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Determinants of youth unemployment rate: case of Slovakia

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Keywords: *youth unemployment; unemployment rate for graduated students; work motivation; determinants of unemployment; quality of high schools*

Abstract

Research background: The employment rate of young individuals in the labour market has considerably decreased in developed countries recently. Due to lower labour capital, skills, and generic and job-specific work experience, youth consider finding suitable job challenging. If they fail to succeed in the labour market soon after graduation, it leads to long-term unemployment, unstable and low-quality jobs, and even social exclusion.
Purpose of the article: This paper aims to analyse the unemployment rate of high school-graduated students and the factors impacting this unemployment rate, such as GDP per capita, total unemployment rate, apartment price per square meter and results from state exams. Identifying the determinants affecting youth unemployment is crucial for theoretical knowledge and for policymakers to ensure youth inclusion in the economic mainstream. As a result, society can reduce social and economic costs and avoid structural problems in the future.
Methods: Data about 464 Slovak high schools from National Institute for Certified Educational. Data include the graduate unemployment rate for each high school in Slovakia. Furthermore, two logistic regression models have been developed to investigate the impact of selected factors on

high school graduates' unemployment rate immediately after graduation and nine months after graduation.

Findings & value added: This paper indicates the existence of statistical dependency between unemployment of high school graduates and overall unemployment rate in the region, GDP per capita in the region, quality of high school education and cost of living in the region immediately after graduation. Analysis of the period nine months after graduation has shown the important decline of education quality provided by high schools. To reduce youth unemployment, the state should focus primarily on improving overall unemployment itself by implementing a dual-learning system, simplifying business opportunities, making part-time work available, or introducing lifelong learning to help transform the economy into a knowledge base.

Introduction

The labour market has changed recently for many different reasons, with technological progress being one of the most important. On the other hand, many positive aspects of this factor are compensated by certain negative aspects. Technological development has changed labour force requirements while increasing demand for skilled and educated workers, described as skill-biased (Goldin & Katz, 2007). Also reflecting this trend, labour market prospects for youth have deteriorated significantly in many developed (as well as developing) economies over recent decades. At the same time, it is important to keep in mind the repetitive findings that aggregate demand is the key determinant of youth employment and unemployment (O'Higgins, 2017).

The youth unemployment rate is represented by number of unemployed 15-24-year-olds expressed as a percentage of the youth labour force (overall amount of both employed and unemployed youth) (OECD, 2020a). It is result of complex relationships among demographic trends and specific economic, cultural, and political contexts. Data show that more young people continue in education to higher levels, and school-to-work transition takes longer, resulting in significant number of young people not completing this transition until their late twenties (O'Higgins, 2017).

A more serious problem for society are so-called NEETs (not in education, employment or training). NEET indicator measures the sum of all youth not in employment, education, or training. It measures the number of unemployed, discouraged, and inactive as a percentage of all youth. Young people who are neither in employment nor in education or training are at risk of becoming socially excluded — individuals with income below the poverty line and lacking the necessary skills to improve their economic situation (OECD, 2020b). For both genders, the proportion of NEETs in population increases with age. The percentage of NEETs among young men peaks at age of 23, whilst for young women this increasing trend con-

tinues into late twenties (O'Higgins, 2017). During the first three years after graduation, the unemployment phase increases the likelihood of exiting employment in the subsequent time periods. Youth unemployment is also posing a negative effect on the later employment chances of young individuals. Based on different studies, it seems that employers consider non-employment at the beginning of their career as a negative signal of an employee´s capabilities. Macroeconomic development and the phase of the economic cycle (e.g. economic boom, or recession, etc.) crucially affects the level of unemployment in the country. For youth who left education in a period of unfavourable macro-economic conditions, non-employment in early work-life is probably less disadvantageous compared to those who entered the labour market in a period of a favourable economic climate (Luijkx & Wolbers, 2009).

In 2020, the youth unemployment rate achieved 17.6% in the EU and 18.1% in the Eurozone, which is persistently more than double of the overall unemployment rate (7.2% within the EU-27 and 8.0% within the Eurozone area in February 2020). (European Commission, 2020) Slovakia is, in the long-term, facing higher rates of youth unemployment (20.4% in February 2020) (European Commission, 2020). Many authors have studied the extent and consequences of ongoing youth unemployment. These authors are mostly analysing the reasons for that state, as well as consequences.
Authors like Bal-Domańska (2021), Bayrak and Tatli (2018), Buttler (2019), Dagume and Gyekye (2016), Demidova and Signorelli (2012), Dvouletý *et al.* (2020), Kang (2021), Stabingis (2020) and Tomić (2018) have tried to identify the determinants of youth unemployment mainly among microeconomic and macroeconomic, demographic or structural factors across countries — mainly across the European Union countries or OECD countries — or within one country (e.g. Hungary, Russia, Romania, and South Africa). These studies indicate that youth unemployment largely depends on local GDP or other macroeconomic factors like inflation. On the other hand, recent studies (e.g. Brada *et al*., 2014; Cvecic & Sokolic, 2018; Dimian, 2011; Danacica, 2014; Kabaklarli *et al*., 2011; Dagume & Gyekye, 2016) have studied possible effects which education quality imposes on youth unemployment only to a limited extend and instead, these studies have focused on the highest education achieved by the youth. Nevertheless, the results of these studies indicate that the degree of highest achieved education does impact the youth unemployment rate. This study, therefore, analyses the quality of individual high schools (upper secondary education) via youth unemployment rates per individual school based on achieved state exam results and selected macroeconomic factors. Evaluation of the high school quality through the students' results achieved in state

exams is a novelty of this manuscript because existing studies perceive the quality of the educational system through the proportion of university-educated people in the population. Therefore, this study has the potential to fill the gap in the Central and Eastern European region (CEE), where such research has not yet taken place.

