ANALYSIS OF UNEMPLOYMENT USING FOUR-FACTOR MODEL IN EUROPEAN UNION COUNTRIES

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Abstract: *The paper deals with the analysis of unemployment in European Union countries on the basis of data of the unemployment rate and the number of unemployed. The data are obtained from the Eurostat website. The aim of the paper is to find out how the number of unemployed in individual EU countries changed in 2018 compared to 2009, in which country the number of unemployed increased the most, in which the least. Appropriate tools of economic statistics are used for the analysis. Based on a four-factor model of the analysis of the number of unemployed, we find out how this indicator has changed depending on the change in the unemployment rate, the economic activity rate, the share of the working age population in the total population, and the total population.*

The application of statistical method is implemented through the programme Microsoft Office Excel.

Keywords: *Unemployment rate, Number of unemployed, Four-factor model, European Union countries.*

1. INTRODUCTION

Each of the world's economies is trying to keep unemployment down. In this respect, Slovakia is experiencing a positive trend, unemployment has been declining since 2013. Unemployment is affected by several factors. Unemployment of young people and graduates is also a much-discussed topic. A large number of young people or graduates with the necessary experience are leaving for work outside the borders of the Slovak Republic. Then it may be a brain drain, which is a negative phenomenon for any economy. However, brain drain can be prevented by a suitable study environment as well as a modern work environment and good working conditions.

Unemployment can be analysed using indicators of the unemployment rate and the number of unemployed.

We recognize several types of unemployment rate – unemployment rate according to data from the Labour Force Survey (for more details see the Employment Institute), unemployment rate of the working age population, registered unemployment rate, available unemployment rate (more in Hurbánková, Sivašová, 2018).

2. LITERATURE OVERVIEW

Card, Freeman (1993) researched that the emergence of a relative unemployment gap between Canada and the United States has sparked much speculation and researched into its causes. Many observers argued that the gap reflected the more severe economic downturn in Canada in the early 1980s. Following the longest expansion in the post-war era, however, it is difficult to argue that the unemployment gap is a short-run adjustment phenomenon. In their paper they investigated an alternative „structural hypothesis": that the divergence in unemployment rates

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reflects an emerging structural difference in the nature of unemployment and labour supply in the two countries. To understand this difference, they analysed individual employment and unemployment data from the United States and Canada at the beginning and end of the 1980s. Their investigation points to several complementary explanations for the relative growth of unemployment in Canada, including relative changes in the fraction of nonworking time that is reported as unemployment, and relative changes in the overall distributions of working and nonworking time.

Belot, Ours (2001) investigated to what extent differences of the unemployment rate between OECD countries are related to labour market institutions. In their analysis they used data of eighteen OECD countries over the period 1960-1994 and showed that the way in which institutions interact is important.

Amato, Beattie (2011) analysed data from 50 states and the District of Columbia from 1960 to 2005 to study how the unemployment rate and the divorce rate are related. Unemployment is positively related to divorce in a bivariate analysis, but the association is not significant when state and year fixed effects are included in the statistical model. When the sample is divided into time periods, unemployment is negatively and significantly associated with divorce after 1980. These findings provide the strongest support for a ''cost of divorce'' perspective and suggest that a high rate of unemployment decreases the rate of divorce.

Kreishan (2011) in his paper investigates the relationship between unemployment and economic growth in Jordan through the implementation of Okun's law using annual data covering the period 1970-2008. Time series techniques, cointegration test and a simple regression he used to test the relation between unemployment and economic growth. He found out that the lack of economic growth does not explain the unemployment problem in Jordan. The study recommended that economic policies related to demand management would not have an important effect in reducing unemployment rate. Accordingly, implementation of economic policies oriented to structural change and reform in the labour market would be more appropriate by policy makers in Jordan.

Hadaš-Dudych, Pietrzak, Balcerzak, (2016) conducted comparative analysis of the unemployment phenomena in Visegrad countries. For this purpose, wavelet analysis was applied. In the research a discrete wavelet transformation was used, which has been recently effectively used for analysis of macroeconomic indicators. The empirical research was conducted for the years 1998-2016 and it was based on the Eurostat data. In the research the following hypothesis was verified: the phenomenon of unemployment in the case of Poland, Slovakia and Hungary is formed in a quite similar way, whereas in Czech Republic the situation on the labour markets is mainly determined by factors of different nature.

