

# Regional Disparities in the Relationship between Economic Growth and Unemployment

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## Abstract

The imbalance of the economic and social level between territorial units is a problem of many countries, including Slovakia. In addition to product losses, the absence of labour incomes of lagging territorial units and their reduced ability to develop independently appear to be a problem. The reason for such a situation may be low economic activity as well as a weak relationship between employment in some regions. The aim of this study is to identify differences in the relationship between the rate of economic growth and changes in the unemployment rate in the all regions at the NUTS3 level in Slovakia in the period 1999-2018. To examine the relationship between unemployment and the rate of economic growth, a difference version of Okun's Law was used. A simple linear regression model was constructed for each region at NUTS 3 level. By comparing the values of constructed econometric models, the regional differences and sources of these differences were identified. The results of the analyses have indicated that there is a direct causal relationship between the change in unemployment and the rate of economic growth in the short term. The correlation coefficients confirmed the negative relationship between GDP growth rate and unemployment. The strength of the relationship across region at NUTS 3 level was differentiated, but in all NUTS 3 regions was statistically significant. The impact of the growth rate on changes in unemployment has been found to be differentiated mainly according to the size of unemployment, as well as the sources and stability of the rate of economic growth and the structure of economic activities.

## Keywords

Regional disparities, Okun's Law, Unemployment, Economic growth, NUTS 3 level, Slovak Republic

## JEL Classification

E24, R12

## Introduction

According to statistics, there have long been differences between regions in the performance of economic systems and in their ability to use available labour. This can be stated when comparing performance and unemployment and the rate of change of both indicators by territorial units of the country and between countries. In 1998, the unemployment rate across the regions of the Slovak Republic was in the range of 5.1 - 20.8%. By 2018, this difference had decreased, the unemployment rate across regions was in the range 2.9 - 10.1% (ŠÚ SR, 2020). At the same time, the economies of these territorial units also differed. An example is the variability of economic growth across the regions of the Slovak Republic: in 1998 in the range of 2.09 - 6.71%, in 2018 in the range of 0.98 - 9.09%.

Similarly, there were differences also between countries in the view of economic performance and its changes, as well as in the use of labour. In 2018, according to statistics, the unemployment rate in the Slovak Republic averaged 6.5%, in the Czech Republic it was 2.2%, in Greece 19.3%. The pace of economic growth in these countries also showed different values (3.9% in the Slovak Republic, 2.8% in the Czech Republic, 1.9% in Greece) (Eurostat, 2020).

This problem is always perceived very sensitively. Differences between regions due to environmental conditions are accepted as a natural phenomenon. Differences in economic and social level, most often described by the value of gross domestic product per capita and the unemployment rate, are undesirable. The negative attitude to economic and social disparities is due to both the social and economic aspects of the problem: the inability to earn an income is socially unfair, restricting the development of the workforce. Moreover, the low economic performance of such a territorial unit entails economic losses also from the perspective of the national economy. This forces the countries to act to create conditions for balanced and sustainable development in all their regions. The instrument

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for achieving the prescribed objective is the gradual reduction of disparities in the level of development of individual regions. The prerequisite for achieving this is to know the relationship between economic growth and unemployment, its strength and the factors behind its change.

According to historical data, the reduction in production volumes in the economy will gradually be reflected in several indicators - increasing unemployment, decreasing work incomes, reducing consumer spending. There is a repeated decrease in production and employment. The change in employment in the economy can be the result not only of a reduction in the economic performance of the system but can also have its origin in economic growth. If economic growth is mainly the result of increased productivity in production, its impact on employment may not be positive. Economic growth induced by increased productivity in production can even cause unemployment.

There is the number of empirical evidence that unemployment may be one of the reasons why the economic system is not performing well. As an example, the empirical findings of the OECD show that real product lags behind its potential value, especially in countries with high unemployment rates. In 2014-2017, at around 24% unemployment of the workforce, there was an almost 15% product gap in Greece annually. The real product of the Spanish economy lagged more than 8% behind the potential product (at 22% level of unemployment of the workforce). On the contrary, a very small difference in real economic performance versus potential is found in countries with unemployment rates close to their natural rate, in the same period. According to available data at 4% of unemployment in Germany, real products exceeded their potential value by 0.92%. Similarly, the real performance of the Japanese economy corresponded to 100.72% of its potential at around 3.1% of unemployment (OECD, 2019).