This manuscript aims to analyse the unemployment rate of high school-graduated students and factors impacting this unemployment rate. Dataset of this manuscript includes data about 464 high schools for period starting 2016 to 2017. To fulfil this aim, two logistic regression models have been developed. The first regression model analysed impact of selected variables on youth unemployment immediately after graduation. The second regression model has analysed this impact on youth unemployment nine months after graduation. As mentioned above, the novelty of this manuscript is its focus on the quality of high school and its effect on youth unemployment. Buttler (2019) has advised this point of view in his study as a possibility for future research. The other novelty is the analysis of the relationship between selected individual factors and youth unemployment during various time series (immediately after graduation and nine months after graduation). This study might be relevant due to its innovative approach, mainly for CEE. The upper secondary level of education structure is similar across many post-communist countries integrated into European structures (e.g. Croatia, the Czech Republic, Hungary, Poland or Slovenia). For non-CEE countries, this approach can also be innovative, provided other countries monitor unemployment at the school level and their school system is finalized by standardized state exams applicable to the whole country.

The manuscript is structured into the following sections: Section 1 contains a literature review of relevant prior studies in youth unemployment. Section 2 describes the research methodology and data preparation process. Section 3 contains description statistics and results of conducted analysis. Section 4 includes a discussion, and the last section represents the concluding remarks.

Literature review

The status of youth in the labour market is, in general, linked to the existing education system. Greater emphasis on specific skills of technological changes and trends and a closer link between schools and employers has led to easier transition from education to the labour market. As already mentioned, the school-to-work transition process is moving to mid and late twenties, as in general young people use to spend longer time in the educa-

tion process. Understandably, an easy transition from education (either secondary or tertiary) to work is necessary to avoid youth unemployment. Education may affect individual labour market vulnerability in several ways. For example, the educational system confers attained skills (general, as well as specific vocational), degree attained at school is also signal of "trainability" of the person. In general, people with higher education are in a more favourable position in the labour market (Korpi *et al*., 2003).

However, transition from education to work should be seen as a sequence of various procedures. This transition includes several phases in the life of young individual, finding a satisfying job can take much time, and this is the period of other important decisions such as leaving the household, forming a family etc. It is also evident that youth react more sensitively to socio-economic changes in labour markets. This is because the status of young people in the labour market is less protected and more vulnerable (Brzinsky-Fay, 2007). Once youth are unemployed, they are more exposed to long-term unemployment, unstable and low-quality jobs, and social exclusion. There is direct effect on the personal well-being and social development of youth on individual level.

Countries use different approaches to find balance between education and labour market needs. Developed countries use mainly vocational upper secondary education to solve the mismatch between supply and demand of the labour market (Estévez-Abe *et al*., 2001). It can be assumed that the specific content of upper vocational education reflecting labour market needs is necessary to reduce youth unemployment. Besides education, as Tåhlin and Westerman (2020) point out, previous experience is a crucial determinant of productive capacity and on-the-job learning rather than formal schooling (Tåhlin & Westerman mention research of, e.g. Mincer, 1984). Many studies proving positive correlation between education requirements and experience exist (Tåhlin & Westerman, 2020). Since young individuals are relatively inexperienced, they are (given education) less competitive in high skill jobs than in low-skill jobs. Availability of low-skill jobs is crucial for youth to start their working careers.

A study by Šafránková and Šikýř (2017) has confirmed that part of young individuals born between the early 1980s and mid-1990s in the Czech Republic have problems finding a job on the labour market. This inability to find a job is caused by high work expectations of these individuals, like high income or rapid career growth combined with a lack of necessary experience and work habits. Similar results have been achieved in other studies from Poland as well. This Polish study has determined that employers had problems with youth employment due to lack of experience, initiative and entrepreneurship skills, and learning skills and courses

(Kobylińska *et al*., 2017). Similar results have been achieved in study of Saxunová and Chorvatovičová (2018). Their study has determined that secondary schools and universities could prepare graduated students for the labour market requirements in a more effective way.

Brada *et al*. (2014) defined three major determinants of youth unemployment such as cyclical conditions, social and structural conditions, and government policies. Similarly, Bayrak and Tatli (2018) have shown that GDP, inflation, and domestic gross savings have a negative effect on youth unemployment whilst labour productivity affects youth unemployment positively. The study by Tomić (2018) indicates that the most important factors affecting the youth unemployment rate are real GDP growth along with the size of the national construction sector. On the other hand, the Tomić (2018) study also suggests that the amount of public debt in GDP is the variable that is vastly associated with youth unemployment in Europe. Studies by Kabaklarli *et al.* (2011), Arslan and Zaman (2014) and Bal-Domańska (2021) have identified the relationship between youth unemployment and GDP, inflation and labour market.

