



ORIGINAL ARTICLE


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Mutual relationships between the unemployment rate and the unemployment duration in the Visegrad Group countries in years 2001–2017

JEL Classification: C61; J64

Keywords: *registered unemployment rate; unemployment duration; business cycle clock; Dynamic Time Warping; Visegrad Group countries*

Abstract

Research background: The most important indicators that describe the situation on the labour market are the unemployment rate and the unemployment duration. If both these indicators are high, then the human capital deteriorates. Therefore, it seems justified to analyse the mutual relationships between them.

Purpose of the article: The article aims at finding the relationships between the unemployment rate and the unemployment duration, and checking if the mutual courses of these two indicators in the Visegrad Group countries are connected with each other.

Methods: The business cycle clock methodology will be used to analyse the relationship between the unemployment rate and the median unemployment duration. Next, the similarity of the course of these two indicators will be analysed by means of the Pearson product-moment correlation coefficient and the Dynamic Time Warping (DTW) technique.

Findings & Value added: Amongst the analysed countries, Czechia, Poland and Slovakia were, to a certain degree, similar with respect to the mutual course of the unemployment rate and the unemployment duration. Until the peak of the financial crisis in 2009, the unemployment rate and the unemployment duration decreased. During the next years, the unemployment rate was increasing and after 2-3 years it was followed by the increase of the unemployment duration. The situa-

tion improved after the year 2013 — both indicators were decreasing. In Hungary, on the contrary, the unemployment rate was increasing or steady until 2012, and during the following years it started to decrease. However, the course of the unemployment duration was completely different than in remaining countries. The value added of the article is application of the business clock cycle and the Dynamic Time Warping technique in finding the relationships and similarity of courses between the unemployment rate and the unemployment duration.

Introduction

In the analyses of the labour market there are many measures and indicators allowing for the assessment of employment, wage and employment level, work conditions, labour costs or demand for work. A lot of labour market research is done within the European Statistical System. It is set out in detail in the Council and European Parliament regulations, and their methodology, deadlines and quality requirements are set out in the implementing regulations of the European Commission. The frequently used indicators are: activity rate, employment rate and unemployment rate. The unemployment rate is the basic indicator in the analysis of the situation on the labour markets. Apart from it, the mean unemployment duration is also analysed. The Main Statistical Office in Poland publishes the mean unemployment duration on the basis of the statistical mean (Labour force survey in Poland). However, due to the fact that the distribution of the unemployment duration is skewed, the median seems to be better measure of central tendency. The Eurostat data allows for its calculation. It also seems that both the unemployment rate and median unemployment duration describe changes on the labour market similarly. During most economic cycles, a strong correlation between the unemployment rate and the unemployment duration can be observed (Abraham & Shimmer, 2001, p. 1). The period of the economic crisis can be characterised by a decrease in demand for work and increasing unemployment, while during the recovery, the opposite takes place. When the economic situation deteriorates, the unemployment rate increases. It should imply the increase of the unemployment duration. On the contrary, the decrease of the unemployment rate should cause the decrease of the unemployment duration. The question arises: do these regularities always occur and do changes of both indicators occur simultaneously? What is the influence of an economic crisis on the unemployment rate and median unemployment duration and is this influence the same in various countries?

Unemployment duration is the basic variable in the model of job search (Mortensen, 1970). In this model, the unemployment duration is directly proportional to the unemployment rate, but the time lag that may exist between these variables, is not analysed. The unemployment duration and the

unemployment rate together were examined together by Mukoyama and Şahin (2004). However, the authors compared only trends of both indicators. Although it was not the subject of their analysis, the presentation of both indicators shows that the reaction of the unemployment duration to the unemployment rate is lagged.

Reaction of the labour markets to changes of the economic conditions depends on many factors, of which the level of the economic development and the structure of economy seem to be the most important. These factors have the greatest impact on the differences in unemployment and employment rates between countries and their response to crises (Chocholatá & Furková, 2018). Counteracting the effects of unemployment depends to a large extent on the effectiveness of the labour market policy pursued in a given country. Its character and influence on the economic situation in particular countries is nuanced (Rollnik-Sadowska & Dąbrowska, 2018). The labour market policy is implemented by the labour market institutions. Their tasks include, *inter alia*, assistance to people in a special situation on the labour market and at risk of long-term unemployment. Some of these activities, such as high unemployment benefits, may extend the unemployment duration (Bieszk-Stolorz & Markowicz, 2014; Meyer, 1990; Mortensen, 1977; Nickell, 1979). Bodies of research suggest that these institutions have deep historical roots and the scope of potential changes depends on the cultural and political heritage of particular communities (Pilc, 2015). Markets in various countries do not always react to changes in the economy as presented in theoretical studies. In order to avoid these sources of diversity, the subject of the analysis are the so-called the Visegrad Group countries: Poland, Czechia, Slovakia and Hungary. These countries can be treated as acting on the similar level of economic development and having similar employment structure. The Visegrad Group countries are currently considered as the example of successful transformation from the centrally planned economy into the market one, and they are often indicated as the benchmark cases of the process of modernisation that increased their competitiveness in the globalised economy (Hadaś-Dyduch *et al*, 2016). They also joined the European Union at the same time and had to face similar problems connected with transition from the centrally planned to the market-oriented economy. Therefore, the labour markets of the Visegrad Group countries can be an interesting subject of comparative analysis. Those are the main reasons for considering these countries as research objects.

