Pauhofová, Iveta; Stehlíková, Beáta

Article

Identifying the relationship between unemployment and wage development in the Slovak Republic

Identifying the Relationship between Unemployment and Wage Development in the Slovak Republic[1]

Iveta PAUHOFOVÁ – Beáta STEHLÍKOVÁ***

Abstract

The problem of high unemployment and expected further growth repetitively appears among major global trends, along with the deepening of social instability. This leads to increased inequalities and deepening polarization of wealth as one of the top three global risks. The aim of this paper is to present the results of unemployment and wage development in Slovakia for the period 2000 – 2015 (at the national and regional levels). The added value for Slovakia results is a comparison of the relevant indicators between Czech Republic, Slovak Republic and Hungary. The authors further focus on the wage development dependence on the development of unemployment. Analyses in the paper are based on data from Eurostat, OECD, the Statistical Office and the Central Office of Labour, Social Affairs and Family in Slovakia. Findings (using quantile regression): increasing unemployment, wages in the districts of SR did not grow (in the focused period), increases in wages in districts with higher unemployment rates were lower than in districts with a lower unemployment rate, in the least developed districts reduced unemployment led to a minor increase in wages than expected.

Keywords: *unemployment, long-term unemployment, development of wages, Slovak Republic, Czech Republic, Hungary, NUTS 2 regions, LAU 1 regions*

JEL Classification: C32, F41, F42

* Iveta PAUHOFOVÁ – Institute of Economic Research Slovak Academy of Sciences, Šancová 56, 811 05 Bratislava 1, Slovak Republic; e-mail: ipauhofova@yahoo.com

** Beáta STEHLÍKOVÁ, Pan-European University, Faculty of Economics of Business, Tematínska 10, 851 05 Bratislava 5, Slovak Republic; e-mail: stehlikovab2@gmail.com

[1] The contribution was written with the support of the Science Grant Agency of the Ministry of Education of the Slovak Republic and the Slovak Academy of Sciences in the framework of the project VEGA 2/0026/15 *Income stratification and prospects of polarization of the Slovak society until 2030.*

Introduction

The problem of high unemployment and its expected further growth has been one of the major global trends along with the growth of social instability. This leads to increasing disparities and a deepening of the polarization of wealth as one of the three most significant global risks. (WEF, 2017). In this respect, it is necessary to be particularly sensitive when considering both the pros and cons of the starting fourth industrial revolution from the point of view of changes in labour markets, mass migration and the ageing European population.

A real search for solutions aimed at decreasing unemployment and increasing wages in a closely interconnected European economic area is not only about competitiveness but, in the case of transformed economies, also about the ambitions and reasonableness of governments to formulate and implement individual national policies with a need for significant social focus on settling regional income disparities.

1. Approach, Methodology and Sources

Examination of connections of the relationship between unemployment and wage development also at a regional level may be encountered in the works of both foreign and Slovak authors. E.g. Blanchflower and Oswald (1994) constructed a wage curve of the dependence between the wage and the unemployment rate (regional level), and in their linear model of dependence of a wage logarithm on the unemployment rate logarithm they state that the regression coefficient for the examined regions was close – 0.1. Their conclusions thus did not confirm that regions with higher unemployment rates have higher wages than regions with lower unemployment rates. This model is enhanced by a model made by Campbell and Orszag (1998) where it is presented that wages are not automatically higher in regions with higher unemployment rates. In their model Albert and Meckl (2001) came to the conclusion that each area of the national economy contributes to unemployment proportionally to sector employment, i.e. that the unemployment rate should be related to the sector employment structure. Spatz (2001) believes that as a result of globalization there are such structural changes occurring in developed countries in which the number of well-paid jobs in production is decreasing and newly generated jobs in services are characterized by low wages. He states that disparity is growing in unemployment between highly qualified workers and low-qualified workers. The work of Pošta, Pavelka and Macáková (2015) may be considered beneficial in clarifying the processes leading to structural unemployment in the Czech Republic – they not

only analyse but also estimate structural unemployment from the point of view of the course of the economic cycle of the Czech economy. Their results indicate that in 2009 structural unemployment grew steeply and went down only slightly in the following period. It has been proven that the main determinant of structural unemployment is long-term unemployment. With regard to Slovak authors we may mention Černohorská (2006) who compared the development of unemployment in CR and SR and discovered the considerably worse position of Slovakia even before the crisis. According to Paukovič (2007), specific structural problems were the main reason for a high unemployment rate in Slovakia in the 1990's. Námešný, Ďurček and Rochovská (2012) discovered the high dependence of growing poverty on unemployment growth in EU countries.

The ambition of our contribution is to discover the connections and dependence of wage development on unemployment, at both national and regional levels, for the Slovak Republic, Czech Republic and Hungary. In the case of the above-stated countries, examinations were carried out also at the NUTS 2 level and the results of analyses at the LAU 1 (district) level are presented for Slovakia. It is primarily expected that the level of wages in the district will increase as unemployment drops. The problem is the overall higher rate of unemployment and long-term unemployment in some districts. This is accompanied by a low wage level. The intention is to find out how such dependence develops over time and if it is true for all Slovak districts.

Extensive data files are used in individual analyses, most frequently representing the time period of 2000 – 2015. They include data from EUROSTAT, OECD, the Statistical Office of SR and the Central Office of Labour, Social Affairs and Family in Slovakia.

The regression model used to describe dependence of wages w on the unemployment rate u is a power model $w = a\, u^b + \varepsilon$. The log-transform model is $\ln w = \ln a + b \ln u$.

