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YOUTH UNEMPLOYMENT AND ECONOMIC GROWTH IN THE EU: A PANEL DATA ANALYSIS

Abstract

In this paper, the authors analyse the factors and their intensity of influence on youth unemployment in the European Union. The aim of the study is to determine how important macroeconomic factors such as gross domestic product (GDP), foreign direct investment (FDI), public investment in education, the proportion of part-time work and investment in research and development influence the employment opportunities of young people. The study is based on panel data and the period analysed ranges from 2009 to 2023 and covers all 27 EU member states. A multiple linear regression is used to analyse the data, with the youth unemployment rate as the dependent variable. The main objective of this paper is to investigate whether economic growth affects youth unemployment and to analyse how government spending on education affects youth unemployment. The research findings can contribute to a better understanding of the role of macroeconomic policies in solving the problem of youth unemployment and provide recommendations for the design of effective employment and economic policies in the EU Member States.

Keywords: youth unemployment, economic growth, labour market

1. INTRODUCTION

In theoretical and empirical analyses, economics has always emphasised the importance of youth employment in economic relations. Here we immediately emphasise the economic law, which is a regularity that appears as a trend rather than a law. It was defined by Arthur Okun and is named after him. It establishes a link between unemployment and production. In his research, he concluded that unemployment and production are negatively correlated. In the original formulation (Okun, 1962), it refers to a ratio of 1 to 0.3, i.e. if gross national product (GNP) falls by 1 per cent, the unemployment rate rises by 0.3 percentage points. Since then, many studies have confirmed this result and Okun's law has become a classic component of macroeconomic textbooks and a useful reference for calibrating forecasts by political institutions. Despite its stability over time, Okun's law exhibits certain deviations that are captured by the residuals in the regression. These deviations can sometimes be large. For example, unemployment was higher than expected at the start of the Great Recession in the US in 2008 and 2009 and subsequently fell to historically low levels, while output

was modest in both the US and the euro area. Okun's Law tells us something about the overall unemployment rate, but it tells us nothing about the youth unemployment rate. However, common sense tells us that based on this generally accepted economic law, we can assume that GDP growth will lead to a decline in youth unemployment, the only question is to what extent. This paper focuses on this problem to prove that this relationship is inverse and to examine the intensity of the relationship.

First, however, it is necessary to define what youth unemployment is. The youth unemployment rate is the percentage of unemployed in the age group of 15 to 24 years in relation to the total labour force. However, it should be noted that a large proportion of people of this age are outside the labour market, such as young people who study regularly and are not available for work. The unemployment rate refers to the people who do not have a job, are available for work and have taken concrete steps to look for work in the last four weeks. Youth unemployment and underemployment are among the biggest problems facing most countries in the world. For this reason, the United Nations has set as its 8th goal in the SDGs to "promote sustained, shared and sustainable economic growth, full and productive employment and decent work for all".

It is very likely that it is not only the development of GDP that influences youth unemployment. We believe that some other macroeconomic variables can also have a significant impact on changes in youth unemployment. For this reason, in this paper we will try to link youth unemployment to investment in the education system, foreign direct investment, part-time employment and investment in research and development, in addition to the development of GDP. Investment in the education system improves the employability of young people, reduces the mismatch between supply and demand in the labour market and can reduce structural unemployment in the long term, although in the short term it may extend the period of training and delay entry into the labour market (in the short term it reduces unemployment). Foreign direct investment usually bring new jobs, but if it is concentrated in sectors that require highly skilled labour or are not labour-intensive, its impact on reducing unemployment may be limited. Temporary forms of employment make it easier for young people to enter the labour market. However, if precarious and low-paid jobs dominate, they can contribute to economic instability and the postponement of permanent employment, which can increase youth unemployment in the long term. Investment in research and development stimulates innovation and the creation of high value-added jobs. However, if they lead to increased productivity without significant employment growth, their effect on reducing youth unemployment may be limited. The ultimate impact of these variables depends on the institutional framework, employment policies and the structure of the economy. For this reason, it is necessary to analyse their impact on youth unemployment.

The youth unemployment rate therefore depends on various macroeconomic factors that shape the labour market, and it is difficult to capture all factors in one study. However, we have selected those variables that appear to be the most significant and whose effects have not been thoroughly analysed in previous studies.