In this context, unemployment is considered a macroeconomic problem that has economic consequences for the socio-economic system. It has been present in the Slovak economy for a long time. It limits the activity of microeconomic entities and the development possibilities of the entire socio-economic system (Tej, 2018). Its solution supposes to know the unemployment rate, which is acceptable both in terms of potential economic performance and in terms of price level stability. In order to achieve this goal, it is necessary to know the extent and nature of the impact of economic growth on changes in unemployment.

In order to determine the sufficiency of real economic growth to address the problems identified in this paper, we analyse the relationship of economic growth and unemployment. However, as there are significant differences between the territorial units of Slovakia not only in geographical conditions, but also differences in economic growth and the use of regional labour, we perform the analysis across of all territorial units of the country. The aim of this study is to identify differences in the relationship between the rate of economic growth and changes in the unemployment rate in the all regions at the NUTS3 level in Slovakia in the period 1999-2018. In all territorial units, we assume the existence of an inverse relationship between unemployment and economic growth, formulated in a difference version of the Okun Act (Okun, 1962).

## Literature Review

There is a mutual dependence between the unemployment rate and economic growth. In the context of the extensive influence of the labour market on economic performance, Keynes (1937), Harrod (1939) and Domar (1946) explained this relationship. The works of Kaldor (1957), Solow (1956) and Lucas (1988) did not confirm the assumption of a constant ratio of labour and capital and a constant ratio of capital and product, considering the impact of technological advancement on labour productivity. This undermines the earlier positive relationship between employment and economic growth and indicates the possibility of increasing unemployment as the economic performance increases.

To clarify the nature, character and strength of the relationship between unemployment and economic growth are important the findings of Okun (1962), now known as difference (1) and gap (2) version of the relationship. In both cases, the Okun Act is based on the simple finding that more manpower is needed to produce more products and services. Thus, if HPD increases, so also employment increases and at the same time unemployment decreases.

The first version captures the relationship between the dependence of changes in the labour market and the growth rate of real output, based on macroeconomic statistics data. This makes it possible to quantify how large change in the unemployment rate is caused by an increase or decrease in output. This relationship is expressed by the equation:

$$\Delta U = a + b \times gGDP \quad (1)$$

The coefficient  $b$  in this equation quantifies the intensity of the relationship between economic growth and unemployment. Its value is mostly negative, as GDP growth is mostly associated with a decline in the unemployment rate.

The gap version of the relationship expresses the fact that unemployment exceeding its natural level in the economy generates the economic losses, the magnitude of which can be quantified by the value of the difference between real and potential output.

$$\Delta U = c + d \times (GDP^* - GDP_R) \quad (2)$$

The difference ( $GDP^* - GDP_R$ ) is the size of the production gap, i.e. the difference between the potential and the real product. If the real product lags behind the potential product, the coefficient  $d$  will be positive.

The second version of the law links the unemployment rate to the gap between a potential product and a real product. It quantifies the losses that arise in the economy if the system does not use its potential opportunities. The problem with this version is that the production gap is not a directly observable variable, that eliminates the possibility of accurately quantifying the size of the losses incurred.

The logical conclusion from these findings is that real GDP growth, which is close to the rate of growth of its potential product is required to maintain a stable unemployment rate. To reduce the unemployment rate, the economy must grow at a rate above its potential.

The data analysed by Okun showed that in order to reduce the unemployment rate by 1%, the real product must grow approximately 2% faster than the potential product. True, according to empirical observations in different sets of countries (Blázquez-Fernández, et al. 2018; Zanin, 2014; Slušná, 2011; Stober, 2015; Oberst and Oelgemöller, 2013 and others) there are differences in the strength of the dependence of variables and these are caused by different factors.