Danacica (2014), like Buttler (2019), has used the cases of Romania and Hungary to show that individuals with higher education leave their jobs more easily. However, they are also more often working in inappropriate positions for their skill set and level of education. There are differences among countries, but in developed economies it is not rare that young people are "over-qualified" for the offered job positions (Ngai *et al*., 2016). Contrary, Robayo and Estévez (2019) have shown that higher achieved education might not lead to a higher probability of employment but rather a higher probability of a better-quality job. Moreover, the duration of youth unemployment also correlates with legal period for receiving unemployment allowances in Romania. Cvecic and Sokolic (2018), Danacica (2014), and Dolado *et al*. (2013) have also pointed out the negative relationship between the level of highest achieved education and youth unemployment. On the other hand, Egessa *et al*. (2021) on a sample from Uganda and Caroleo *et al.* (2022) on a sample from Italy, Romania, and Bulgaria showed that unemployment affects young people with lower levels of education. Therefore, if the employment rate needs to be improved, the actual education system needs to be improved. The impact of education on employment has been reduced in Finland, where Pitkänen *et al.* (2021) showed that youth unemployment currently depends more on the socio-economic background and adverse childhood experiences than on education. However, these findings do not apply to the country´s senior population, which started their education within the previous educational system. According to

Kang (2021), countries with more work-oriented study programs have lower youth unemployment than other countries.

Dvouletý *et al.* (2020) and Marelli and Vakulenko (2016) showed a higher unemployment rate for younger individuals, Dvouletý *et al.* (2020), Lallukka *et al.* (2019), Lim and Lee (2019), Petrakis (2021) and Schioppa and Lupi (2002) for females and Dvouletý *et al*. (2020) for people from ethnic minority groups. Similar results were also achieved by Dagume and Gyekye (2016), Maynou *et al*. (2022) and Wesseling (2021). They have shown that among all characteristics of an individual (e.g. gender, age, education), training and previous work experience have the biggest impact on employment. The importance of training programmes and their effect on employment has been confirmed by a Polish study by Styczyńska (2013). Demidova and Signorelli (2012) have shown that youth unemployment is higher than overall unemployment in Russia from 2000 to 2009. Across all regions, it has been shown that youth unemployment can be improved by migration, institutional and labour policies (both macroeconomic and microeconomic), permitting sustainable economic and social development of young people. It is therefore important to focus on permanent monitoring of these attributes across regions. Dimian (2011) has compared the impact of selected demographic, institutional and business cycle factors on youth unemployment. This study has shown that skilled youth unemployment, unlike unskilled youth unemployment, depends on structural factors like unemployment benefits or taxes on labour. It has also shown that youth unemployment is negatively related to GDP per capita and positively related to the unemployment rate from the previous period. Impacts of the unemployment benefit system (negatively for passive labour market policies and positively for the duration of unemployment benefits) were observed by Ductor and Grechyna (2020).

A factor impacting unemployment rate is also financial security of individuals, e.g., in the form of savings, liquid assets and homeownership, and lack of debts. Several studies have indicated that having savings allows individuals to find a new job faster as they have the means to network and travel for job interviews (Bayrak & Tatli, 2018; Tapsin, 2011). On the other hand, having life savings also decreases the motivation of some individuals to look for a new job (Kanfer *et al*., 2001; Solove *et al.*, 2015). This financial security is created by parents' financial support or living in parents' houses for young individuals. According to a study by Aquilino (2005), young individuals may also benefit from continuous parent support in difficult life situations. In addition, Ngai *et al.* (2016) have indicated that young individuals with lower dependency on their parents have higher motivation to look for a job and remain unemployed for shorter time period.

Youth unemployment is one of the key determinants of market income inequalities, which leads to costs and structural problems for both states and society and individuals and their families. Unemployment and related loss of income, skills, motivations or dignity are closely linked to inequality in all its different "spaces". Many experts in different parts of the world raise concerns about increasing income disparities and persistent unemployment. Special attention is also given to youth unemployment, because it could serve as a potential cause of political and social unrest (Huber & Stephens, 2014; Ngai *et al*., 2016).

Income inequalities seem to have also occurred between technological changes and education, a division of benefits of economic expansion is not clear. Positive progress of economy based on technological advances is indicated, but income increase is not equal within the labour market and the economy in general. If workers have flexible skills and if educational infrastructure expands sufficiently, then the supply of skills will increase due to increased demand. Goldin and Katz, based on their findings, conclude that when it comes to changes in the wage structure and returns to skill, supply changes are critical, and education changes are by far the most important on the supply side (Goldin & Katz, 2007).

The majority of the existing studies (Bayrak & Tatli, 2018; Bal-Domanska, 2021; Buttler, 2019; Hasan & Sasan, 2020; Kang, 2021; Tomić, 2020) performed their analysis for a group of countries, e.g. EU countries or OECD countries and a longer period. Therefore, panel data models (especially general linear models) were developed in the existing studies. This method was also used by Hasan and Sasana (2020), who worked with the Association of Southeast Asian Nations (ASEAN) countries, and Demidova and Signorelli (2012), who analysed several regions within one country — Russia. Ductor and Grechyna (2020) used the Bayesian model averaging approach as an alternative to the panel data models. However, studies using data for a single period and usually from one country, such as Dagume and Gyekye (2016), Dimian (2011), Egessa *et al*. (2021) and Luijkx and Wolbers (2009), use logistic regression in their analysis.