The goal of the article is examination of the relationship between the unemployment rate and the unemployment duration and the similarity of course of these indicators in the Visegrad Group countries. The Eurostat data for years 2001–2017 was used in the research. This period was select-

ed because the data needed to perform full analysis was available only since 2001 (for the unemployment duration in Slovakia). The two research hypotheses were made — that there was relation between the unemployment rate and unemployment duration and that the latter was lagged in relation to the former. The analysis was performed by means of the scatter-plot charts for each country, which were analysed similarly to the so-called business cycle clock. The similarity of the course of the unemployment rate and the median unemployment duration was analysed by means of the Pearson product-moment correlation coefficients and the Dynamic Time Warping technique.

The first part of the paper presents the literature review of the labour market analyses in the Visegrad Group countries. It is followed by a brief presentation of the situation on the labour market in these countries. In the next part, the research methodology was presented. The next part of the paper contains the results of empirical research, followed by the discussion of obtained results and conclusions.

Literature review

In the analysis of the unemployment rate (years 1998–2016) by means of the wavelet analysis, Hadaś-Dyduch *et al.* (2016) proved that the labour markets of four Visegrad Group countries had different reactions on the exogenous factors coming from the world market. High fluctuations of the unemployment rate indicate a high sensitivity of the labour markets on the exogenous factors coming from the global economy. Low fluctuations indicate relatively high stability of the labour markets. The research revealed significant differences in the functioning of the labour market in the Visegrad Group and confirmed that the markets had varying stability. The best situation was in Czechia, where the unemployment rate was low and the labour market was relatively highly stable. The lowest effectiveness of the labour markets was observed for Poland and Slovakia.

Labour market surveys indicated that the employment level reacted to changes in the economic situation. Zieliński (2018) analysed eleven Central and Eastern European countries. He proved that the recession caused by the global financial crisis of 2007–2009 had a different course and depth in these countries. It affected the Baltic States to the largest extent. The Balkan countries were hit by the recession slightly more than the EU–25 average. The effect of recession in the Visegrad Group countries was on a similar level as in the EU–25 (Poland, as the only country recorded a slowdown, not recession). The recession caused a decrease in the employment level in

all analysed countries. As far as Poland, Czechia and Hungary are concerned, they managed to rebuild the employment rate in 2015 at least to the level from before the crisis, while in the remaining countries the employment rate in 2015 was lower than it had been before 2007.

The Visegrad Group countries joined the European Union in 2004. Analyses with the use of composite measures of development indicate that in that year the level of development in these countries was low. In 2008 the values of indicators increased, whereby the highest indicator of development of the labour market was in Slovakia and the lowest — in Poland and Hungary (Szymczak & Gawrycka, 2013). The research on the influence of the crisis 2007–2009 on the labour markets in the Visegrad Group countries proved that Poland and Hungary were less elastic and returned to the equilibrium level slower (Furuoka, 2014). Finally, it can be noticed that after disturbances resulting from the global financial crisis the situation on the labour markets in the Visegrad Group countries seems to stabilise (Hadaś-Dyduch *et al.*, 2016).

Kwiatkowski (2011) analysed the situation on the labour markets in the Visegrad Group countries. In the period of the global crisis of 2007–2009 the unemployment rates increased and the employment rates decreased. In Poland both indicators changed slightly. The reason for this was advantageous increasing tendencies of the GDP and reduction of real wages and working time.

Significant decrease of employment in Hungary was caused by the decrease of GDP. It was slightly halted by reductions of the work time, real wages and labour productivity. Large decreases in the employment level in Slovakia and Czechia were connected with the weak increase of GDP and a strong increase of real wages. Reductions of the working hours and labour productivity were not able to reverse the unfavourable tendencies in employment.