The dependence of labour market changes on economic growth is not always the same in all countries because the employment is affected by some other factors than economic growth. Individual factors usually exist and operate in parallel, the nature of the relationship of economic growth and employment will always be the result of their complex operation. The pyramidal breakdown of the essence of economic growth and employment rates brings us to two groups of factors: one group is made up of factors related to labour demand and thus predetermines the size of economic growth.

Since economic growth depends on the degree of development and structure of the economy, the business cycle, capital resource involvement and labour productivity, then the magnitude of employment change can be associated with actual labour utilization, the economic cycle (Slušná, 2011), the output gap (Pesaran and Shin, 1995; Ball et al., 2012; Nurudeen, 2017) and the size of labour productivity (Seyfried, 2005).

The impact of the developmental stage of the economy was identified as a factor of the relationship of economic growth and unemployment by comparing the results of analyses of the relationship in the underdeveloped countries with the findings of other authors who conducted such analyses on the data of developed countries. High levels of unemployment and extensive economic growth in underdeveloped countries are considered to be the cause of divergent findings. In developed economies, the ever-increasing impact of technological equipment is an important factor in economic growth. This creates little demand for additional labor (Stober, 2015). In economically weaker economies, the share of labour force in economic growth is high, the growth of the system performance thus leads to an increase in employment (Adenomon and Tela, 2017; Akutson et al., 2018).

Blázquez-Fernández et al (2018) found a direct correlation between production losses and unemployment rates in the 2005-2017 sample. Cazes et al. (2013) verified the parameters of the relationship between economic performance and unemployment on a sample of data for the macro-regions of continental Europe, the Nordic countries, southern Europe and the Anglo-Saxon countries for the period 2000-2010. According to their findings, estimates of the Okun coefficient significantly increased in economies severely affected by the global financial crisis. Similarly, Košta et al. (2011) found that Okun's law was more pronounced at the time of recession than during expansion. The problem was analysed on a sample of data collected for a set of EU countries in the period 1997-2009, also in a period when economies were in recession. Across the sample, it found relatively different values of dependence between economic growth and unemployment. Extreme levels of dependence were found in years of recession. Ball et al. (2012), stated a different, but always strong and stable relationship between economic growth and unemployment among countries, which did not change significantly during the recession.

The second group of factors is related to labour market supply. Differences in labour supply between countries and over time have their origins in the socio-economic environment, in the structure of the workforce, in the elasticity of the labour market and in wage levels.

According to some experts, the differences in labour supply are related to the structure of the workforce. Bargain et al. (2011) found similar values of labour supply elasticity across countries and across different groups of workforce. As a special case, they cite labour markets with a high share of married women, for whom they found extremely low values of elasticity of labour supply. The availability of young and skilled labour in the economically weaker economies of the European Community may be influenced by international labour migration (Kotulič and Adamišin, 2013) as well as by the degree of employment of labour force that is close to the values of NAIRU. A high degree of employment may even have the effect of reducing the values of the Okun coefficient (Cazes et al., 2013; Shuvaev et al., 2018).

The relative rigidity of the labour market, as stated by several authors (Kitov and Kitov, 2012), is the reason that the impact of economic growth on the labour market is manifested in the long term. Christl et al. (2017) found similarity in the findings of the classical and dynamic versions, based on the validation of the classical and dynamic versions of Okun's Law on the data of the Austrian economy for the period 1950-2014. However, they cited the delay of two quarters as a comparability criterion. Due to the simultaneous impact of other factors (migration, adjustment of the pension system, etc.), the use of both the static and dynamic versions of the relationship to predict developments and changes in unemployment based on GDP growth is considered limited. Moreover, it depends on its application to specific conditions, as these differ in time and across countries.

Based on a review of the published findings in this study, we assume that changes in unemployment are determined by changes in the rate of economic growth. The magnitude of the impact depends on the cumulative effect of several factors, in particular on the trends of economic development given by the cyclical development of the economy. In order to verify this assumption, we find changes in the Okun coefficient expressing the strength of dependency across the territorial units of Slovakia. In further analyses we verify the contribution of economic growth to the change in the unemployment rate.