Research method

Students start upper secondary education in Slovakia at the age of 15, similarly to many CEE countries (Czech Republic — 15, Slovenia — 15, Hungary — 14, Poland — 16, Croatia — 14). Secondary education lasts from 4 to 5 years and ends with a state exam. Secondary schools can be organizationally divided into general, vocational and art schools. Data of 464 Slo-

vak high schools (out of 800 Slovak high schools) from the National Institute for Certified Educational Measurements place during the 2015/2016 academic year have been collected to fulfil the aim of this manuscript. The 2015/2016 academic year was the last academic year prior to announcing a significant change in the educational system in Slovakia and was, therefore, the last academic year unaffected by the preparations for this reform. Data contain graduate unemployment rate for each of the high schools for A) September 2016 and B) period nine months afterwards (May 2017). High schools and other institutions use this data to determine their graduates' chances to succeed in the labour market.

Moreover, dataset from National Institute for Certified Educational Measurements has been extended by results from the Slovak Language State Exams, which represent the quality of education factor provided by a particular high school. Analysis of high school quality through the students' results from the state exams is a new approach in this study. Existing studies (Brada *et al*., 2014; Cvecic & Sokolic, 2018; Dagume & Gyekye, 2016; Danacica, 2014; Dimian, 2011; Kabaklarli *et al*., 2011) mostly perceive the quality of the educational system through the proportion of university-educated people in the population. State exams from many courses took place during the 2015/2016 academic year. However, only Slovak Language State Exam was mandatory for all high schools in Slovakia, making it one of the independent variables of this manuscript. Furthermore, Slovak Language State Exam is not compulsory only at those high schools with tuition language other than the Slovak language. The mentioned data are publicly available on the webpage of the National Institute for Certified Educational Measurements.

Other independent variables identified in this manuscript are unemployment rate and gross domestic product (GDP) per capita, both on regional level and cost of living, determined by apartment price per square meter on regional level. These variables have been chosen as they provide ideas about economic growth and inflation in each of the Slovak regions (Buttler, 2019; Dagume & Gyekye, 2016; Demidova & Signorelli, 2012). When graduates do not have enough job opportunities in their home regions due to slow or no economic growth, neither graduation from high-quality high school nor above-average graduation exam results are of any use when looking for a job in these regions. The same situation occurs with the apartment price per square meter when students who reside in regions with higher living costs tend to be less motivated to find a job as they cannot be entirely independent on their parents. Even being employed due to the high cost of living, they have to share accommodation with their relatives making it non-motivational to have a proper job. Especially in the eastern Slo-

vak regions, individuals prefer having their apartment instead of renting it. It leads to a vicious circle, with young individuals not having their places because of the high cost of living. Thus, they live with their parents, meaning they have lower monthly expenses then they would have if living independently. The result is that these young individuals are not under pressure to look for a job, and when they do not have money, they cannot afford their apartment.

As a basic economic theory describing the relationship between these transformations, the Philips curve can be used as it expresses the relationship between inflation (based on economic growth) and unemployment. According to the Phillips curve, a decline in unemployment caused by economic growth increases prices, leading to increased inflation and thus increased living costs.

Therefore, the test unit is a high school, and the predicted variable is the unemployment of graduates of a particular secondary school. The macroeconomic variables of a given region or the state test results at a given school are then selected as explanatory variables. The models are simplified because it is impossible to record macroeconomic indicators at a lower level than the regional level (e.g., city level). Based on one macroeconomic value, they try to predict multiple unemployment opportunities for secondary schools belonging to the region. This approach can be considered a limitation of the applied methodology and the developed regression models. All these data are publicly available on the webpage of Slovak Statistical Office.

Studied logistic model (1) describing relationship between unemployment rate of graduated students and independent variables described above has the following vector form

$$uyp_{Sep} = \frac{1}{1+e^{-(\beta_0+\beta_1 u_{Sep}+\beta_2 GDPpC+\beta_3 PP+\beta_4 SE+\varepsilon)}} \tag{1}$$

where uyp_{Sep} represents unemployment rate of graduated high school students in September 2016 for high schools included in data sample, u_{Sep} is unemployment rate in the region, $GDPpC$ is gross domestic product per capita in the region, PP represents apartment price per square meter in the region and SE stands for results of the Slovak Language State Exams. β_1, β_2, β_3 and β_4 are estimated coefficients by the OLS method and ε corresponds to residuals. Coefficient β_0 is intercept of logistic regression model.

Whilst model (1) analyses relationship between unemployment rate of high school graduates and quality of economic or education factors imme-

diately after graduation, and another model has been developed to describe relationship between these factors nine months after graduation, in May of the following year. Model (2) has used results of model (1) as another independent variable. It is expected that high schools with higher graduate unemployment rate in September 2016 would also report higher graduate unemployment rate in May 2017. This would help to explain the theory of difficulties in employment of young individuals in regions.