Using a regression analysis and based on the measured values $\boldsymbol{X}$ we predict a dependent variable Y using a suitable function h which approximates the dependent variable Y very well in a certain sense. A linear function is often selected for the function h in common regression analysis, i.e.

$$h(\boldsymbol{X}) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k \qquad (1)$$

and parameters β_i (i = 1, 2, ..., k) are called regression coefficients. In our case k = 1, $\beta_0 = \ln a$, $\beta_1 = b$ in (1). They are estimated using the method of least squares or the method of maximum likelihood. However, such an approach provides only a partial view of the relation between variables. We may often be interested also in a description of relations at various points of the conditioned

distribution of the variable *Y*. Quantile regression can answer such a question. The $L(u)=u^2$ loss function is selected and a conditioned $E(Y|\boldsymbol{X})$ mean value is estimated. Let $F(y)=P(Y\le y)$ be a distribution function of a random variable *Y* and α be arbitrary number from the interval (0, 1). α – quantile y_α divides the definition range of the random variable *Y* into two parts:

$$P(Y\le y_\alpha)=\alpha \text{ a } P(Y\ge y_\alpha)=1-\alpha \tag{2}$$

A quantile function is a function given by the formula $Q(\alpha)=F^{-1}(\alpha)=$ $inf\{y\in R: F(y)\ge\alpha\}$. If the loss function has the form $L(u)=\frac{1}{2}|u|c$, it is median regression and we are looking for an estimate of a conditioned median by minimizing the formula $E\left[L(Y-\theta)|\,\mathbf{X}\right]=\frac{1}{2}E\left[|Y-\theta||\mathbf{X}\right]$, with regard to the θ parameter. Regression coefficients will be estimated by minimizing the $\sum L(y_i-\boldsymbol{x}_i^T\boldsymbol{\beta})=\frac{1}{2}\sum|y_i-\boldsymbol{x}_i^T\boldsymbol{\beta}|$ value. When a median is replaced by the α – quantile and the loss function has the following form:

$$L(u)=\begin{cases}\alpha u & for\ u\ge 0\\ (\alpha-1)u & for\ u<0\end{cases} \tag{3}$$

it is a quantile regression. The loss function may be expressed using the following function

$$\chi_A(u)=\begin{cases}1\ for\ u\in A\\ 0\end{cases} \tag{4}$$

otherwise, by the relation

$$\rho_\alpha(u)=(\alpha-1)u\chi_{(-\infty,0)}(u)+\alpha u\,\chi_{[0,\infty)}(u) \tag{5}$$

The conditioned α – quantiles are estimated by minimizing the formula $E\left[L(Y-\theta)|\,\mathbf{X}\right]=E\left[\rho_\alpha(Y-\theta)|\mathbf{X}\right]$ with regard to the θ *parameter*. The estimation of parameters $\boldsymbol{\beta}$ is obtained by minimizing

$$\min_{\boldsymbol{\beta}\in\mathbf{R}^k}\ \sum_{i=1}^{n}\rho_\alpha(y_i-\boldsymbol{x}_i^T\boldsymbol{\beta}) \tag{6}$$

using methods of linear programming (simplex method, inner point method, etc.). It is necessary to state that, since in estimating regression coefficients in quantile regression it is an optimization problem, adding other variables does not lead to

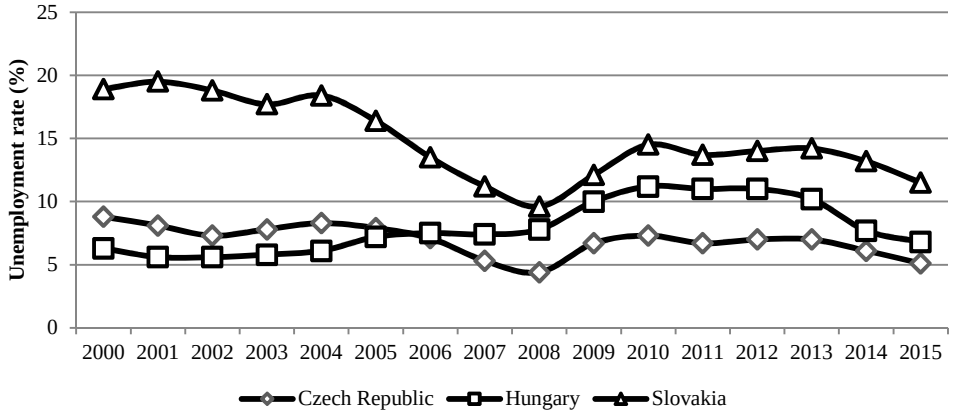
enhancement of the model. For our calculations we used the QUANTREG procedure of the SAS programme. As for optimization methods we used the simplex method. We use official data from Eurostat, OECD databases, data from national statistics at regional level and data from Central Office of Labour, Social Affairs and Family in Slovakia

2. Results and Discussion

The development of the unemployment rate in Slovakia, the Czech Republic and Hungary presented in Figure 1 is a result of significantly different implementation of the economic policy even before 2000.

F i g u r e 1

Unemployment Rate Developments in Slovakia, the Czech Republic and Hungary (%, 2000 – 2015)



Source: Own processing with the use of data from EUROSTAT.

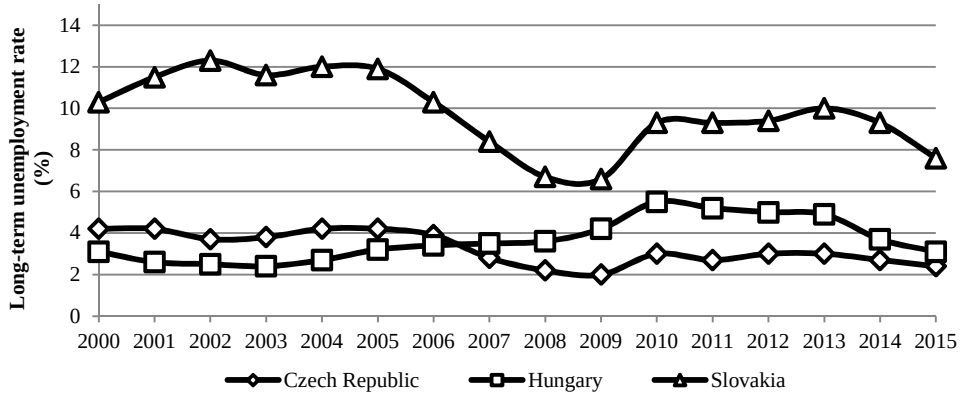
At that time the values for Slovakia were more than twice as high as figures seen in the Czech Republic or Hungary. Considerable drops in the unemployment rate may be seen in Slovakia only since 2004 and they were connected to significant increases in economic growth. Undoubtedly, the higher unemployment rate since the start of transformation in Slovakia was and is a result of major interferences in the structure of the economy. In Slovakia the economic potential of most Slovak regions weakened considerably as a result of the so-called conversion programmes, gradual comprehensive liquidation of certain industrial areas, formation of a new type of the labour market of construction workers working only in small national companies and specific transformation of agriculture. The GDP of Slovakia (but also of the Czech Republic and of Hungary) was and is increasingly more generated by daughters and granddaughters of transnational