Unemployment rate and the unemployment duration in the Visegrad Group countries

Analysing the unemployment rate in years 2001–2017 it can be seen that for Poland, Czechia and Slovakia the period after the accession to the EU (since 2004) until the moment of the global financial crisis was the time of constant improvement of the situation on the labour markets that was characterised by the decrease of the unemployment rate (Figure 1). In the case of Hungary, it noticeable that the unemployment rate was the lowest before 2004 and increased afterwards. It may be the result of the fact that the Hun-

garian labour market did not gain much after the accession to the EU. Slovakia had the worst situation after 2004 — it had the highest values of the unemployment rate. According to the statistical data, the longest unemployment duration and the highest unemployment indicators were in Slovakia. It should be noticed that it could be influenced by the fact that Slovakia had the highest ratio of the maximum benefit to the minimum wage, as well as very high net replacement rate, or the ratio of the amount of benefit in the initial period of unemployment to the last salary (Szymańska, 2017). The social security system established in the Visegrad Group countries may be the cause that unemployment, especially the long-term one, is not the structural, but the system problem. It is not profitable for the unemployed to look for the job (Tvrđon, 2011).

Indisputably, the worst situation of Slovakia in years 2001–2007 was confirmed by the chart of the median unemployment duration (Figure 2). It was much higher than the median calculated for the remaining countries and in the year 2007 it was equal to almost 35 months. During the following two years it decreased to the level of about 14.5 months, and grew again up to 24.5 months in 2013. In the case of Poland, Czechia and Hungary, mean median unemployment durations were similar and equal to 10.1, 10.9 and 10.7, respectively. The median values in years 2001–2017 were least nuanced in case of Hungary (standard deviation was equal 0.7 months).

Research methodology

The research was conducted in two stages. In the first stage, the mutual relation between the unemployment rate and median unemployment duration was analysed by means of the scatterplot charts that were analysed similarly as the business cycle clock (Abberger & Nierhaus, 2010). In the second stage, it was analysed if there were lags between the changes of the unemployment rate and the median unemployment duration. It was assumed that changes of the unemployment duration occur with certain lag with respect to the changes of the unemployment rate. For example, during the recession the unemployment increases, some persons so far working lose their jobs and consequently the unemployed persons have bigger difficulties in finding a job. Therefore, after a certain period, the unemployment duration increases. During the recovery the unemployment rate decreases, more people find their jobs and after certain period the unemployment duration also decreases. Consistency of the course of time series of the unemployment rate and median unemployment duration was analysed by means

of the Pearson product-moment correlation coefficient. The relationship between time series without lags and with lagged median unemployment duration with respect to the unemployment rate was analysed. The consistency was analysed with lags from 1 year until 5 years (it was assumed that the lag between both indicators cannot last longer than several years). The course of the time series in more consistent, the higher the positive correlation between them is. Hence, the lag was estimated by the highest positive value of the correlation coefficient.

Knowing the length of the lag of the unemployment duration with respect to the unemployment rate, the similarity of analysed time series was analysed by means of the Dynamic Time Warping (DTW) method. DTW method was created in the early seventies and was originally applied for the context speech recognition (Giorgino, 2009, p. 1). It is used for estimation of the optimal alignment of timeseries by means of the dynamic programming methods. If we have the same variables in both compared series (but measured, for example, for various objects) then these series can be compared directly. However, if both series are described by means of different variables, they must be normalised. Amongst many possible normalisation methods, one of the quotient inversions was applied:

$$z_t = \frac{y_t}{\sqrt{\sum_{t=1}^n y_t^2}}, \quad (1)$$

where:

y_t – value of analysed variable in the period t ,

n – number of analysed periods.

The reason for selection of the above formula was to preserve the measurement scale (both features — unemployment rate and median unemployment time were measured on the ratio scale) and differences in the mean values and the variability.

By means of the DTW method we can (among the other things) draw the alignment plot that presents the similarity (alignment) between the two analysed time series. In the case of normalised variables, if the course of both series was identical, the alignment plot would be the straight line going from the lower-left to the upper-right corner. The more the alignment plot diverges from the minor diagonal, the more dissimilar the series are. In general, the higher Pearson product-moment correlation coefficient between the series is, the more similar to the minor diagonal the alignment is.

Results of the analysis

In the first stage the relationship between the unemployment rate and median unemployment duration was analysed. For this purpose, the scatterplot charts showing four directions of changes were drawn up:

1. Change right upwards – along with the increase of the unemployment rate the median unemployment duration increases.
2. Change left upwards – along with the decrease of the unemployment rate the median unemployment duration increases.
3. Change left downwards – along with the decrease of the unemployment rate the median unemployment duration decreases.
4. Change right downwards – along with the increase of the unemployment rate the median unemployment duration decreases.