Against this background, this paper analyses the extent to which selected macroeconomic factors influence youth unemployment in the European Union. The paper is organised as follows. This introductory section is followed by a literature review in section 2, in which the most important theoretical and empirical findings on the determinants of youth unemployment are presented. Section 3 explains the methodology and describes the data used for the analysis, including the model specification and sources. Section 4 provides the empirical results obtained using a fixed-effects regression model. Section 5 discusses the main results in the context of the existing literature and economic theory. Finally, Section 6 provides concluding remarks and policy recommendations as well as suggestions for future research.

2. LITERATURE REVIEW

Youth unemployment remains a persistent and complex socio-economic challenge in the European Union, attracting considerable attention from academics, policy makers and international organisations. The existing literature highlights a variety of factors contributing to this phenomenon, from macroeconomic conditions to structural labour market problems and skills shortages.

The relationship between economic growth and unemployment has long been a central topic in economics, with Okun's Law (Okun, 1962) serving as a foundational concept. Numerous studies have investigated the applicability of Okun's Law in various contexts, including its relevance to youth unemployment. As (Martin, 1993) stands out the most practical innovation in macroeconomic theory during the past decade has been the replacement of the Phillips curve with the aggregate-supply relationship. However, the AS curve is not a radically new concept; in fact, it is derived directly from the Phillips curve with the help of Okun's Law as the link between unemployment rates and output. While the inverse relationship between GDP growth and overall unemployment is well-established, the specific dynamics affecting youth unemployment may differ due to factors such as labour market segmentation and entry barriers. For example, Joko and Welly (2022) based on Okun Law analysed whether the effect of growth on unemployment differs between youth and adults. Their research period was from 1991 to 2021 and the results of regression model show that growth has no impact on youth unemployment, but growth has a negative effect on adult unemployment. Their study support Okun Law only if we analyse adult unemployment. However, the results do not support Okun's law for youth unemployment.

The impact of public investment in education on labour market outcomes has been extensively studied. Theoretically, increased educational attainment should enhance employability and reduce unemployment. Farzanegan and Gholipour (2021) they investigate the role of quality of education in explaining the within country variation of youth unemployment in the Middle East and North Africa (MENA) region. They used fixed effect regression methodology for a panel of 18 MENA countries from 2007 to 2017. Results show a significant and robust negative effect of higher quality of education system on youth unemployment rate. The results show that a one unit increase in perceived quality of education systems is associated with approximately 4 percentage points decline in youth unemployment. Mehmetaj and Xhindi (2022) analysed whether the government-allocated share of funds to total public expenditures in education affects the unemployment rates of youth in Albania. Their study showed that there is a long-term causality between total public expenditures in education and the youth unemployment rate. If total public expenditures in education increase by 1%, the youth unemployment rate would decrease by 10.81%. There is also a long-term causality between public expenditures in higher education and the graduated youth unemployment rate. If public expenditures in higher education increase by 1%, the graduated youth unemployment rate would decrease by 5.85%.

The role of part-time employment in youth labour markets is a subject of ongoing debate. On one hand, part-time jobs can provide valuable work experience and income for young people, facilitating their entry into the labour market. For example, Gontkovičová et al. (2015) in their research, they state that a low youth unemployment rate in the Netherlands is because majority of employed young people work on part-time. So, part-time contracts should decrease youth unemployment. On the other hand, a high prevalence of part-time work among youth may indicate a lack of full-time opportunities and the existence of precarious employment conditions.

The effects of Foreign Direct Investment (FDI) and Research and Development expenditures (R&D) on employment have been widely examined. The extent to which FDI and R&D benefit youth employment may depend on factors such as the sectoral composition of investments and the skill requirements of new jobs. FDI can stimulate job creation through increased production and technology transfer and it is expected that the growth of FDI will have an impact on the reduction of youth unemployment. Mkombe et al. (2021) examines the effect of FDI on youth unemployment in the Southern African Development Community (SADC) region using panel data from the World

Bank for the period 1994–2017. Results show that FDI has an insignificant effect on reducing youth unemployment in the SADC region. This could be because the type of FDI in the region is partly mergers and acquisitions, which has fewer jobs creating capacity compared to Greenfield investment. However, Tanaya and Suyanto (2023) investigated relationship between youth unemployment and FDI in the case of Indonesia from 1991 until 2019. The short-run and long-run situations were analysed using the Auto-Regressive-Distribution-Lag (ARDL) technique. Based on the findings, it is found that in the short run, FDI can increase youth unemployment in Indonesia. This situation can be due to the reallocation industry, which requires workers' adjustment. However, in the long run, FDI significantly reduces youth unemployment.