corporations (TNCs), the presence of which, particularly in the automotive and electrical engineering industries, and in the area of energy production and distribution, triggered a wage growth. In their operation the national SMEs were becoming dependent on foreign producers and service providers. In strategic production areas (the energy sector) the state was gradually ceding a major part of its influence to foreign companies, even though its role of a price regulator was getting stronger. The financial sector has undergone considerable transformation; currently, only Slovak names of banking and financial institutions may be registered while there is no Slovak property portfolio in general.

It is obvious from the figure that the affected countries saw a turning point in decreasing the unemployment at the start of the crisis in 2008. The impact of the financial and real crisis was gradually demonstrated in the significant growth of budgetary problems of a high number of EU member states. The financial crisis turned into a debt crisis which individual countries tried to deal with using budget cuts. The unemployment rate started growing. In 2010 the growth stopped and the unemployment rate started dropping slightly, more significantly from 2013. However, in Slovakia it was a considerably smaller drop in unemployment compared to the pre-crisis period, and in the following years the values remained proportionally higher than in the Czech Republic and Hungary. It is worth noting that Slovakia and the Czech Republic, which "managed their financial issues" jointly until 1993, have very different values of the examined indicator. Such differences were significant even at the start of Slovakia´s independence. Such nature of development results in problems related to the development of long-term unemployment in Slovakia, which is ranked among the countries with the highest rate of long-term unemployment in the EU.

F i g u r e 2

Long-term Unemployment Rate Developments in Slovakia, the Czech Republic and Hungary (%, 2000 – 2015)



Source: Own processing with the use of data from EUROSTAT.

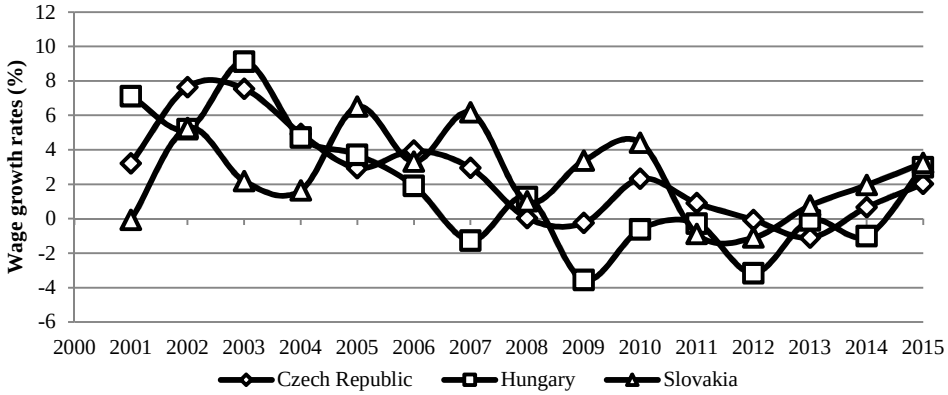
I the boom period the proportion of the long-term unemployed to the total number of unemployed rose in Slovakia and we could observe extremely high values of such an indicator (the number of the short-term unemployed dropped significantly); in the Czech Republic the values of the affected indicator were basically stable. However, when comparing the affected countries, proportions of values at the start and at the end of the period under review are more important than the course of development of the proportion of long-term unemployment to the long-term unemployment. The proportion of the long-term unemployed to the total number of unemployed was considerably higher (with their high number in relation to the total number of inhabitants), representing the crucial problem of a long-term failure to use a part of the human potential of the country which is able to work.

Wage Development

A long wave of economic, financial and social insecurity in the EU has contributed to certain wage stagnation, and in transformed economies to their stabilization at a particularly low level. In the forthcoming period there are high hopes connected to the benefits of the Industry 4.0 strategy, which should considerably accelerate the innovation process and make the transition to the so-called digital economy.

F i g u r e 3

Evolution of the Wage Growth Rates in Slovakia, the Czech Republic and Hungary (%, 2000 – 2015)



Note: Constant prices in 2015, in national currency.

Source: Own processing with the use of data from OECD.

The adopted Slovak Smart Industry (2016) concept (MH SR, 2016) counts on the fact that human work will be transformed into creative activities and physically

demanding routine work will be delegated to machines and systems. It results from a high number of steps in this transformation process that numerous new jobs are expected to be created, mainly in the area of services and trade, since new trends are expected to spread also to other areas such as the automotive and electrical engineering industries.

The expected implementation of an innovation process of advanced production and services requires a change in the form of educating future generations and also in preparing them for their lives and work. A large portion of traditional professions will cease to exist according to such a concept. However, there is the question whether the proportion of the employed will generally rise in Slovakia or if such transition to a digital economy will be accompanied by a significant loss in employment.

