest negative relationships for this age group were found in Lithuania, Poland, and Slovakia (for both the total cohort and for men), while the weakest were in Czechia and Slovenia. For women, the strongest sensitivity was observed in Czechia, Latvia, and Lithuania, while the weakest was in Estonia and Poland. Attempts to explain cross-country differences in estimates based on data on temporary employment, EPL indices, and enrolment rates proved only partially successful, suggesting a need for further investigation.

Similarly, cohort analyses in the three non-OECD countries Bulgaria, Croatia, and Romania confirmed the presence of Okun's Law, particularly in the 15–24 age group, where the negative relationship between the analysed variables was the strongest. Unlike in the other countries, the negative relationship for women in these cases was stronger than for men, which calls for a separate, dedicated analysis.

Finally, the results of the interactive models confirm that Okun's law holds in CEE countries; however, its strength depends on the structural and institutional characteristics of the labour market. A high share of temporary employment weakens the classical Okun's effect, whereas a higher level of young people remaining in education amplifies the responsiveness of unemployment to changes in GDP. Furthermore, stricter employment protection for permanent contracts (EPL A) mitigates this relationship, while stronger regulations for temporary contracts (EPL B) reinforce it.

Appendix

Table 1A. Wald test for gender differences ($\Delta Y \times \text{Male}$)

Cohort	Test	p
15–24	F(1, 7) = 3.94	0.082
25–34	F(1, 7) = 3.61	0.093
35–44	F(1, 7) = 2.12	0.184
45–54	F(1, 7) = 0.84	0.389
55–64	F(1, 7) = 0.55	0.486

Source: own calculations based on Eurostat (n.d.).

Table 2A. Wald test for slope heterogeneity ($\Delta Y \times \text{Country}_i$)

Cohort	Test	p
15–24	F(7, 240) = 2.18	0.037
25–34	F(7, 240) = 2.44	0.028
35–44	F(7, 240) = 1.91	0.068
45–54	F(7, 240) = 1.57	0.135
55–64	F(7, 240) = 1.22	0.283

Source: own calculations based on Eurostat (n.d.).

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Bezrobocie młodzieży w krajach Europy Środkowo-Wschodniej. Czy prawo Okuna działa?

Artykuł analizuje empiryczną zasadność prawa Okuna w kontekście bezrobocia młodzieży w krajach Europy Środkowo-Wschodniej w latach 2000–2023. Badaniem objęto 11 państw, wykorzystując dane panelowe z rozbiem na kohorty wiekowe oraz płeć. W analizie zastosowano odporne modele regresji liniowej (RLM) z funkcją straty Hubera oraz modele z efektami stałymi (TWFE). Główna uwaga została poświęcona kohorcie wiekowej 15–24 lata. Wyniki wskazują na istotną statystycznie negatywną zależność pomiędzy wzrostem gospodarczym a stopą bezrobocia młodzieży w większości analizowanych krajów, przy czym obserwuje się wyraźne zróżnicowanie zarówno między krajami, jak i ze względu na płeć. Prawo Okuna znajduje potwierdzenie w danych empirycznych, najsilniejsze efekty zaobserwowano w krajach bałtyckich oraz w Polsce, natomiast naj słabsze na Węgrzech i w Rumunii. Badanie pokazuje również, że wyższy udział zatrudnienia tymczasowego oraz wyższe wartości wskaźnika EPL dla umów na czas nieokreślony zmniejszają wrażliwość bezrobocia młodzieży na zmiany PKB, natomiast wyższe wskaźniki skolaryzacji młodzieży i wyższe wartości EPL dla umów tymczasowych zwiększają tę wrażliwość.

Słowa kluczowe: bezrobocie młodzieży, prawo Okuna, Europa Środkowo-Wschodnia, regresje panelowe