R&D investments can foster innovation and generate new employment opportunities, particularly in high-tech sectors that young people are prone to. Gür (2021) analysed the relationship between Research and Development (R&D) expenditures and youth unemployment in EU member states. In the research, the members of the European Union are divided into two groups: old and new members. The analysis covers the period 2000–2018. As a result of the analysis, it was determined that R&D expenditures reduced youth unemployment by 5.6% for older members and had a 4.1% decreasing effect for new member states. This study did not divide the members of the European Union into groups, but the results of our research also show a strong and negative impact of R&D on the youth unemployment rate.

While the existing literature offers valuable insights into the causes of youth unemployment, there are still some gaps. First, few studies have comprehensively analysed the combined effects of macroeconomic factors, education expenditure, part-time employment, foreign direct investment and research and development on youth unemployment in the EU using panel data analysis. Secondly, the potential for time lags and non-linear relationships between these factors and youth unemployment need to be further investigated. Finally, the role of specific labour market institutions and policies in mitigating the impact of these factors on youth employment deserves more attention.

This study aims to fill these gaps by using a panel data analysis of 27 EU Member States for the period 2009 to 2023. By examining the interplay between macroeconomic variables, education expenditure, part-time employment, foreign direct investment and research and development, this study aims to provide a more nuanced understanding of the factors influencing youth unemployment in the EU and inform the design of effective employment policies.

3. METHODOLOGY AND DATA

3.1   Hypotheses and variables

The empirical part of this paper analyses the relationship between youth unemployment, economic growth, government spending on education, part-time employment, foreign direct investment and investment in research and development. The main objective of this paper is to investigate whether and how economic growth affects youth unemployment and to analyse how fluctuations in government spending on education affect youth unemployment. Furthermore, the authors analyse the relationship between youth unemployment, foreign direct investment and R&D investment.

To define the research framework, the authors conducted a literature review, which led to the formulation of the following hypotheses:

-   H1: Economic growth negatively and significantly impacts youth unemployment;
-   H2: Government expenditure on education negatively and significantly impacts youth unemployment;
-   H3: Foreign direct investment and research and development investments have significant effects on youth job creation.

First hypothesis (H1) is based on Okun's Law, which posits an inverse relationship between GDP growth and unemployment. It assumes that higher economic growth leads to job creation and

reduces the number of unemployed, including among young people. The aim is to test whether this general economic principle also applies to youth unemployment in EU member states. Second hypotheses (H2) assumes that public investment in education improves the skills and employability of young people, thereby reducing structural mismatches in the labour market. In the long run, better educational outcomes are expected to lower youth unemployment rates. Third hypothesis (H3) explores whether external capital inflows and innovation-driven growth contribute to reducing youth unemployment. FDI may create new job opportunities, while investment in R&D is expected to foster innovation, productivity, and employment in knowledge-intensive sectors, particularly attractive to young, educated individuals.

To test these hypotheses, the authors used a multiple linear regression analysis on panel data collected by Eurostat and the World Bank, all data is publicly available. The study covered 27 EU members over 15 years from 2009 to 2023 and in the research, we used six variables that were determined by the set hypotheses.

The descriptive statistics of the data are shown in Table 1. At this point, it should be noted that the study also covered the period of the COVID-19 pandemic, which had a significant impact on economic development.

Table 1 Descriptive statistics

Variable	Number of observations	Mean	Standard deviation	Min	Max
UNEMP	403	20,74	10,08	5,6	59,2
GROWTH	403	1,68	4,17	-16	24,6
GEE	403	11,28	2,02	7,11	17,01
PTE	403	14,19	9,53	1,4	42,4
FDI	403	446,3	1278,21	11,9	9533
GERD	403	1,62	0,897	0,38	3,73

Source: author's calculations

It is interesting to highlight some data points. The highest youth unemployment rate was recorded in Greece in 2013 at 59,2 percent and the lowest in 2019 in the Czech Republic at 5,6 percent. On the other hand, GDP growth recorded its lowest value in 2009 in Latvia with -16 percent, while the highest value in 2015 was recorded in Ireland with 24,6 percent.