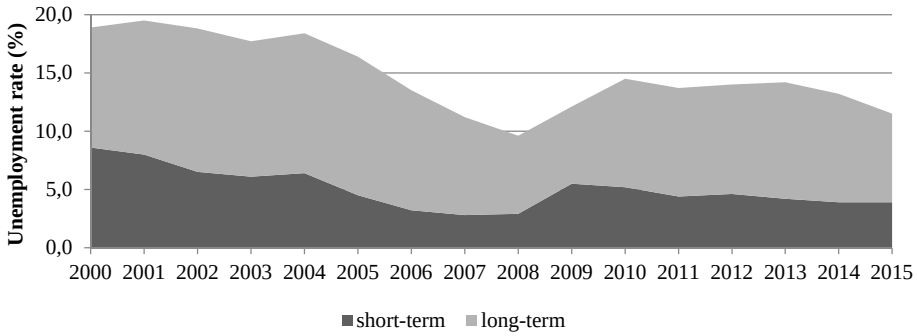
The highest wage level in all affected countries was seen in the service sector and not in the area of real goods production. The lowest wage level was seen in the areas of education, healthcare, social and other services. The greatest wage differences between the above-stated sectors were seen in Slovakia. A certain common nature in the lines of development of real wages was seen only in 2010. While after 2010 real wages in the Czech Republic were stagnating and in the areas of education, healthcare, social and other services they were even going down, the wage levels in Slovakia and Hungary were slightly increasing. After 2010 the level of real wages was higher in Slovakia than in Hungary. With regard to similar development trends but different wage levels in compared countries as well as to significant differences in employment rate development, implementation of the Industry 4.0 strategy is expected to have different stages. Daughters and granddaughters of TNCs operating both in Slovakia and in the Czech Republic and Hungary are supposed to be best informed about the particular form and time of the start of implementation of the Industry 4.0 strategy. Then it is again also a question of preparation of certain investment incentives where competition is expected among V4 countries regarding a large amount of investments. In this regard we cannot neglect also the preparedness of labour markets for the expected major changes in relation to the qualification and professional structure, flexibility, potential of “free” workers, and ageing of the population.

Unemployment

The following figures for individual compared countries indicate a similar decreasing tendency in both short-term and long-term unemployment. However, different starting points in 2000 and at present are obvious. Slovakia has the worst results in both indicators.

F i g u r e 4

Development of Short-term and Long-term Unemployment Rate in the Slovak Republic (%, 2000 – 2015)

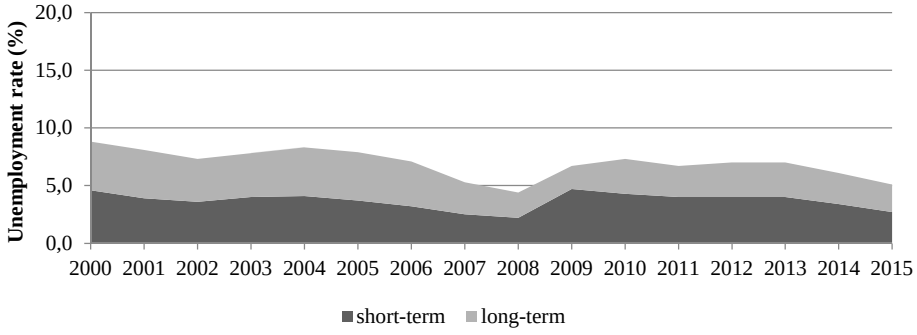


Source: Own processing with the use of data from EUROSTAT.

The Czech Republic has the best results in the affected indicators. It is obvious that the main reasons for such significant differences between Slovakia and the Czech Republic must be "looked for" even before 2000, as well as in the quality of management processes after the crisis started in 2008. It is apparent in all compared countries that the crisis clearly affected mainly the development of long-term unemployment (the later occurrence of peaks compared to short-term unemployment and the resulting forming of curves).

F i g u r e 5

Development of Short-term and Long-term Unemployment Rate in the Czech Republic (%, 2000 – 2015)



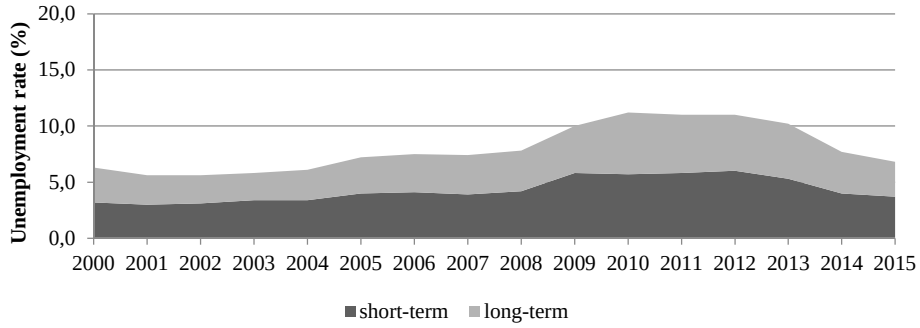
Source: Own processing with the use of data from EUROSTAT.

When comparing the parameters and lines of the development of short-term and long-term unemployment rates only between Slovakia and the Czech Republic, and seeing such great differences, we should ask what the main causes were and why such huge differences (in long-term unemployment) could not be

considerably diminished during more than three governments' terms of office? The reasons included also crisis conditions even though they affected not only Slovakia but the Czech Republic as well.

Figure 6

Development of Short-term and Long-term Unemployment Rate in the Hungary (%, 2000 – 2015)

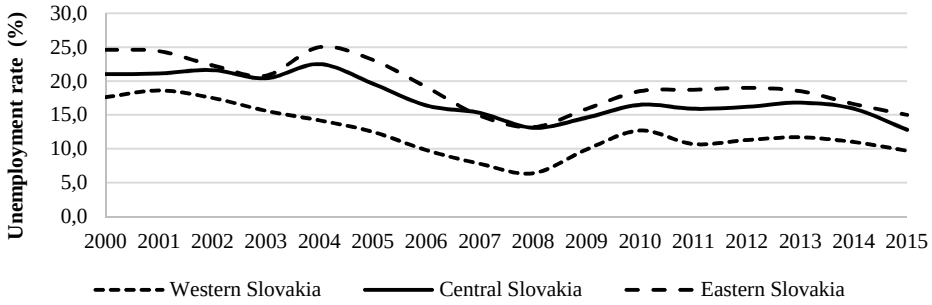


Source: Own processing with the use of data from EUROSTAT.