During the analysis, second logistic model (2) has developed with the following form

$$uyp_{May} = \frac{1}{1+e^{-(\beta_0+\beta_1 uyp_{Sep}+\beta_2 u_{Sep}+\beta_3 GDPpC+\beta_4 PP+\beta_5 SE+\varepsilon)}} \quad (2)$$

where all variables are identical to variables from Model (1) and uyp_{MayUY} represents unemployment rate for graduated high school students in May of the following year for analysed high schools and β_5 represents estimated coefficient.

Parameters of both models (1, 2) have been estimated by statistical software R-studio, namely its build-in function for generalized linear models (glm()) (Chambers, 1992). The selection of final models was conducted through a stepwise regression function using R squared, Akaike Information Criterion and Bayesian Information. Multicollinearity has been detected by variance inflation factor (VIF). Linearity between predictors and response variable has been tested by Box-Tidwell test. Outliers have been analysed by Cook's distance plot (Draper & Smith, 2014; Faraway, 2002).

Results

Table 1 shows number of high schools in each of the individual regions. Data from 464 high schools in Slovakia were collected in overall. Most of the schools in the data sample are located in the Bratislava, Trnava or Nitra regions. These three regions cover high acreage, have high number of inhabitants, and therefore proportion of the high schools is higher there.

Table 1 also indicates the average unemployment rate of high school graduates measured immediately after graduation (in September) and after nine months afterwards (May of the following year). The region with the highest graduate unemployment rate is the Košice region located in the easter part of Slovakia. This region is characterised by generally low number of vacant job opportunities. The high school graduate unemployment

rate in Košice region is well over 12% immediately after graduation, which is more than 2 p.p. higher than the average. From September to May, however, the highest decline in the unemployment rate was observed in this region - the unemployment rate decreased from 14.24% to 6.28%.

The average result achieved by Slovak students from the Slovak Language State Exams in sample is 53.55%. The worst result was achieved mainly in regions with a high presence of the Hungarian minority in the south of Slovakia, such as the Banská Bystrica, Nitra and Trnava regions. Worse results from Slovak Language State Exams in these regions do not indicate lower quality of these high schools, but rather problems with integration of Hungarian minority into Slovak majority. On the other hand, regions located in the north and west of Slovakia, like the Žilina, Trenčín, Prešov and Bratislava region, have achieved above-average results of over 53.55%.

Table 2 includes the following macroeconomic information related to each of the individual regions: unemployment rate, GDP per capita and apartment price per square meter in September 2016 and May 2017. The unemployment rate during the analysed period has decreased by almost two percent, with this decline in the unemployment rate taking place in all Slovak regions. In the case of GDP per capita, growth has been reported in the Bratislava and Žilina regions. However, other regions have reported a decline in GDP per capita.

The price of real estate did not change significantly during the analysed period. As was the case with GDP per capita, some regions have reported a decline in apartment prices or flat period-over-period prices (e.g. Bratislava, Košice, Prešov, and Žilina regions). Cost of living slightly increased in the remaining regions. The overall cost of living remained constant, as was the case for GDP per capita during same analysed period.

Analysis of model (1) has identified the following independent variables as statistically significant at level 0.1%: GDP per capita in the region and Slovak Language State Exam results of particular high school and at the level 1%: unemployment rate in the region, as shown in Table 3. Model (1) confirmed that should the unemployment rate in the region be rather high, then also rate of high school graduates is rather high as well. The employment rate of high school graduates is thus dependent on the labour market of the region. Moreover, Model (1) showed a negative relationship between GDP and youth unemployment rate. Young people living in regions with higher economic growth have a higher chance to employ after graduation.

The last statistically significant variable, which was identified by model (1), is the result from Slovak Language State Exam of particular high school. However, the Slovak Language State Exam results indicated rather

insufficient for high schools with Hungarian tuition language. Despite this fact, analysis of model (1) indicated that quality education has an impact on high school graduates. the better the study results of high school graduates, the higher the probability of finding a job immediately after graduation.

Pseudo R-squared is 79.6%, so the model fits well to the research sample. Akaike information criterion is -1 833.59, and the Bayesian information criterion is -1 806.93. Variance inflation factors are under 2.1, which indicate weak correlations among predictors. Moreover, there is also linearity, tested by Box-Tidwell test, between predictors and response variable was. Cook's distance plot shows that there are no outliers.

Model (2) of this manuscript studies variables affecting high school graduate unemployment rate nine months after graduation and results are shown in Table 4. Analysis of model (2) has identified the following independent variables as statistically significant at level 0.1%: the unemployment rate in the region and the unemployment rate of high school graduates from September 2016 and at the level 5%: GDP per capita. Thus, the dependency between the unemployment rate in the region and the unemployment rate of high school graduates is decreasing in nine months. However, it is still correct to say that regions with higher unemployment rates and lower GDP per capita also report higher high school graduate unemployment rates. Most regions' results indicate that the high school graduate unemployment rate is decreasing below the regional unemployment rate after nine months. This would indicate that young individuals are able, when given a few more months of searching on the labour market, to find job easier than a majority of unemployed population. On the other hand, results also show that should a high school report higher graduate unemployment rate in September, it would still report higher graduate unemployment rate after nine months.