3.2 Specification of the model

The model to be estimated is a static panel data model of youth unemployment and economic growth and is defined as follows:

$$UNEMP_{i,t} = \beta_0 + \beta_1 ln(GROWTH_{i,t}) + \beta_2 ln(GEE_{i,t-2}) +$$
$$\beta_3 ln(PTE_{i,t}) + \beta_4 ln(FDI_{i,t}) + \beta_5 ln(GERD_{i,t}) + \varepsilon_{i,t}$$

(1)

where are:
- UNEMP$_{i,t}$ – Youth unemployment rate (from 15 to 24 year old) in country *i* in year *t*;
- GROWTH$_{i,t}$ – Economic growth in country *i* in year *t*;
- GEE$_{i,t-2}$ – Government expenditure on education as percentage of total government expenditure in country *i* in year *t-2*;
- PTE$_{i,t}$ – Part-time employment as a percentage of total employment in country *i* in year *t*;
- FDI$_{i,t}$ – Foreign direct investment as a percentage of GDP in country *i* in year *t*;
- GERD$_{i,t}$ – Research and development investments as a percentage of GDP in country *i* in year *t*;

- while $\beta_{1\ldots5}$ are coefficients to be estimated;
- β_0 - denotes the constant;
- $\varepsilon_{i,t}$ – the error term of the fixed effects model.

All variables included in the model were logarithmized prior to the analysis. This transformation was applied for three main reasons: (1) to reduce skewness and stabilize the variance of the variables, making the data more suitable for linear regression; (2) to normalize differences in measurement scales across variables, facilitating comparability; and (3) to allow for the interpretation of regression coefficients in terms of elasticities, i.e. the percentage change in youth unemployment associated with a one percent change in the independent variable.

In the model, a two-year lagged variable of government spending on education was used. We believe that this approach is justified and methodologically sound for the following reasons. The lagged effect of education on the labour market, i.e. the impact of increased government spending on education is usually not immediately reflected in the youth unemployment rate. It takes time for reforms of the education system or increased investment in education and higher education to improve the qualifications of young people, which can increase their employability. In this way, the endogeneity of the variable is avoided. If current government spending on education were included without a lag, there would be a possibility of endogeneity, as governments could increase investment in education in response to high youth unemployment. The lag of two years reduces the simultaneity problem in the model. Moreover, young people currently in education enter the labour market only after a few years, and a two-year lag may better reflect this process.

To determine the most appropriate econometric model for analysing the panel data from the 27 countries in the period 2009-2023, the authors conducted several statistical tests to distinguish between pooled ordinary least squares (OLS), random effects (RE) and fixed effects (FE) models. In a first step, Breusch and Pagan's Lagrange multiplier (LM) test was performed to determine whether a random effects model is more appropriate than a pooled OLS model. This test is used to check whether there are significant differences between the analysed units (countries). The null hypothesis (H_0) states that the variance between the entities is zero, indicating that there is no significant difference between them, which is in favour of the pooled OLS method. The alternative hypothesis (H_1), on the other hand, states that the variance between the entities is considerable, which favours the use of random effects. The test resulted in a p-value of 0.000 (see Table 2), which is a strong indication against the null hypothesis and confirms the presence of significant entity-specific variation. Consequently, the pooled OLS model was deemed inappropriate, necessitating a shift in focus to random effects and fixed effects models.

Table 2 Results of LM test in STATA

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Breusch and Pagan Lagrangian multiplier test for random effects

    Y[countryID,t] = Xb + u[countryID] + e[countryID,t]

    Estimated results:
                         Var       SD = sqrt(Var)

               Y      101.7314          10.0862
               e      25.68662          5.068197
               u      44.34488          6.659195

    Test: Var(u) = 0
                        chibar2(01) =    805.96
                     Prob > chibar2 =    0.0000
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Source: author's calculations

Following the LM test, the Hausman test was carried out to determine whether the individual effects are correlated with the explanatory variables. This test can be used to determine whether the model with fixed effects or random effects is more suitable.