When comparing the unemployment rate indicator in the affected countries, we also use the NUTS 2 level where a similar development tendency was seen towards a decrease in unemployment. It became apparent that in the Czech Republic and Hungary the unemployment parameters in territorial units are not very different, and in the Czech Republic we can speak about approaching parameters for territorial units over time. As seen in the following image, in Slovakia the parameters were considerably different from each other in the initial period of time and they are gradually approaching. A more significant decrease in the unemployment rate until 2008 was typical mainly in Eastern Slovakia with extremely high values of the unemployment rate.

Figure 7

Development of Unemployment Rate in the SR – NUTS 2 level (%, 2000 – 2015)

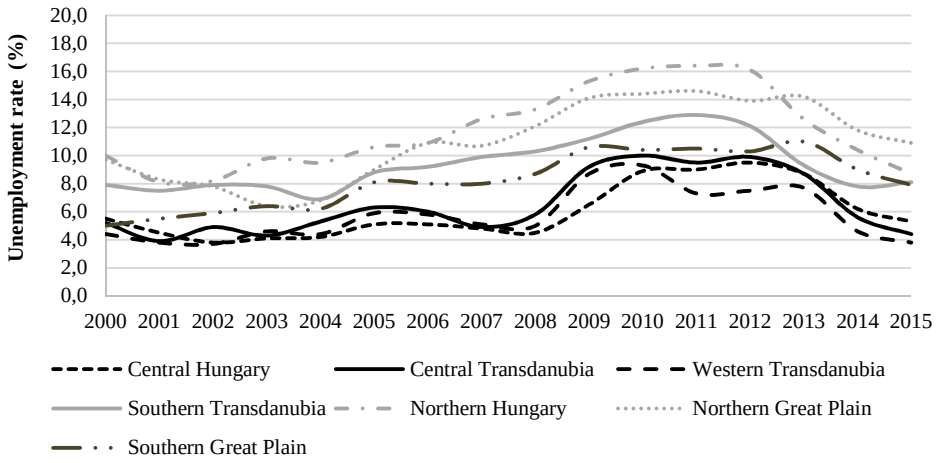


Source: Own processing with the use of data from SO SR (2000 – 2015).

Similarly to the higher unemployment rate in Eastern Slovakia, in Hungary the unemployment rate at the NUTS 2 level is higher in the eastern, north-eastern and south-eastern parts of the country bordering Slovakia, Ukraine, Romania, Serbia and Croatia in the south (Észak Magyarország, Észak-Alfold, Alfold és Észak, Dél-Alfold, and Dél-Dunántúl). A lower unemployment rate may be seen in regions bordering Austria and Slovenia in the west of the country, overlapping to the central part of the country. At the same time, there are smaller differences in the unemployment rate between such regions than between the above-defined regions. It is evident that there is a connection to corridors directed towards the western EU countries and their centres which is stronger than connections with other regions. Such corridors are better equipped with infrastructure, particularly transport infrastructure, which a major part of investments is directed to.

F i g u r e 8

Development of Unemployment Rate in the Hungary – NUTS 2 Level (%, 2000 – 2015)

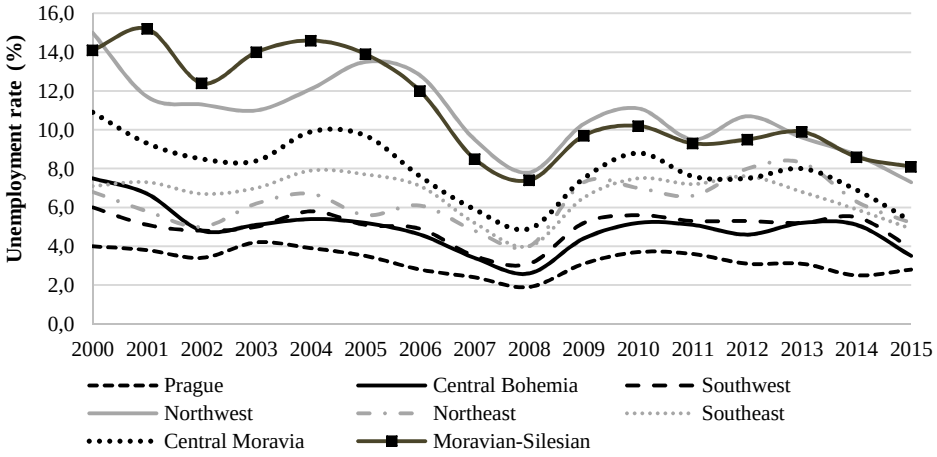


Source: Own processing with the use of data from HSCO (2000 – 2015).

In the Czech Republic the "distances" between NUTS 2 regions has decreased over time. The highest unemployment rate is seen in the north-west and in the Moravskoslezsko regions while the lowest one is seem in the Střední Čechy and Jihozápad regions. Also, in this case the regions with the lowest unemployment rates are closely connected to corridors directed to the stronger regions of Germany and Austria compared to regions in the north of the country bordering Poland and weaker regions in Germany (the former German Democratic Republic). Compared to Slovakia (NUTS 2), the unemployment rate values in the Czech Republic are considerably lower.

Figure 9

Development of Unemployment Rate in the Czech Republic – NUTS 2 Level (%, 2000 – 2015)



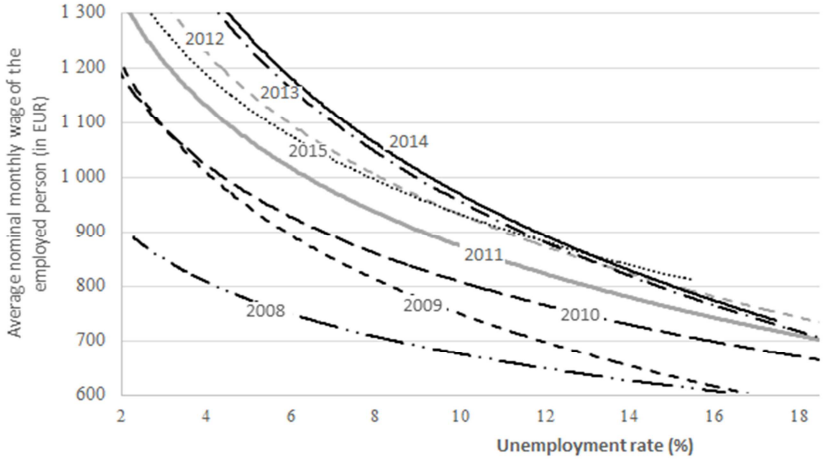
Source: Own processing with the use of data from CZ SO (2000 – 2015).