Model (1) indicates that if a graduate studied at quality high school, they would succeed on the labour market sooner. However, this positive impact of education quality diminishes at the course of time as is shown in model (2). The quality of education is considered important benefit for high school graduates which allows them to find a job in shorter time period. As time goes, other factors like the macroeconomic situation (measured by the unemployment rate or GDP per capita) in the region become more important than the quality of education.

Model (2) has pseudo R-squared equal to 83.2% and also, this model fits well to observed data. Akaike information criterion is -3 178.97, and Bayesian information criterion is -3 147.45. Variance inflation factors are under 1.4, which indicate even weaker correlations among predictors than model (1). Linearity between predictors and response variable was con-

firmed by Box-Tidwell test. Moreover, Cook's distance plot does not show any extreme values.

Discussion

This manuscript has indicated that high school graduates´ unemployment rate is affected by several factors. The unemployment rate of high school graduates immediately after graduation depends on the macroeconomic situation (overall unemployment rate and GDP per capita in the region) and quality of education. Studies identified the positive impact of overall unemployment by Bal-Domańska (2021) and Dimian (2011), whilst the negative impact of GDP was identified by studies of Arslan and Zaman (2014), Bal-Domańska (2021), Bayrak and Tatli (2018), Buttler (2019) and Dimian (2011) and Tomić (2018). Although according to these studies, it is enough to boost the economic growth to reduce youth unemployment, the reality of many European economies shows that during the economic growth also, other various macroeconomic and non-macroeconomic indicators affect unemployment. The findings from this study are also in line with Tomić (2018), who showed that the results from the application of individual-level data could be beneficial not only for the country which was analysed. Unlike existing studies (Brada *et al*., 2014; Cvecic & Sokolic, 2018; Dimian, 2011; Danacica, 2014; Kabaklarli *et al*., 2011; Dagume & Gyekye, 2016), this manuscript has measured quality of education not by the highest achieved level, but rather by the results achieved in the state exams. The quality of education measured in this way directly impacted the lower unemployment rate immediately after graduation. The positive impact of education in the short term was also observed by Dvouletý *et al.* (2020), Maynou *et al.* (2022) and Tomić (2018). They indicate that education of good quality and training programs contribute to school-to-work transition. Despite the minor difference in used methods, the results of this study from high school-level perspective are similar and comparable to studies from other CEE countries like Romania or Hungary, but also with Russia (Danacica, 2014; Demidova & Signorelli, 2012) and Western Europe (Bal-Domańska, 2021; Buttler, 2019; Dvouletý *et al*., 2020) in short-term.

Analysis of data nine months later after graduation has shown that the statistical significance of education quality decreased with time. Contrary to the findings of this manuscript are the findings by Lallukka *et al.* (2019). They observed lower unemployment among young people with better social determinants such as education in the long run. The difference among the findings may be caused by the time interval when both studies exam-

ined employment rate — nine months after graduation in this study and 12 months after graduation in the Lallukka et al. study (2019). Since there is common practice in Slovakia to provide limited-term contracts (usually one year) to people entering the labour market. It is possible that after 12 months, some graduated students who were initially employed did not have their contracts extended and became unemployed — a possibility this research did not capture. Regardless, the impact change of in the educational process on employment over time could be classified as a major finding resulting from this manuscript.

The results of this paper confirm expected results that the youth unemployment rate depends on the quality of provided education. The employment rate of graduates from higher-quality high schools is significantly higher than the rate of graduates from lower-quality high schools immediately after graduation. Education support for students from regions with higher unemployment is hence crucial. However, this support would decrease youth unemployment mainly in the short run. If we aim to decrease youth unemployment in the medium run, we shall decrease overall unemployment. The relationship between youth unemployment and overall unemployment was significant also after nine months after graduation.

The collected data might be considered as a limitation of this study. A more extended period analysed would provide higher-quality results smoothing abnormalities of the analysed year. Using several years in the analysis would allow the application of a panel data model within one country, as some existing studies have done (Bayrak & Tatli, 2018; Bal-Domanska, 2021; Buttler, 2019; Hasan & Sasan, 2020; Kang, 2021). Moreover, the panel data model could also contain a region or a type of high school as factors, which might help distinguish specific behaviour across these units. Another limitation of this paper could be the lack of information about the job vacancies available to graduates. This limitation could be resolved by considering job offers pools in the prediction model. Job vacancies are an important factor, as they show better young people's chances of finding employment in a given region than the economy's performance measured by GDP. Based on the methods used, a limitation can be observed in the granularity of predictors, which are not at a lower level than regions. Insufficient detailed data can then skew the prediction to estimate the unemployment of graduates of individual schools through high-level information from a given region.

Conclusions

Even though this study was conducted only on data from Slovak high schools, its results are applicable also for other countries since these results are in line with those from other studies from CEE. Results of this manuscript show that should state want to achieve lower youth unemployment, it should concentrate on improvement of education quality and overall macroeconomic situation in the region. The quality of education has the highest impact on youth unemployment immediately after graduation, whilst the macroeconomic situation in the region measured by the overall unemployment rate impacts youth unemployment rate in a few months after graduation.