3.   ANALYSIS OF THE UNEMPLOYMENT RATE IN INDIVIDUAL EUROPEAN UNION COUNTRIES

We will first deal with the analysis of the unemployment rate, specifically the unemployment rate of the working age population. Figure 1 shows the unemployment rate of the working age population in individual countries of the European Union (hereinafter EU) in 2009 and 2018. The countries are ranked according to the lowest value of the analysed indicator in 2018.
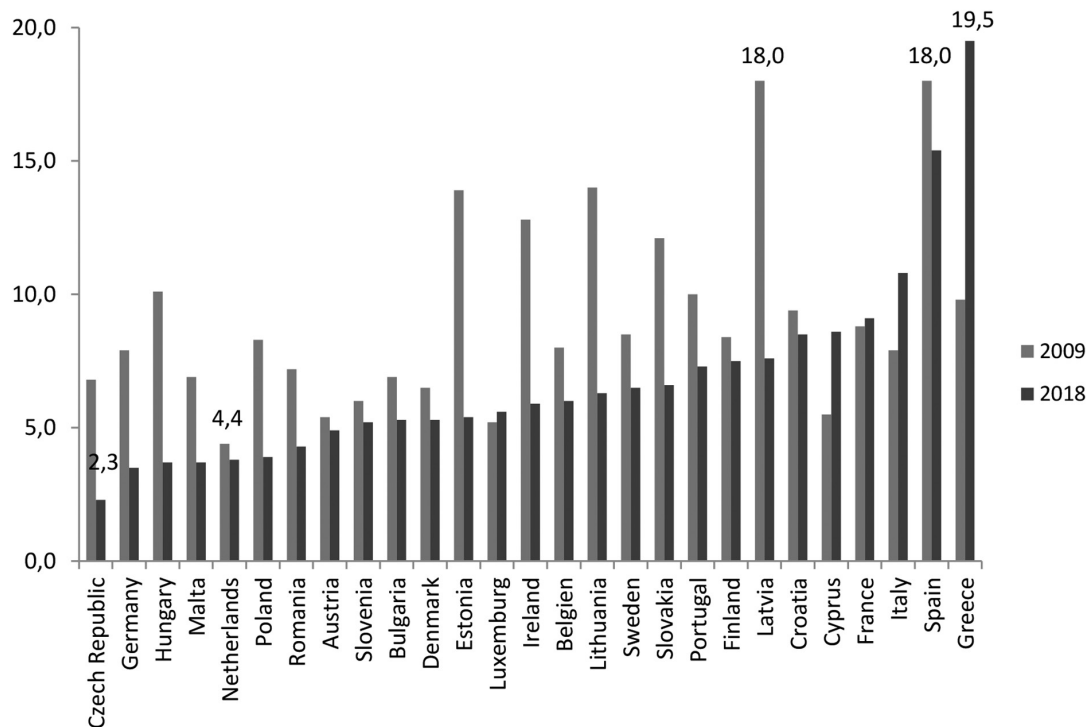
Figure 1. Unemployment rate of persons aged 15-64 in %
in individual EU countries in 2009 and 2018

Source: own processing in MS Excel based on data from Eurostat

As we can see from Figure 1, in 2018 the lowest unemployment rate of the working age population was in the Czech Republic, only 2.3% of the working age population was unemployed of the number of economically active working age population. The Czech Republic is followed by Germany, Hungary, Malta, the Netherlands and Poland, which had an unemployment rate of 3.5-3.9%. The highest rate in 2018 was 19.5% in Greece, 15.4% in Spain and 10.8% in Italy. In Slovakia, this indicator was at the level of 6.6%, while our country ranked 18th among the analysed 27 countries of the European Union. As of 2009, the lowest unemployment rates of the working age population were recorded in the Netherlands (4.4%), Luxembourg, Austria and Cyprus (around 5%). The highest value of this indicator was in Latvia and Spain at 18.0%. In our country it was at the level of 12.1%. We can observe that in most countries there was a decrease in the unemployment rate in 2018 compared to 2009. The highest decrease was recorded in Latvia (by 10.4 percentage points). In Slovakia, there was a decrease of 5.5 pp. A slight increase can be observed in France (by 0.3 pp) and Luxembourg (by 0.4 pp), the highest increase in Greece (by 9.7 pp). There has also been an increase in the unemployment rate of the working age population in Cyprus and Italy.