Analysis of the Relationship between Wage and Unemployment Developments at a Regional Level (regions and districts of the Slovak Republic)

When examining the dependence of wages on the unemployment rate it was found that at the regional level wages in regions were decreasing with a rising unemployment rate. This is shown in the following image for the period under review, i.e. 2008 – 2015.

Figure 10

Trend Lines of the Average Nominal Monthly Wage Dependence from the Level of Unemployment in the Slovak Republic at the Regional Level (NUTS 3) (2008 – 2015)



Source: Own calculations using data from SO SR (2008 – 2015).

The unemployment rate in a district is a basic criterion for deciding if such district will be classified as one of the least developed districts. In accordance with Act No. 336/2015 Coll., support should be provided in the least developed districts (LDDs), conditions should be created for decreasing the unemployment rate and increasing the number of jobs.

In the Banská Bystrica region LDDs currently include the districts of Lučenec, Poltár, Revúca, Rimavská Sobota and Veľký Krtíš; in the Prešov region they include the districts of Kežmarok, Sabinov, Svidník and Vranov nad Topľou; in the Košice region they include the districts of Rožňava, Sobrance and Trebišov. The following picture shows that the above-defined districts already had considerable problems with unemployment in 2005; they were defined according to the Act only in 2015.

Quantile regression was used to examine in detail the dependence of wages on the unemployment rate in districts. Its regression coefficients estimated changes in the particular quantile of the average wage logarithm caused by a unit change in the unemployment rate logarithm. From this it was discovered which average wage percentiles are affected more and which less by the unemployment rate, which is reflected in a change in regression coefficients. The value of regression coefficients dropped most significantly in 2015 with a rising order of the average wage logarithm quantile. Regression coefficients have a decreasing trend with a rising quantile in other years as well, even though there is certain oscillation around the trend. It means that a unit rise in the unemployment rate logarithm considerably decreased a higher average wage logarithm, i.e. higher average wages in the period under review responded more sensitively to changes in the unemployment rate. The values of regression coefficients for the average wage logarithm quantiles in the period under review are shown in the table below.

The regression coefficient β_1 has a negative sign in each quantile in all the reviewed years of 2009 – 2015. It means that a growth in unemployment leads to a drop in wages. Only for 0.10 and 0.15 quantile in 2009 is the regression coefficient β_1 positive and significant, i.e. an increase in unemployment in this case leads to a rise in wages.

Other significant regression coefficients β_1 are negative. The common linear regression in each of the years under review clearly shows the dependence of wages and the unemployment rate. The regression coefficients of the quantile regression for certain quantiles in individual years are higher in their numerical values than the regression coefficient β_1 of the common linear regression. In these cases the common regression underestimates (undervalues) the impact of a wage drop in the case of rising unemployment.

T a b l e 1

Regression Coefficient β_1^* for Classical Linear Regression and α – Quantiles of the log Average Wage in 2009 – 2015

	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Coefficient β_1	–0.29188	–0.28380	–0.22631	–0.24062	–0.28080	–0.28137	–0.26460
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
R^2	0.6158	0.5979	0.4479	0.5324	0.5771	0.5243	0.4929
Quantile	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
0.10	3.1689	–0.2564	–0.1816	–0.1511	***–0.1326***	–0.1504	–0.1500
P-value	<0.0001	<0.0001	0.0003	0.0003	***0.0716***	0.0261	0.0087
0.15	2.9070	–0.2332	–0.1562	–0.166	–0.1568	–0.1966	–0.1679
P-value	0.0042	0.0002	0.0007	0.0001	0.0156	0.0018	0.0002
0.20	***0.0895***	–0.2416	–0.1846	–0.1931	–0.1992	–0.1665	–0.1728
P-value	***0.9419***	<0.0001	<0.0001	<0.0001	0.0016	0.0010	<0.0001
0.25	***0.0411***	–0.2380	–0.2082	–0.2163	–0.2293	–0.1818	–0.1790
P-value	***0.9549***	<0.0001	<0.0001	<0.0001	<0.0001	0.0004	<0.0001
0.30	***–0.0061***	–0.2404	–0.1968	–0.2369	–0.2399	–0.1988	–0.2004
P-value	***0.9433***	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.35	***–0.0926***	–0.2817	–0.2162	–0.2317	–0.2224	–0.2229	–0.2125
P-value	***0.1397***	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.40	–0.0887	–0.2640	–0.2054	–0.2327	–0.2396	–0.2317	–0.2263
P-value	0.0361	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.45	–0.1034	–0.2297	–0.2174	–0.2415	–0.2313	–0.2353	–0.2297
P-value	0.0214	0.0006	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.50	–0.1156	–0.2488	–0.2435	–0.2516	–0.2353	–0.2414	–0.2258
P-value	0.0164	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.55	–0.1319	–0.2576	–0.2611	–0.2787	–0.2637	–0.2307	–0.2599
P-value	0.0011	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.60	–0.1612	–0.2503	–0.2809	–0.2718	–0.2760	–0.3039	–0.2647
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.65	–0.1657	–0.2709	–0.2677	–0.2605	–0.2776	–0.2994	–0.2771
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.70	–0.1761	–0.2789	–0.2612	–0.2655	–0.3090	–0.2992	–0.2795
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.75	–0.1874	–0.2940	–0.2603	–0.2499	–0.3293	–0.3251	–0.2868
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.80	–0.1654	–0.2920	–0.2223	–0.2269	–0.3445	–0.3459	–0.3100
P-value	0.0036	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.85	–0.1608	–0.3020	–0.2262	–0.2453	–0.3525	–0.3588	–0.3323
P-value	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.90	–0.1891	–0.3052	–0.2433	–0.2573	–0.3358	–0.3621	–0.4101
P-value	0.0174	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.95	***–0.1976***	–0.2900	***–0.2012***	–0.2944	–0.3369	–0.3497	–0.3879
P-value	***0.3405***	<0.0001	***0.2147***	0.0030	0.0001	<0.0001	<0.0001

Remark: * The regression coefficient β_1 is significant at a significance level of at least 0.05 for almost every quantile in all 2009 – 2015 years, except for bold cases.