There are several ways in which governments and policymakers could reduce youth unemployment. Experience from Western Europe (e.g., Finland) shows that the improvement of the education system contributes to a reduction in youth unemployment. Such improvements to the education system include various training programs or the implementation of a dual education system, which aims to combine theoretical knowledge from schools with the practical experience from the work environment — another aspect where policymakers can reduce the barriers arising during this process. Experience from abroad also shows that the possibility of part-time contracts leads to a lower youth unemployment rate. In the long run, however, policymakers should focus on making lifelong learning more accessible and thus contribute to the transformation of their countries to knowledge-based economies.

From the national perspective, the main contribution of this paper is that it has analysed the vast majority of Slovak high schools. Furthermore, this study did not focus on the highest achieved education, but rather on the quality of education expressed as achieved results in the state exams. Future studies could concentrate on analysis of university student's unemployment as majority of youth has started studying at universities. Hence the challenges of unemployment are shifted from high school graduates to university graduates. Possible future factors that could be analysed are individual personal attributes of youth, environment where youth grew up, and personal motivation to look for a job. Even though system parameters are not set in favour of young job applicants, several examples from other countries show that youth can find a job despite unfavourable system conditions.

From the international perspective, the main contribution of this paper is the methodological perspective. The novel approach of this paper relates to the measurement of the upper secondary school quality through the

achieved results of students from state exams, in contrast to the existing studies, which usually measure the proportion of university-educated people in a population. Therefore, it contributes to a more comprehensive and homogenous comparison. Future research abroad should try to perform similar analyses if similar data is available within a given country. In the context of CEE, it is possible to extend this comparison to an international perspective and comparison as some countries already collect similar data (e.g., a comparison of Slovakia and the Czech Republic).

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Annex

Table 1. Description table for high school attributes for regions

Region	Number of high schools	Unemployment rate Sep. - graduated	Unemployment rate May. - graduated	Results state exams
BA	122	8.23%	3.25%	54.85%
BB	41	12.14%	5.92%	51.98%
KE	33	14.24%	6.28%	52.93%
NR	60	10.79%	4.39%	50.59%
PO	48	10.87%	5.43%	56.58%
TN	48	9.70%	3.65%	54.01%
TT	64	10.38%	3.97%	52.24%
ZA	48	10.95%	5.43%	53.92%
Total	**464**	**10.34%**	**4.44%**	**53.55%**

Note: (Meaning: BA — Bratislava region, BB — Banská Bystrica region, KE — Košice region, NR — Nitra region, PO — Prešov region, TN — Trenčín region, TT — Trnava region and ZA — Žilina region).

Source: own calculation based on data from Statistical Office of the Slovak Republic and National Institute for Certified Educational Measurements.

Table 2. Description table for regional data

Region	Unemployment rate Sep.	Unemployment rate May	GDP Sep.	GDP May	Property price Sep.	Property price May
BA	5.00%	3.68%	235.25	240.29	1.38	1.37
BB	13.70%	11.31%	73.77	72.99	0.52	0.55
KE	11.15%	9.86%	83.16	78.44	0.71	0.71
NR	7.66%	5.14%	87.46	86.38	0.46	0.48
PO	14.08%	11.66%	59.85	60.64	0.60	0.60
TN	6.26%	4.06%	87.46	86.38	0.50	0.53
TT	5.12%	3.15%	108.62	109.04	0.66	0.67
ZA	7.37%	5.71%	85.34	86.24	0.63	0.62
Total	**9.26%**	**7.32%**	**103.50**	**103.56**	**0.71**	**0.71**

Note: (Meaning: BA — Bratislava region, BB — Banská Bystrica region, KE — Košice region, NR — Nitra region, PO — Prešov region, TN — Trenčín region, TT — Trnava region and ZA — Žilina region).

Source: own calculation based on data from Statistical Office of the Slovak Republic and National Institute for Certified Educational Measurements.

Table 3. Results of logistic model for unemployment rate — high school graduates in September 2016

Variables	Estimate	Std. Error	t value	Pr(>|t|)	Sign.
(Intercept)	0.3946	0.04004	9.857	< 2e-16	***
Unemployment rate	0.2412	0.09098	2.652	0.0082	**
GDP per capita	-0.0012	0.00034	-3.452	0.0005	***
Apartment price for square meter	0.0182	0.02794	0.652	0.5148	
Results from state exams	-0.0042	0.00021	-19.734	< 2e-16	***
Box-Tidwell test	**MLE of lambda**	**t value**	**Pr(>|t|)**	**Sign.**	**vif**
Unemployment rate	0.4786	-0.5683	0.5698		2.0157
GDP per capita	-63.92397	-1.9517	0.0510		2.0218
Apartment price for square meter	8.57818	-1.9077	0.0564		1.0191
Results from state exams	0.9060	0.4012	0.6883		1.0070
Pseudo R-squared	0.796				
Residual standard error	1.946				
Degrees of freedom residuals	460				
Akaike Inf. Criterion	-1 833.59				
Bayesian Inf. Criterion	-1 806.93				

Note: Significance: * corresponds to statistical significance at 5%, ** corresponds to statistical significance at 1% and *** corresponds to statistical significance at 0.1%

Source: own calculation in R-studio based on data from Statistical Office of the Slovak Republic and National Institute for Certified Educational Measurements.