The material is logically divided into three parts. The theoretical part is based on the research of published findings on the effects of economic growth and their impact on unemployment of labour force. In the analytical part, in order to answer the question of the existence and causal dependence of unemployment on the rate of economic growth, we analyse the impact of the labour market and population demography on economic growth by using the methods of correlation and regression analysis. The last section presents the main findings.

## Methods

There are many studies that examine the validity of the Okun law and the range of Okun coefficients using alternative econometric techniques and various samples. The main aim of this study is to identify differences in the relationship between the rate of economic growth and changes in the unemployment rate in the all regions at the NUTS3 level in Slovakia in the period 1999-2018 (Table 1).

**Table 1.** Codes of territorial units of the Slovak Republic according to the NUTS classification.

NUTS Code	Territorial Unit	NUTS Code	Territorial Unit
SK010	Bratislava region	SK031	Žilina region
SK021	Trnava region	SK032	Banská Bystrica region
SK022	Trenčín region	SK041	Prešov region
SK023	Nitra region	SK042	Košice region

This relationship is manifested as a change in the employment of the workforce, which occurs as the rate of economic growth changes. According to empirical observations, the relationship between unemployment and economic growth is still not the same. The change in unemployment caused by the change in economic growth varies over time and between countries. With extensive production growth in the economy, the employment is growing at the same time. In the event that economic growth is not exclusively extensive, the strength and nature of its impact on the employment of the labor force is various. The aim of this study is to identify differences in the relationship between the rate of economic growth and changes in the unemployment rate in the all regions at the NUTS3 level in Slovakia. Analyses were performed on data for a 20-year period covering the years 1999-2018.

In determining the relationship between economic growth and unemployment, we assumed that unemployment changes depend on changes in economic growth (Okun, 1962). Formally, this assumption can be written by a regression relationship:

$$\Delta U_t = \beta_0 + \beta_1 \times gY_t \quad (3)$$

where  $\beta_0$  - change in the unemployment rate due to factors other than the independent variable;  $\beta_1$  - the Okun's coefficient, that quantifies the strength of unemployment dependence on economic growth;  $\Delta$  - the first difference operator;  $\Delta U_t$  - the change in the unemployment rate compared to the previous period;  $\Delta Y_t$  - the GDP growth rate,  $n$  - the number of elements in the sample.

The relationship (3) thus expressed captures the current level of correlation between GDP growth and the change in unemployment rate. It also makes it possible to estimate the level of output growth needed to bring about a zero change in the unemployment rate:

$$gY_t = -\beta_0/\beta_1 \quad (4)$$

The equation (4) can be used to test the relationship between economic growth and unemployment.

To verify the presence of the relationship of the variables under consideration, the correlation coefficient values ( $r_{g,\Delta U}$ ) were determined. We classified the presence of linear dependence on an interval basis:  $0,5 < |r| < 0,7$  (moderate),  $0,7 < |r| < 0,9$ , (strong),  $|r| > 0,9$  (perfect) (Hudec, 2007).

Finding the relationship between the variables under consideration does not guarantee the existence of causal dependence and does not quantify its degree. To test the causal dependence and determine its strength, we used an econometric model suitable for the difference version of Okun's law:

$$\Delta U_t = \beta_0 + \beta_1 \times \Delta Y_t + \varepsilon_t, \quad (t = 1, 2, \dots, n) \quad (5)$$

where:  $\beta_0$  - location constant, expresses the change in the unemployment rate that occurs despite the fact that the output will not change;  $\beta_1$  - the Okun's coefficient, that quantifies the strength of unemployment dependence on economic growth;  $\Delta$  - the first difference operator;  $\Delta U_t$  - the change in the unemployment rate compared to the previous period;  $\Delta Y_t$  - the GDP growth rate at time  $t$ ,  $\varepsilon_t$  - the estimation error model,  $n$  - the number of elements in the sample.

The rate of GDP growth is considered as an independent variable in the model (5), and the change in unemployment rate is a dependent variable for the purposes of this study. The pace of economic growth was determined as a relative change in GDP, the change in unemployment was calculated as the difference between the values of the variable in two consecutive periods.