The most desirable situation is when both the unemployment rate and unemployment duration are low. In the crisis situations, when the number of the unemployed persons increases, both the unemployment rate and duration increase and during the recovery both indicators decrease. On the chart, the angle of inclination of the broken line is in such cases sharp (the straight line grows). However, these processes cannot occur simultaneously, but must be lagged. Therefore, the decrease of the unemployment rate is accompanied by the increase of the unemployment duration and vice versa. In this case, the angle of inclination of the broken line is open (the straight line decreases).

Figure 3 presents the scatterplot charts for all Visegrad Group countries. Year 2001 (the beginning of all broken lines) was marked by the square. The scatterplot charts show that in years 2001–2007 the unemployment rates for Poland and Slovakia were very high and similar. In Poland, the highest unemployment rate was in the year 2002 (20%) and in Slovakia in 2001 (19.4%). However, both countries differed significantly with respect to the unemployment duration. In Poland the highest median unemployment duration was equal to 14.6 months (2005) and in Slovakia — 34.6 months (2007). In the case of Slovakia, the changes in the unemployment rate were high and they generated high changes in the median unemployment duration. In Poland equally high changes of the unemployment rate did not cause such big changes of median unemployment duration. On the contrary, in Czechia changes of the median unemployment duration were similar to those in Poland, but the unemployment rate was much lower and was characterised by the least variability. In Hungary the changes of the median unemployment duration were the lowest among all analysed countries and changes in the unemployment rate were higher than in Czechia, but much lower than in the cases of Poland and Slovakia. In 2017 the situa-

tion in all countries improved, but in Slovakia it was still much worse than in the remaining countries. The biggest recovery was observed in Poland. Due to big differences in courses of the scatterplot curves, particular Visegrad Group countries were analysed separately (Figures 4–7).

It can be seen that until the accession to the UE, the unemployment rate in Poland was very high. After 2004 it began to decrease, while the median unemployment duration began to decrease one year after. Both indicators had a decreasing trend until 2008 — after this year the unemployment rate slightly increased, in 2009 also the median unemployment duration increased. Between the years 2009–2013 both indicators increased and since 2014 — both began to decrease (Figure 4).

In Czechia both indicators fluctuated, but until the year 2004 the changes were in the same direction. Since 2004, the unemployment rate was decreasing, but until 2006 the median unemployment duration was increasing. Until 2008, both indicators had a decreasing trend. In 2009, the unemployment rate grew and the median unemployment duration grew one year after. Since 2010 the unemployment rate has been decreasing, followed by the decrease in the median unemployment duration since 2015 (Figure 5).

In Slovakia the unemployment rate was decreasing until the year 2008, while in the same period, until 2007 the median unemployment duration increased significantly. Since 2008 until 2013, the unemployment rate was increasing again and the median unemployment duration began to increase with 1-year lag. Since 2014 both indicators were decreasing (in 2017 median unemployment duration noted small increase) (Figure 6).

In Hungary the mutual course of the unemployment rate and median unemployment duration was much more complicated than in the remaining three Visegrad countries. It results from the fact that the median unemployment duration was changing in various directions and these changes were relatively very small. Only after 2010 was the unemployment rate characterised by a steady decrease, followed in 2013 by the decrease of median unemployment duration (Figure 7).

In the next stage of the analysis, the lag of the median unemployment duration with respect to the unemployment rate was estimated. For this purpose, the Pearson product-moment correlation coefficients between the unemployment rate and lagged median unemployment duration were calculated. They are presented in Table 1.

In Poland, the unemployment rate was the most strongly connected with the median unemployment duration. The strongest correlation was for 1-year delay of the median unemployment duration. For Czechia, the strongest correlation was obtained for 2 years lag of the median unemployment duration, however, the strength was much smaller than in case of Poland.

The analysis for Hungary showed that the median unemployment duration was 1 year lagged with respect to the unemployment rate, but the correlation between these variables was smaller than for Czechia. Quite interesting results were obtained for Slovakia — the median unemployment duration was 3 years lagged with respect to the unemployment rate and the correlation strength between these variables was the weakest amongst the group. Therefore, we can say that in Poland the median unemployment duration reacted the most strongly to the changes of the unemployment rate with 1-year delay. Also strong, but still much weaker than in Poland was the reaction in Czechia with 2-year delay. Strong, 1 year lagged reaction was observed in the case of Hungary and quite strong and 3 years lagged — for Slovakia. The main reason for this was the fact that in Slovakia until the year 2007, despite decreasing unemployment rate, the median unemployment duration increased significantly (from just over 15 months in 2001 up to almost 35 months in 2007).