4. ANALYSIS OF THE NUMBER OF UNEMPLOYED IN INDIVIDUAL EUROPEAN UNION COUNTRIES

In this part of the paper, we will focus our attention on the analysis of an extensive indicator – the number of unemployed in the working age (in the age of 15-64 years). We will monitor how this indicator changed in individual EU countries in 2018 compared to 2009 and based on a four-factor model of the analysis of the number of unemployed, we find out how this indicator has changed depending on the change in the unemployment rate, the economic activity rate, the share of the working age population in the total population and the total population.

4.1 Four-factor model for the analysis of the number of unemployed

The number of unemployed in the working age is influenced by the factors of the unemployment rate of the working-age population, the economic activity rate of the working age population, the share of the working age population in the total population and the total population. We obtain a 4-factor model, which we can write as follows:

$$U_{15-64} = \frac{U_{15-64}}{M_{15-64}} * \frac{M_{15-64}}{N_{15-64}} * \frac{N_{15-64}}{N_{0-100}} * N_{0-100} \tag{1}$$

where:

$\dfrac{U_{15-64}}{M_{15-64}}$ is the unemployment rate of the working age population (u_{15-64}),

$\dfrac{M_{15-64}}{N_{15-64}}$ is the economic activity rate of the working age population (a_{15-64}),

$\dfrac{N_{15-64}}{N_{0-100}}$ is the share of the working age population in the total population (p_{15-64}),

N_{0-100} is the total population.

We can also write the relationship as follows:

$$U_{15-64} = u_{15-64} * a_{15-64} * p_{15-64} * N_{0-100} \tag{2}$$

Since the multiplicative relation applies to individual factors, the following also applies to their development indices:

$$i_{U_{15-64}} = i_{u_{15-64}} * i_{a_{15-64}} * i_{p_{15-64}} * i_{N_{0-100}} \tag{3}$$

We will use a logarithmic decomposition to analyse the absolute changes in the number of unemployed. When we logarithm relation 3, we get the relation:

$$\log i_{U_{15-64}} = \log i_{u_{15-64}} + \log i_{a_{15-64}} + \log i_{p_{15-64}} + \log i_{N_{0-100}} \tag{4}$$

To adjust the relationship, we divide all logarithms of individual factors by the logarithm of the top indicator (number of unemployed):

$$1 = \frac{\log i_{u_{15-64}}}{\log i_{U_{15-64}}} + \frac{\log i_{a_{15-64}}}{\log i_{U_{15-64}}} + \frac{\log i_{p_{15-64}}}{\log i_{U_{15-64}}} + \frac{\log i_{N_{0-100}}}{\log i_{U_{15-64}}} \tag{5}$$

When we multiply the relationship (5) by the absolute change in the number of unemployed, we find out how the number of unemployed has changed due to changes in individual factors (unemployment rate, economic activity rate, share of working age population in total population, total population):

$$\Delta_{U_{15-64}} = \frac{\log i_{u_{15-64}}}{\log i_{U_{15-64}}} * \Delta_{U_{15-64}} + \frac{\log i_{a_{15-64}}}{\log i_{U_{15-64}}} * \Delta_{U_{15-64}} + \frac{\log i_{p_{15-64}}}{\log i_{U_{15-64}}} * \Delta_{U_{15-64}} + \frac{\log i_{N_{0-100}}}{\log i_{U_{15-64}}} * \Delta_{U_{15-64}} \tag{6}$$

Table 1. Application of the influence of individual factors on the trend of the number of unemployed in individual EU countries in 2009 and 2018