In the analysis were used time series of data on unemployment and gross domestic product obtained from the macroeconomic database DATAcube and STATdat. by the Statistical Office of the Slovak Republic. Both time series of data were available on an annual basis. On their basis, the obtained data on the change of variables between periods necessary for the determination of Okun's coefficient. The obtained data panel (Table 2) was used to determine the regression coefficients of econometric models, which explain the dependence of the ability to use the available labour force effectively on economic growth in the territorial units of the Slovak Republic at the NUTS 3 level, in the period 1999 - 2018.

The testing was carried out using the OLS estimate, where the independent variable was the real GDP growth rate and the dependent variable was the change in the unemployment rate. The suitability of models for estimating the Okun's coefficient has been verified by the diagnosis of error processes such as the absence of serial correlation, the presence of normality and homoscedasticity. Statistical significance of the models was verified using the F test at the significance level  $\alpha = 0.05$ . All analyses were processed in MS-Excel and the Gretl statistical program.

## Results and Discussion

In order to quantify the impact of the intensity of economic activity on employment, the trends in the development of economic activity and employment of the workforce were analysed and compared at the NUTS 3 level. The main findings of data of time series analysis are presented in Table 2.

**Table 2.** Descriptive characteristics of the data panel.

		SK010	SK021	SK022	SK023	SK031	SK032	SK041	SK042
GDP/empl (EUR)	Min	33 962.45	20 071.71	18 549.48	18 821.36	17 026.29	17 927.48	13 027.08	20 869.31
	Max	69 939.00	35 790.62	27 311.06	28 253.91	29 075.63	25 300.55	23 251.33	30 968.55
	Mean	55 639.54	29 705.14	24 572.97	23 665.98	24 972.89	22 635.66	18 239.80	27 095.50
	StDev	12 959.10	5 225.57	3 369.17	3 171.63	4 544.15	2 284.99	3 138.62	2 979.38
g_GDP (%)	Min	-2.14	-8.86	-7.55	-5.85	-5.96	-8.51	-6.67	-10.14
	Max	15.19	22.61	14.68	9.03	14.50	11.44	13.00	9.41
	Mean	3.75	3.38	2.12	4.07	3.52	3.12	4.29	3.33
	StDev	3.99	6.03	4.20	3.83	4.17	4.80	4.22	4.19
U <sub>t</sub> (%)	Min	1.98	2.31	2.93	3.12	4.04	7.03	8.61	8.17
	Max	7.27	16.14	14.02	23.12	18.01	23.77	24.94	26.14
	Mean	4.57	8.27	9.54	11.74	10.90	18.59	17.63	17.27
	StDev	1.62	4.13	3.23	5.97	4.10	4.71	4.69	5.11
U <sub>t</sub> -U <sub>t-1</sub> (%)	Min	-1.48	-2.52	-2.32	-4.27	-2.30	-4.13	-4.23	-3.27
	Max	2.09	4.08	5.18	4.39	5.02	5.31	5.43	6.15
	Mean	-0.31	-0.78	-0.87	-1.41	-1.50	-1.03	-1.19	-1.35
	StDev	1.00	1.83	1.91	2.40	2.12	2.40	2.47	2.34

The analysis confirmed the long-term persistence of differences in the unemployment rate and performance in economic growth across the NUTS3 regions and year-on-year.

The long-term lowest percentage of the unemployed was in SK010 ( $\bar{U}=4.47$ ), the highest in SK041 ( $\bar{U}=17.63$ ). In the analyzed period in all regions according to NUTS 3, the trend of decreasing unemployment was found. A decrease in unemployment of 0.5-0.86% per year was found in all regions of NUTS 3 except SK010. The decrease in the unemployment rate observed in SK010 was on average 0.2% per year. The effect of this development is reducing the difference in the unemployment rate between regions with the highest and lowest value of the indicator (from 18.68 to 5.55%) in the period 1999-2018.

In GDP formation, the analysis of the data panel showed 46.14 - 69.59% more GDP formation in SK010 than in other regions at NUTS 3 level. This may be due to e.g. different number and types of economic activities. To eliminate this impact, ratio indicators were calculated and analysed. A comparison across regions showed that the territorial units SK021 - SK042 were lagging behind in GDP per capita (also GDP per employee) compared to region SK010. On average, the territorial units SK021 - SK042 were lagging by 36% to 45.18% in GDP per employee in comparison of region SK010.