Source: Own calculation in SAS.

T a b l e 2

Regression Coefficient β_0^* for Classical Linear Regression and α – Quantiles of the log Average Wage in 2009 – 2015

	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Coefficient β_0	7.25012	7.27272	7.21039	7.29085	7.38597	7.42355	7.37652
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Quantile	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
0.10	–3.8686	7.0590	6.9457	6.9165	6.8715	6.9581	6.9783
P-value	0.0015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.15	***–2.8981***	7.0221	6.8982	6.9749	6.9556	7.1031	7.0358
P-value	***0.3604***	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.20	***6.0778***	7.0643	6.9937	7.0606	7.0892	7.0469	7.0642
P-value	***0.1235***	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.25	6.2387	7.0614	7.0692	7.1376	7.1883	7.0952	7.0839
P-value	0.0078	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.30	6.6688	7.0731	7.0465	7.2128	7.2231	7.1488	7.1597
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.35	6.6688	7.1962	7.1180	7.2120	7.1874	7.2321	7.2115
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.40	6.6688	7.1764	7.1015	7.2226	7.2423	7.2659	7.2542
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.45	6.7219	7.1210	7.1573	7.2707	7.2315	7.2802	7.2674
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.50	6.7595	7.1875	7.2467	7.3100	7.2564	7.3048	7.2664
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.55	6.8221	7.2245	7.3121	7.4029	7.3509	7.2835	7.3700
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.60	6.9161	7.2196	7.3928	7.3940	7.3971	7.5087	7.4046
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.65	6.9403	7.2923	7.3733	7.3910	7.4028	7.4996	7.4401
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.70	6.9777	7.3227	7.3638	7.4081	7.5106	7.5010	7.4534
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.75	7.0250	7.3843	7.3658	7.3840	7.5808	7.6040	7.4994
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.80	6.9868	7.3915	7.3064	7.3487	7.6414	7.6747	7.5746
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.85	7.0049	7.4374	7.3341	7.4326	7.6828	7.7301	7.6415
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.90	7.1006	7.4747	7.4061	7.4947	7.6561	7.7779	7.8858
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.95	7.1596	7.4862	7.3629	7.6288	7.7201	7.7888	7.8729
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Remark: * The regression coefficient β_0 is significant at a significance level of at least 0.05 for almost every quantile in all 2009 – 2015 years, except for bold cases.

Source: Own calculation in SAS.

Using common regression we were also looking for relations of overestimating or underestimating the amounts of wage increases depending on unemployment in relation to the least developed districts in the Slovak Republic (LDDs). It was found that a drop in the unemployment rate brought smaller increases in wages in all LDDs than expected. This concerns the districts of the Banská Bystrica, Prešov and Košice regions detailed above (12 out of 79 districts).

T a b l e 3

Quantities in which Classical Regression Underestimates the Impact of Wage Decline in Case of Increase in Unemployment Rate

	2009	2010	2011	2012	2013	2014	2015
Quantile							
0.45	X	X	X	–0.241500	X	X	X
0.50	X	X	–0.243500	–0.251600	X	X	X
0.55	X	X	–0.261100	–0.278700	X	X	X
0.60	X	X	–0.280900	–0.271800	X	–0.303900	–0.264700
0.65	X	X	–0.267700	–0.260500	X	–0.299400	–0.277100
0.70	X	X	–0.261200	–0.265500	–0.309000	–0.299200	–0.279500
0.75	X	–0.294000	–0.260300	–0.249900	–0.329300	–0.325100	–0.286800
0.80	X	–0.292000	X	X	–0.344500	–0.345900	–0.310000
0.85	X	–0.302000	X	–0.245300	–0.352500	–0.358800	–0.332300
0.90	X	–0.305200	–0.243300	–0.257300	–0.335800	–0.362100	–0.410100
0.95	X	–0.290000	X	–0.294400	–0.336900	–0.349700	–0.387900

Source: Own calculation in SAS.

If we want to find out, hypothetically, into which regions it is purposeful to put money, be it in the form of investments or different kinds of support, which should lead to a rise in wages and to lower unemployment and thus contribute to a growth in economic performance of the region through an increase in the incomes of households and businesses, it is appropriate to consider using also the so-called order of regression coefficients when allocating resources. This is a methodology which is based on using the already acquired regression coefficients of the dependence of wages and the unemployment rate at a district level for a certain period under review. In our case it is based on allocating the sequence number 1 to the highest value of the regression coefficient (since it is a negative value, the smallest one in numerical terms). Then the lowest value of the regression coefficient will have the sequence number 18. We repeated such procedure for every year under review and we made an average from the acquired orders. Based on the results for the period under review, i.e. 2010 – 2015, we may speak about the existence of regularity when higher average wages (their logarithm) responded more sensitively to a unit change in unemployment (its logarithm). We already know that average wages are lower when the unemployment rate is high. The same drop in the unemployment rate – in the case of a high unemployment rate (low wages) – leads to a lower increase in wages than

in the case of regions with a low unemployment rate (higher wages). This means that the unemployment rate decreases in such a manner that disparities between regions may keep increasing. If we e.g. put the amount of funds P1 into district A with a high average wage (0.9 quantile) in order to decrease the unemployment rate with the logarithm = 0.5 and the amount of funds P2 into district B with a low average wage (0.1 quantile) when we achieve the same drop in the unemployment rate with the logarithm = 0.5, there is a different wage increase which will be higher in district A than in district B. This may increase the disparity between the districts.