Country	Indices				
	$i_{U_{15-64}}$	$i_{u_{15-64}}$	$i_{a_{15-64}}$	$i_{p_{15-64}}$	N_{0-100}
Belgium	0,7910	0,7545	1,0152	0,9743	1,0600
Bulgaria	0,7216	0,7666	1,0617	0,9391	0,9441
Czech Republic	0,3421	0,3383	1,0834	0,9171	1,0177
Denmark	0,8178	0,8045	0,9955	0,9735	1,0489
Germany	0,4526	0,4412	1,0302	0,9864	1,0096
Estonia	0,3926	0,3922	1,0694	0,9479	0,9876
Ireland	0,4699	0,4585	1,0050	0,9544	1,0684
Greece	1,8717	1,9907	1,0135	0,9583	0,9681
Spain	0,8363	0,8548	1,0110	0,9590	1,0091
France	1,0898	1,0392	1,0541	0,9566	1,0399
Croatia	0,8567	0,9064	1,0117	0,9807	0,9526
Italy	1,4409	1,3783	1,0442	0,9766	1,0251
Cyprus	1,6898	1,5566	1,0304	0,9716	1,0845
Latvia	0,3740	0,4229	1,0502	0,9416	0,8944
Lithuania	0,4264	0,4525	1,1060	0,9658	0,8822
Luxemburg	1,4103	1,0832	1,0449	1,0214	1,2199
Hungary	0,4115	0,3713	1,1753	0,9673	0,9748
Malta	0,7712	0,5377	1,2919	0,9590	1,1576
Netherlands	0,9010	0,8720	1,0250	0,9672	1,0422
Austria	0,9861	0,9134	1,0288	0,9914	1,0585
Poland	0,4659	0,4728	1,0417	0,9499	0,9958
Portugal	0,6998	0,7258	1,0192	0,9710	0,9743
Romania	0,5574	0,6035	0,9945	0,9721	0,9555
Slovenia	0,8656	0,8666	1,0426	0,9420	1,0170
Slovakia	0,5546	0,5479	1,0486	0,9545	1,0113
Finland	0,9081	0,9008	1,0372	0,9389	1,0351
Sweden	0,8377	0,7655	1,0509	0,9524	1,0933

Source: own processing in MS Excel based on data from Eurostat

Table 1 shows the development of the number of unemployed in the working age and the trend of the unemployment rate of the working age population, the economic activity rate of the working age population, the share of the working age population in the total population and the total population. We see that the unemployment rate decreased the most in the Czech Republic, namely by 66.17%, in Hungary by 62.87% and in Estonia by 60.78%, it increased the most in Greece by 99.07%, in Cyprus by 55.66 % and in Italy by 37.83%. The economic activity rate decreased only in Denmark, by 0.45%, in other countries it increased, most notably in Malta by 29.19%, in Hungary by 17.53% and in Lithuania by 10.60%. The share of the working age population in the total population increased only in Luxembourg by 2.14%, decreased in other countries, with the highest decreases recorded in the Czech Republic by 8.29%, in Finland by 6.11% and in Bulgaria by 6.09%. The total population increased the most in 2018 compared to 2009 in Luxembourg by 21.99%, in Malta by 15.76% and in Sweden by 9.33%, the largest decrease in Lithuania by 11.78%, in Latvia by 10.56% and in Bulgaria by 5.59%. In Slovakia, the unemployment rate of the working age population decreased by 45.21%, the economic activity rate increased by 4.86%, the share of the working age population in the total population decreased by 4.55% and the total population increased by 1.13%.

Table 2. Absolute change in the number of unemployed due to changes in individual factors in EU countries in 2009 and 2018 in thousand people

Country	Absolute change in the number of unemployed				
	$U_{15\text{-}64}$	$u_{15\text{-}64}$	$a_{15\text{-}64}$	$p_{15\text{-}64}$	$N_{0\text{-}100}$
Belgium	-79,3	-95,3	5,1	-8,8	19,7
Bulgaria	-65,9	-53,7	12,1	-12,7	-11,6
Czech Republic	-231,4	-233,8	17,3	-18,7	3,8
Denmark	-33,9	-36,7	-0,8	-4,5	8,1
Germany	-1 763,6	-1 820,6	66,2	-30,5	21,3
Estonia	-56,0	-56,1	4,0	-3,2	-0,7
Ireland	-153,9	-158,9	1,0	-9,5	13,5
Greece	421,9	463,4	9,0	-28,7	-21,8
Spain	-679,1	-595,9	41,6	-159,1	34,3
France	220,3	98,6	135,0	-113,6	100,3
Croatia	-25,5	-16,2	1,9	-3,2	-8,0
Italy	838,9	736,9	99,3	-54,4	57,0
Cyprus	14,9	12,6	0,8	-0,8	2,3
Latvia	-120,2	-105,2	6,0	-7,4	-13,6
Lithuania	-120,4	-112,0	14,2	-4,9	-17,7
Luxemburg	4,8	1,1	0,6	0,3	2,8
Hungary	-245,7	-274,1	44,7	-9,2	-7,1
Malta	-2,7	-6,4	2,7	-0,4	1,5
Netherlands	-37,4	-49,1	8,9	-12,0	14,8
Austria	-3,1	-20,0	6,3	-1,9	12,6
Poland	-752,7	-738,2	40,2	-50,6	-4,1
Portugal	-155,0	-139,2	8,3	-12,8	-11,3
Romania	-301,2	-260,3	-2,9	-14,6	-23,5
Slovenia	-8,2	-8,1	2,4	-3,4	1,0
Slovakia	-144,0	-147,0	11,6	-11,4	2,7
Finland	-20,3	-22,0	7,7	-13,3	7,3
Sweden	-66,1	-99,8	18,5	-18,2	33,3