The panel data set showed an average of 3.57% economic growth rate for the set of all regions at NUTS 3 level. Despite the observed regions, year-on-year rates of economic growth showed high volatility of values. In 2006, territorial units showed extremely high growth rates (e.g. 22.6% in SK022 region or 14.68% in SK023 region). In 2009, the trend of the lowest rates of economic growth was observed (e.g. a decline of 10.14% in SK042 region).

These findings classify the regions at NUTS 3 level into two groups. The first group is made up of regions (SK010, SK021 and SK022) where GDP per capita is high and low unemployment rates were observed early in the period under review. The second group is made up of regions (SK023, SK031, SK032, SK041, SK042) in which lower GDP per capita and high unemployment rates were observed at the beginning of the period under review. This typological division of NUTS3 regions is in accordance with the opinions on the polarization of the territory of the Slovak Republic by an imaginary line of the southwest-northeast direction (Rajčáková and Švecová, 2014). It divides Slovakia into two subregions with differentiated assumptions and the level of socio-economic environment. To the west of the dividing line there are regions (SK010, SK021 and SK022), which are formed as dynamically developing regions due to the use of high endogenous potential, foreign investment and support from structural funds. Another group consists of NUTS3 regions, which have a core area with a concentration of diversified economic activities. On the other hand, they are characterized by several negative characteristics (stagnant economic entities, high unemployment, above-average poverty risk, absence of transport infrastructure, etc.), whose synergistic effect causes stagnation of economic development. Nevertheless, we consider it as sufficient to illustrate regional differences of the state and development of the issue, which may have a significant impact on the parameters of the relationship defined by the difference version of Okun's law. In order to ascertain the existence and importance of these differences, the correctness of the following assumptions has been verified:

- there is an indirect relationship between unemployment and economic development, that is reflected in the impact of economic growth on reducing unemployment,
- the labour market in regions with high unemployment rate responds positively to economic growth,
- the positive response of the labour market to economic growth is conditional on the stability of the economic growth trend.

Correlation and regression analysis procedures were used to analyse the relationship between economic growth rate and unemployment rate. A regression model has been constructed for each region, explaining the impact of economic growth on unemployment change and verifying the strength of the dependence of the variables.

From the results of correlation analysis obtained ( $p < 0.05$ ), it can be concluded that there is a statistically significant relationship between unemployment and economic growth in all regions at NUTS3 level. The Spearman correlation coefficient ( $-0.64 \leq r_s \leq 0.39$ ) confirmed a slight to strong degree of linear dependence between the rate of economic growth and changes in the unemployment rate in all regions. This result confirms the validity of the relationship formulated by Okun even in the conditions of Slovak NUTS3 regions, as well as its different strength in individual regions.

The Okun's coefficients were estimated using the OLS method, and a linear regression model was used to express the relationship. Its use is in line with Okun's view on the linear nature of the dependence of the change in unemployment on economic growth. The results of the regression analysis for each region at NUTS3 level are shown in Table 3.



**Table 3.** Estimation of regression model parameters for NUTS3.

	SK010	SK021	SK022	SK023	SK031	SK032	SK041	SK042
$\beta_0$	0.44137	0.23083	0.47515	0.22884	0.87738	0.19815	0.58148	0.53333
$\beta_1$ ( $p < 0.05$ )	- 0.13733	- 0.17804	- 0.29064	- 0.26427	- 0.33766	- 0.25350	- 0.27706	- 0.32720
Obs.	20	20	20	20	20	20	20	20
Mean	- 0.09550	- 0.46050	- 0.31350	- 0.63900	-0.39053	- 0.49850	- 0.45335	- 0.54900
StDev	0.99606	1.82533	1.91178	2.40146	2.18139	2.40101	2.44910	2.34465
SumSqResid	14.89115	43.27311	45.87572	89.12577	50.24996	83.37109	91.36531	66.78432
StErrRegress	0.90955	1.55050	1.59645	2.22518	1.71927	2.15215	2.25297	1.92620
R-squared	0.21005	0.31642	0.33938	0.18661	0.41333	0.23890	0.19836	0.36061
g_stabil	3.21407	1.29650	1.63485	0.86593	2.59839	0.78166	2.09874	1.62998