Table 4 Results of logistic model for unemployment rate — high school graduates in May 2017

Variables	Estimate	Std. Error	t value	Pr(>|t|)	Sign.
(Intercept)	0.0162	0.01366	1.182	0.2375	
Unemployment rate	0.1504	0.03768	3.992	0.0001	***
Unemployment rate – high school graduates in September	0.2712	0.01257	21.571	< 2e-16	***
GDP per capita	-0.0002	0.00011	-2.265	0.0238	*
Apartment price for square meter	0.0029	0.01237	0.233	0.8156	
Results from state exams	0.0002	0.00010	1.696	0.0904	
Box-Tidwell test	**MLE of lambda**	**t value**	**Pr(>|t|)**	**Sign.**	**vif**
Unemployment rate	-1.15476	-1.8532	0.0638		1.3767
Unemployment rate – high school graduates in September	0.9348	-0.3965	0.6917		1.3903

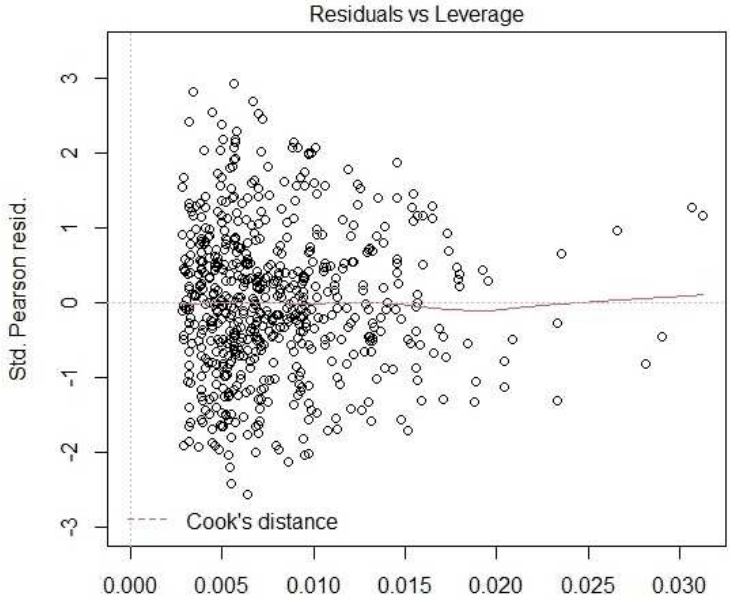
Table 4. Continued

Box-Tidwell test	MLE of lambda	t value	Pr(>|t|)	Sign.	vif
GDP per capita	32.3105	-1.3787	0.1682		1.3814
Apartment price for square meter	277.9150	-0.6584	0.5103		1.0107
Results from state exams	2.3785	-1.4023	0.1608		1.3527
R-squared	0.832				
Residual standard error	0.326				
Degrees of freedom residuals	459				
Akaike Inf. Criterion	-3 178.97				
Bayesian Inf. Criterion	-3 147.45				

Note: Significance: * corresponds to statistical significance at 5%, ** corresponds to statistical significance at 1% and *** corresponds to statistical significance at 0.1%

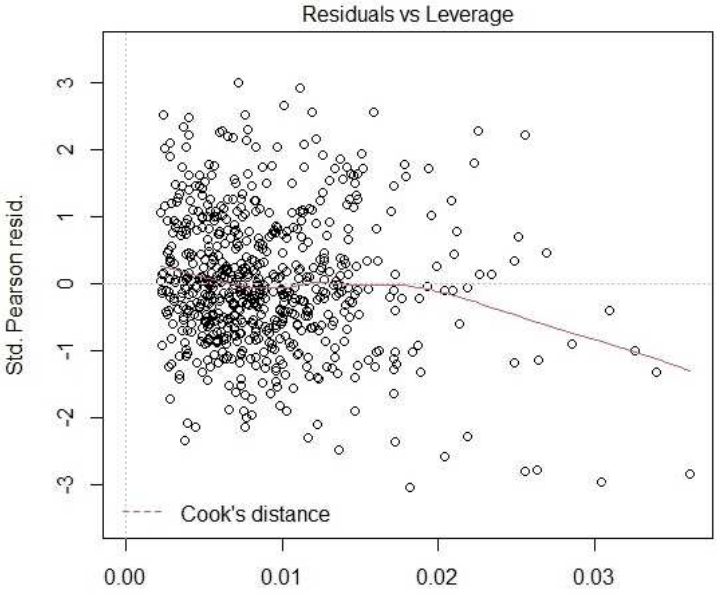
Source: own calculation in R-studio based on data from Statistical Office of the Slovak Republic and National Institute for Certified Educational Measurements.

Figure 1. Cook's distance for model (1)



Source: own calculation in R-studio based on data from Statistical Office of the Slovak Republic and National Institute for Certified Educational Measurements

Figure 2. Cook's distance for model (2)



Source: own calculation in R-studio based on data from Statistical Office of the Slovak Republic and National Institute for Certified Educational Measurements.