Source: own processing in MS Excel based on data from Eurostat

Table 2 tells us how the number of unemployed of working age in individual countries of the European Union has changed due to a change in individual factors. We found that the number of unemployed in Germany decreased the most, by 1,763,600 persons due to changes in the unemployment rate of the working age population decreased the number of unemployed by 1,820,600 persons, due to the change in the economic activity rate of the working age population increased by 66,200 persons, due to changes in the share of the working age population in the total population decreased by 30,500 persons and due to changes in the total population increased by 21,300 persons. The number of unemployed of working age increased the most in Italy, by 838,900 persons, due to changes in the unemployment rate the number of unemployed increased by 736,900 persons, due to changes in economic activity rate it increased by 99,300 persons, due to changes in the share of working age population in total population decreased by 54,400 persons and due to changes in the total population increased by 57,000 persons. In Slovakia, the number of unemployed of working age decreased by 144,000 persons, due to changes in the unemployment rate the number of unemployed decreased by 147,000 persons, due to changes in economic activity rate increased by 11,600 persons, due to changes in the share of working age population in the total population decreased by 11,400 persons and due to changes in the total population increased by 2,700 persons.

5. CONCLUSION

From the realized analyses we can draw the following conclusions:

- The lowest unemployment rate of the working age population was in the Czech Republic in 2018, only 2.3% of the working age population was unemployed of the economically active working age population, 3.5% in Germany, Hungary and Malta 3,7%. The highest was in Greece 19.5%, in Spain 15.4% and in Italy 10.8%. In Slovakia, this indicator was at the level of 6.6%, which put our country in 18th place among the analysed 27 countries of the European Union;
- In 2009, the lowest unemployment rates of the working age population were recorded in the Netherlands (4.4%), Luxembourg (5.2%) and Austria (5.4%). The highest value of this indicator was in 2009 in Latvia and Spain, up 18.0%. In our country, the unemployment rate was at the level of 12.1%;
- In most countries, the unemployment rate decreased in 2018 compared to 2009, with the highest decrease recorded in Latvia (by 10.4 percentage points). In Slovakia, there was a decrease of 5.5 pp. A slight increase can be observed in France (by 0.3 pp) and Luxembourg (by 0.4 pp), the highest increase in Greece (by 9.7 pp). There has also been an increase in the unemployment rate of the working age population in Cyprus and Italy;
- In most countries there was a decrease in the number of unemployed in 2018 compared to 2009, while the highest decrease was recorded in the Czech Republic, namely by 65.79%, in Latvia by 62.60% and in Estonia by 60.74%. In Slovakia, there was a decrease of 44.54%. The number of unemployed increased by 87.17% in Greece, 68.98% in Cyprus, 44.09% in Italy, 41.03% in Luxembourg and 8.98% in France;
- The number of unemployed in Germany decreased the most, by 1,763,600 persons, due to changes in the unemployment rate of the working age population decreased the number of unemployed by 1,820,600 persons, due to changes in the economic activity rate of the working age population increased by 66,200 persons, due to changes in the share of the working age population in the total population decreased by 30,500 persons and increased by 21,300 persons as a result of changes in the total population;
- The number of unemployed in working age increased the most in Italy, by 838,900 persons, due to changes in the unemployment rate the number of unemployed increased by 736,900 persons, due to changes in economic activity rate increased by 99,300 persons, due to changes in the share of working age population in the total population decreased by 54,400 persons and increased by 57,000 persons due to changes in the total population;
- In Slovakia, the number of unemployed in working age decreased by 144,000 persons, due to changes in the unemployment rate the number of unemployed decreased by 147,000 persons, due to changes in economic activity rate increased by 11,600 persons, due to changes in the share of working age in the total population decreased by 11,400 persons and due to changes in the total population increased by 2,700 persons.

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