The regression results showed regional disparities in the values of the regression model coefficients. In the most productive regions with high employment rates (SK010 and SK021), the value of  $\beta_0$  is explained by reducing labour demand as the result of labour substitution by capital and cyclical changes in labour demand. In these regions is only little space to further reduce the unemployment rate. In contrast, the higher values of  $\beta_0$  in regions with low GDP per employee (SK031, SK041), indicate a lack of labour demand due to low density of economic activities, the impact of labour substitution by capital, the effects of demography, skills shortages, and loss of work habits. Regression models in these regions indicate an increase in the unemployment rate by 0.58 (SK041) to 0.88 (SK031) at zero rate of economic growth.

The values of  $\beta_0$  indicate changes in the unemployment rate in the case of zero economic growth, the value of  $\beta_1$  informs about its effects in the case of non-zero values of economic growth. The observed interval range of  $\beta_1$  regressor values across the NUTS3 regions ( $-0.33766 \leq \beta_1 \leq -0.13733$ ) indicates a regionally different strength of the impact of economic growth on the labour market. At the same time, it is in line with findings of other authors that the non-negative pace of economic growth counteracts rising unemployment.

The question remains, what is the cause of the identified disparities in the strength of the impact of economic growth on the labour market. The coefficients of determination are at a very low level in all NUTS3 regions (in the range of 0.187 - 0.413), which indicates that there is only a low causal relationship between economic growth and unemployment. Much of the change in unemployment is due to other endogenous and exogenous factors. Okun himself states in his original work that the strength of a relationship is also influenced by factors related to labour productivity, the level of participation in the labour market and number of hours worked. In developed economies, the impact of migration has also been demonstrated, that weakens the positive impact of economic growth on the employment rate of the domestic labour force.

Since each local economic system included in our analyses has different features, each region is affected by a specific complex of endogenous and exogenous factors. According to the observed distinguishing features across the NUTS3 regions, this will be mainly the impact of the structure of economic activities, the impact of labour productivity growth due to increased capital adequacy, but also the impact of recessionary and expansionary trends in economic development. The limit is always the existence of free labour and its willingness to work. According to recent findings, it is also phenomena related to the processes of globalization, especially labour migration. The quantification of the influence of these factors does not allow the use of a simple regression model because the variables that would quantify this influence are not included in the model.

Based on our further analyses, in highly productive regions (SK010, SK021, SK041), the value of  $\beta_1$  can be also reduced due to the high contribution of labour productivity to economic growth. The low elasticity of the labour supply in the case of an unemployment rate close to the value of frictional unemployment may also have a significant weakening effect. This view is based on the findings that in NUTS3 region (which is characterized by high economic growth, unemployment close to NAIRU values and high labour productivity), the positive impact of economic growth on the labour market is reflected, but the values of the  $\beta_1$  coefficient indicate a weak strength of influence. By comparing its values across the group, a decrease in the values of the Okun coefficient in NUTS3 region with an unstable rate of economic growth was also empirically found, which justifies lower labour market elasticity during economic growth than during recession. In the case of the stated unstable trend of economic growth, its positive effects, especially in economically weaker NUTS3 regions, are weakened by the inelasticity of the labour market.

In economically weaker NUTS3 regions (SK032, SK042) with a high proportion of less productive economic activities and a low rate of labour use, the regressor values reflect the low elasticity of the labour market and the impact of substituting labour with a more productive production factor. The analyses of the relationship for different time periods also revealed a negative effect of the instability of trends of economic growth. In these

regions, we consider higher values of the coefficient  $\beta_1$  rather as a manifestation of an extensive way of achieving economic growth.