The null hypothesis (H₀) of the Hausman test states that there is no correlation between entity-specific effects and explanatory variables, so that the random effects model is appropriate. In contrast, the alternative hypothesis (H₁) claims that such a correlation exists, which speaks in favour of the fixed effects model. With a p-value of 0.0000 from the Hausman test, the authors reject the null hypothesis, indicating a significant correlation. Therefore, the fixed-effects model is the preferred method for this analysis as it controls for unobservable, time-invariant characteristics and reduces possible biases in the estimated coefficients.

To verify the reliability of the model, diagnostic tests were conducted to detect potential econometric issues. The Wooldridge test for autocorrelation indicated the presence of first-order serial correlation in the panel data, with a p-value of 0.000. Additionally, the Modified Wald test for groupwise heteroskedasticity confirmed heteroskedasticity, also with a p-value of 0.000. Given these results, the standard errors obtained from the fixed effects model could be biased and inconsistent. To address these problems, the model was re-estimated using clustered robust standard errors by panel identifier (country), which corrects for both autocorrelation and heteroskedasticity within panels and provides more reliable inference.

4. EMPIRICAL RESULTS

The results of the coefficient determining the impact of GDP growth on youth unemployment are consistent with our predictions and in line with generally accepted economic theory, referring primarily to Okun's law. This law is an economic concept that relates the change in the unemployment rate to the change in the economic growth rate. In essence, it assumes a quantitative relationship between the percentage change in real GDP and the change in the unemployment rate. The law states that there is an inverse relationship between these two variables. The research has confirmed that the relationship between GDP growth and the youth unemployment rate is negative and statistically significant (the p-value is 0,000). The research results indicate that a 1 percent GDP growth leads to a 0,21 percent decrease in youth unemployment. The relationship between these two variables is negative and statistically significant, which confirms our first hypothesis.

Table 3 Results of coefficients obtained using linear regression with fixed effects

Variable	Number of groups	Coefficient	Robust standard error	p-value	95% confidence interval	
GROWTH	27	-0,214	0,0445	0,000	-0,3058	-0,1227
GEE$_{t-2}$	27	0,547	0,4038	0,187	-0,283	1,3771
PTE	27	0,841	0,228	0,001	0,3719	1,3096
FDI	27	-0,292	0,1356	0,040	-0,5715	-0,0139
GERD	27	-0,396	0,1913	0,048	-0,7899	-0,0032

Source: author's calculations

Government spending on education has a positive and strong influence on youth unemployment. The coefficient that determines this relationship is positive and statistically not significant (p-value is 0,187), indicating that the effect is uncertain in this model specification. Part-time employment (PTE) shows a positive and statistically significant relationship with youth unemployment and it has the strongest influence (of the variables analysed) on the youth unemployment rate. A 1 percent increase in the share of part-time employment leads to a 0,84 percent increase in youth unemployment, suggesting that part-time jobs may not be an effective

pathway to stable employment for young people. According to these research results, we are not able to accept the second hypothesis.

Foreign direct investment and investment in research and development have a negative and statistically significant impact on the youth unemployment rate. The coefficient indicates that a one percent increase in foreign direct investment leads to a decrease in the youth unemployment rate of 0,29 percent. The impact of investment in research and development has a negative and statistically significant effect. A one percent increase in R&D investment leads to a 0,40 percent reduction in youth unemployment, underscoring the importance of innovation-driven economic development in creating employment opportunities for young people. These results support the third hypothesis.

5. DISCUSSION

The results of this study confirm basic economic theories about the relationship between economic growth and youth unemployment. The negative and statistically significant correlation between GDP growth and youth unemployment indicates that an increase in economic activity contributes to a decrease in youth unemployment. This result is consistent with Okun's law, which postulates an inverse relationship between GDP growth and unemployment and emphasises the importance of economic growth in creating employment opportunities for young people. However, the relatively small coefficient of GDP (-0,21) suggests that economic growth alone is not sufficient to solve the problem of youth unemployment. This suggests that additional labour market policies targeting young workers are necessary to achieve significant improvements.