Conclusions

In spite of great achievements at the macroeconomic level, Slovakia remains affected by high unemployment rates, particularly the long-term one, present mainly in the districts of the Banská Bystrica, Prešov and Košice regions. We believe that it is important to focus on further decreasing the unemployment rate, particularly the long-term one, which will stop the deepening of disparities between Slovak regions and decrease the values of income poverty and deprivation. The need for further increases in the wage level is related not only to ensuring an increase in the final consumption of households from a short-term and medium-term perspective. Generating a higher wage level creates room for saturating old-age pensions in the following period since the number of pensioners will considerably increase in the forthcoming period. With regard to the issue we dealt with, the adoption of the LDD Support Act will open another road for dealing with unemployment issues in Slovak regions with long-term problems. From the point of view of generating and maintaining new jobs, particular implementation of action plans in districts should turn out better than the results of an active labour market policy with its requalification programmes.

In relation to the challenges we are facing as a result of the starting 4th Industrial Revolution, it is necessary to sensitively consider both its pros and cons in connection to shaping the labour market where termination of a large portion of traditional professions is expected, and the demand for higher qualifications and new forms of work is increasing. Therefore, it is a great challenge for Slovakia to assume a responsible approach to introducing major changes in the education system at a regional level as well. The effort to generate new jobs should not reflect only the level of implementation of the Industry 4.0 strategy, which most concerns the automotive and electrical engineering industries, services and trade, but it should also strive to considerably boost the economic potential of rural areas. However, if we manage to continue supporting regional development at

the level of real allocation of high amounts of investments in districts with low unemployment rates and no sustainable new jobs and programmes are prepared, then we will discover – when examining the relations between unemployment and wage developments – that wages are not rising in districts where the unemployment rate is increasing. Purposeful allocation of financial sources to LDDs which require legally stipulated support should also be efficient but the overall framework of ensuring growth in the economic performance of all regions should not be neglected (by letting income disparities in the regions and between regions rise). The methodologies prepared and used by us have contributed to the finding that, in the period under review, i.e. 2010 – 2015, the same drop in the unemployment rate leads to a lower increase in wages in districts with high unemployment rates (low wages) than in regions with low unemployment rates (higher wages). When deciding on the allocation of financial resources to districts, it is appropriate to consider such findings since a drop in the unemployment rate may lead to an increase in disparities between regions in the subsequent time period.

The development of unemployment and wages represents basic determinants in the area of examining income polarization. We cannot therefore only speak about a positive development of the average wage, which hides a deepening income polarization. Household consumption is rising not in relation to a growth in incomes but rather in relation to a rise in the number and the amount of debts of the population. Such trends represent risk development lines in the future in spite of a positive drop in unemployment in the Czech Republic, Slovakia, as well as Hungary.

References

ALBERT, M. – MECKL, J. (2001): Efficiency-Wage Unemployment and Intersectoral Wage Differentials in a Heckscher-Ohlin Model. German Economic Review, *3*, No. 2, pp. 287 – 301.

BLANCHFLOWER, D. G. – OSWALD, J. A. (1994): The Wage Curve. Cambridge, MA: MIT Press, 481 pp. ISBN 978-02-6202-375-7.

CAMPBELL, C. – ORSZAG, J. M. (1998): A Model of the Wage Curve. Economics Letters, *59*, No. 1, pp. 119 – 125.

CZ SU (Czech Statistical Office) (2000 – 2015): Database. Available on: <https://www.czso.cz/>.

ČERNOHORSKÁ, L. (2006): Komparace nezaměstnanosti v České republice a na Slovensku. [Scientific Papers, Series D, No. 10, pp. 34 – 43.] Pardubice: University of Pardubice, Faculty of Economics and Administration.

HSCO (Hungarian Central Statistical Office) (2000 – 2015): Database. Available at: <http://www.ksh.hu/stadat_eves_2_1>.

KOENKER, R. – HALLOCK, K. (2001): Quantile Regression: An Introduction. Journal of Economic Perspectives, *15*, No. 4, pp. 43 – 56.

MH SR (2016): Koncepcia inteligentného priemyslu pre Slovensko. Bratislava: Ministerstvo Hospodárstva SR, 31 pp. Available at: <http://www.rokovania.sk/File.aspx/ViewDocumentHtml/Mater-Dokum-04565?prefixFile=m_;lang=sk>.

NÁMEŠNÝ, L. – ĎURČEK, P. – ROCHOVSKÁ, A. (2012): Vzťah nezamestnanosti a chudoby pracujúcich – skúmanie geografickej nerovnomernosti v EU pomocou Theilovho indexu. Geographia Cassoviensis, *6*, No. 2, pp. 141 – 151.

PAUHOFOVÁ, I. a kol. (2016): Súvislosti príjmovej polarizácie na Slovensku. Bratislava: Ekonomický ústav SAV, 233 pp. ISBN 978-80-7144-259-2.

PAUKOVIČ, V. (2007): Problém nezamestnanosti – vybrané makrosociologické a mikrosociologické kontexty. Sociálne a politické analýzy, *1*, No. 1, pp. 73 – 101.

POŠTA, V. – PAVELKA, T. – MACÁKOVÁ, L. (2015): Strukturální míra nezaměstnanosti v ČR. Praha: Management Press, 84 pp. ISBN 978-80-7261-296-3.

SO SR (Statistical Office of SR) (2000 – 2015): Database DATAcube. Available at: <https://slovak.statistics.sk/wps/portal/ext/Databases/DATAcube_sk>.

SPATZ, J. (2001): Explaining Intra, and Intersectoral Wage Differentials in Simple General Equilibrium Trade Model. Kieler Arbeitspapiere, No. 1042, 47 pp.

WEF (2017): The Global Risks. Report 2017. 12th Edition. Available at: <http://www3.weforum.org/docs/GRR17_Report_web.pdf>.