In regions with an unemployment rate close to frictional unemployment values, the question also arises as to what are the growth rate values that will make it possible to stabilize the current unemployment rate. Due to the high variability of the values of the coefficients  $\beta_0$  and  $\beta_1$ , the requirement is different across the NUTS3 regions ( $Var_{g_{stab}} = 0,61696$ ). In regions with highly productive economic activities that maintain the certain employment rate, a high rate of economic growth is needed. In regions with a lower density of highly productive activities and low employment, only to half the economic growth rate is sufficient to maintain the status quo. The values of the economic growth rate needed to stabilize the unemployment rate are shown in Table 3. It is indisputable from the available data panel that the actual rate of economic growth in each NUTS3 differed from the stabilizing value to varying degrees (Table 4). The result is a change in the unemployment rate in each region compared to the base year, but also a decrease in its values ( $Var_{U_{1999}} = 36.03693$ ,  $Var_{U_{2018}} = 6.08402$ ).

**Table 4.** Differences between the real rate of economic growth and its value stabilizing unemployment.

		SK010	SK021	SK022	SK023	SK031	SK032	SK041	SK042
$\Delta(g_{stab}-g_{real})$	Min	-4.57	-12.94	-7.86	-13.23	-8.24	-11.52	-19.27	-12.19
	Max	8.15	18.53	9.40	7.84	9.95	9.99	10.14	8.77
	Mean	-0.23	1.13	-0.37	0.77	-0.89	1.41	1.25	0.15

Finally, the same rates of economic growth will not have the same impact on reducing unemployment in all regions. This is proved by our findings, according to which in the evaluated period the increase in economic growth caused a decrease in unemployment (decrease in the unemployment rate in the range of 0.05 - 0.54%).

The different strength of the relationship meant that the effect of one percent economic growth in the more economically advanced NUTS3 regions was reflected in a reduction in the unemployment rate by only 0.14-0.18%. In less developed regions, the effect of one percent economic growth was a decrease in unemployment by up to 0.22 - 0.32%. The different strength of the relationship meant that the effect of one percent economic growth in the more economically advanced NUTS3 regions was reflected in a reduction in the unemployment rate by only 0.14-0.18%. In less developed regions, the effect of one percent economic growth was a decrease in unemployment by up to 0.22 - 0.32%. On the other hand, according to the results of the regression analysis with zero economic growth, unemployment would grow by only 0.44% in SK032, which is characterized by a high unemployment rate. In other NUTS3 regions, the negative effect of stagnation would be many times higher.

These findings are also in line with the findings of others authors, that the values of the Okun's coefficient are dependent on the size and diversification of the region's economy, the presence of sectors with higher added value and the quality of human capital.

## Conclusion

The aim of this study was to identify differences in the relationship between the rate of economic growth and changes in the unemployment rate in the all regions at the NUTS3 level in Slovakia in the period 1999-2018. We based on the difference version of Okun's law, i.e. on the assumption of an inverse relationship between GDP growth rate and unemployment rate, as well as on the assumption that the values of Okun's coefficient are dependent on the type of unemployment and the rate of economic growth.

The performed analyses confirmed the basic assumption of inverse linear dependence of unemployment on GDP growth rate in all territorial units of Slovakia at the NUTS3 level. However, the results suggest that there are statistically significant differences in the magnitude of the impact of economic growth on labour market changes across in the regions according to NUTS 3. A one percent increase in the rate of economic growth in the NUTS territorial units caused a decrease in unemployment by 0.05 - 0.5%. Logically, the regions at NUTS 3 level also differed in the rate of economic growth needed to stabilize the unemployment rate (0.78 - 3.21% depending on NUTS 3 level).

The results of the partial analyses also confirmed the instability of the values of the Okun's coefficient over time. These values mainly depended on the level and causes of unemployment, to a lesser extent on the size and nature of economic growth. The dependence of both variables on large number of influencing factors limits the possibility of reliably estimating the labour market developments as the result of economic growth. However, it does not exclude the possibility of using repeatedly obtained reports to explain the situation in Slovakia and also as a basis for making economic and political decisions. Given the seriousness of the economic and social consequences of the situation on the labour market, we consider this knowledge as important in determining economic policy objectives.



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