A particularly striking result is the positive and statistically significant relationship between public spending on education and youth unemployment. Contrary to expectations, higher public spending on education appears to correlate with higher youth unemployment. This result could indicate a mismatch between the education system and demand on the labour market. Higher investment in education increases the supply of highly qualified people without a proportional increase in demand for their skills. Another possible explanation is that government investment in education takes time to have an impact on employment and that during this transition, youth unemployment temporarily increases. These results suggest that educational policy reforms are needed that focus on aligning educational outcomes with labour market needs. The two-year lag in government spending on education may not fully capture the long-term benefits of education investment. It is possible that the immediate impact of increased spending may not translate directly into job creation for youth, as education reforms and skills development take time to translate into tangible employment outcomes. Therefore, it may be necessary to use a variable with a longer time lag than two years. We plan to include these in future research as they are necessary to unravel the complexity of this relationship and identify the specific types of educational investments that have the greatest impact on youth employment.

The study also emphasises the role of part-time employment in youth unemployment. The positive relationship between part-time employment and youth unemployment also raises important considerations. While part-time work can provide valuable experience and income for young people, its prevalence may also indicate a lack of full-time employment opportunities. It is possible that a significant proportion of part-time employment among young people is involuntary and indicates underemployment rather than a favoured employment relationship. This supports the argument that the fragmentation of the labour market and the increase in non-standard forms of employment could exacerbate employment problems for young people.

In contrast, investment in research and development (R&D) has the strongest negative effect on youth unemployment of all the variables analysed. This suggests that countries that prioritise innovation and technological progress create more employment opportunities for young, well-educated workers. These results reinforce the idea that promoting a knowledge-based economy is crucial to reducing youth unemployment.

Foreign direct investment (FDI), while statistically significant, has a negligible impact on youth unemployment. This result implies that FDI in its current form does not contribute significantly to job creation for young workers. It is possible that FDI inflows are concentrated in sectors that do not primarily employ young people, or that foreign investment is not well integrated into domestic labour markets. Policy makers should consider strategies to attract FDI that better align with youth employment objectives.

6. CONCLUSIONS

The paper presents only some of the macroeconomic variables that have an impact on the youth unemployment rate. We recognise that this issue is complex and that a period of fifteen years cannot provide insight into the exact evolution of this complex social, economic and political problem. The results we have obtained in this paper only give an indication of the impact of the selected macroeconomic variables on the independent variable.

The results confirm that economic growth plays a key role in reducing youth unemployment, but its effect is relatively modest, suggesting that growth alone is not a sufficient policy solution and that economic policy makers also need to consider the broader socio-economic context. The quality of economic growth is crucial. If growth comes from sectors that create new jobs and enable young people to acquire relevant skills, youth unemployment will fall significantly. If growth comes from sectors that do not employ young people, or if there are structural barriers in the labour market, then the effect may be weaker. Obviously, the European Union has been confronted with precisely this situation in recent years. In future studies, it would be useful to analyse the impact of sectoral growth on youth unemployment. Young people are more orientated towards the technology sector (IT, digital economy…), so we can expect countries that base their economic growth on these activities to have lower youth unemployment.

The positive correlation between government spending on education and youth unemployment suggests that increasing spending on education alone is not enough to reduce youth unemployment. Instead, policy should focus on bridging the gap between education programmes and the needs of the labour market. The role of part-time employment underscores concerns about labour market insecurity and highlights the need for policies that promote stable and quality employment opportunities for young people. On the other hand, part-time employment offers young people flexible jobs that are easily accessible but short-term.

The most important factor in reducing youth unemployment appears to be investment in research and development, which emphasises the importance of promoting an innovation-driven economy. This link is particularly evident in the fact that R&D investment stimulates the creation of new jobs in areas such as technology, engineering and IT, which in turn reduces unemployment among young people with relevant skills. In addition, innovation often leads to new businesses and start-up ecosystems, where young people often find employment or self-employment. Investment in research and development generally helps to reduce youth unemployment, but only if young people have access to the necessary skills and training. On the other hand, if R&D leads to rapid automation, unemployment can increase for those who are unable to adapt to change.

On the other hand, the impact of foreign direct investment suggests that the current inflow of foreign direct investment does not contribute sufficiently to youth employment and that a better adjustment to the needs of the domestic labour market may be necessary. Following on from the above, future research should first examine the sectors into which foreign direct investment flows and then analyse their impact on youth unemployment rates by sector.

These findings offer valuable insights for policy makers seeking to address the problem of youth unemployment in the EU. Future research should examine additional factors that we have discussed above, especially in the context of decomposing the aggregate variables into individual sectors.

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