In order to perform deeper analysis of similarity of the course of the unemployment rate to the course of the lagged median unemployment duration, the alignment plots for four analysed countries were made. They are presented on Figures 8–11.

As seen on Figure 8, the course of the alignment plot for Poland (where the median unemployment duration is 1 year lagged with respect to the unemployment rate) goes the closest to the minor diagonal, with minor deviations in the periods 2001–2005 (until the accession to the EU) and 2010–2015 (in the years following the financial crisis of 2007–2009). These periods were the years, in which the differences between the course of the unemployment rate and median unemployment duration were the biggest.

For Czechia, the alignment between the unemployment rate and the 2 years lagged median unemployment duration was much weaker than in case of Poland. There was one major discrepancy in the period 2008–2015, or since the beginning of the crisis until several years of its termination (Figure 9).

In Slovakia the discrepancies between the unemployment rate and the 3 years lagged median unemployment duration were much deeper than for Poland and Czechia and they were long-lasting. It results from the fact, that Slovakia had (and still has) the highest unemployment duration and during the first period (years 2001–2007) it rose dramatically. After the financial crisis ended, the situation on the Slovak labour market much improved and at the same time the mutual changes of both analysed indicators became much better adjusted (Figure 10).

The results for Hungary are quite surprising. Although the correlation between the unemployment rate and the 1-year lagged median unemployment duration was higher than in case of Slovakia, the alignment plot between both indicators differed the most from the minor diagonal. Moreover, these discrepancies lasted virtually in the whole analysed period (Figure 11). Probably it resulted from the fact that the median unemployment duration in the whole analysed period did not change much, as compared to other countries.

Discussion

Conducted analysis confirmed the differentiation of the Visegrad Group countries with respect to the unemployment rate and the median unemployment duration. Considering these two indicators it should be stated that in years 2001–2017, covering the pre-accession period and the period of financial crisis (years 2007–2009), the Polish economy coped best with unemployment. The reason for long-term unemployment is given as the long period of time during which the benefit is received and its high level. In Poland, the time of payment of the benefit is relatively long, but its amount is very low in comparison with salaries. On the contrary, in Slovakia the benefits were the highest. Despite the differences in the unemployment rate and the median unemployment duration in Poland, Czechia and Slovakia the courses of curves joining the scatterplot points were similar, which indicated the similar reaction of the labour markets to the fact of accession to the EU and financial crisis. On the contrary, the situation in Hungary was quite different. Relatively high values of the analysed indicators are characteristic for Slovakia despite the fact that this country had the highest increase of GDP in the analysed period (255%). The lowest increase of GDP was observed in Hungary (106%), in Czechia it was 154% and in Poland — 120%.

The second problem analysed in the article was the lag of reaction of the unemployment duration with respect to the changes of the unemployment rate (it is assumed that the changes of the unemployment rate occur faster). The shortest lag (1 year) and the highest relationship between both indicators was observed for Poland. 1-year lag was also in Hungary, but the relationship between both indicators was much smaller and their courses were much more different (what was confirmed by the analysis of the correlation coefficients and the similarity of time series by means of the DTW method). In Czechia the lag of the median unemployment duration with relation to the unemployment rate was about 2 years and the course of both curves

was quite similar. In Slovakia the unemployment duration reacted to changes in the unemployment rate at the latest (after 3 years), however, the correlation strength between them was the weakest, which also meant that the courses of both rows differed quite strongly between each other.

Conclusions

The article presents the analysis of relationship between the unemployment rate and unemployment duration in the Visegrad Group countries in years 2001–2017. The research was limited to these countries because all of them underwent systemic transformation, presented similar level of social and economic development and joined the European Union in the same time. Therefore, all these countries had to solve similar problems connected with transition from the centrally planned to the market-oriented economy. They also included the problems occurring on the labour market. The obtained results show that changes of the unemployment rate and median unemployment duration were diversified between countries. In addition, the lag in the reaction of one of the indicators in relation to the other was also different. The smallest lag was observed in Poland and Hungary and the biggest — in Slovakia. It seems that a better situation is when this lag is shorter, because the adjustment of the unemployment duration to the unemployment rate is quicker. The existence of the lag between both indicators has positively verified the second research hypothesis.

It also turned out that both indicators were mutually correlated. This fact confirmed the first research hypothesis. Correlation between them was the strongest in Poland and the weakest — in Slovakia. The weaker the relationship between the analysed indicators, the stronger they are probably influenced by other factors, not considered in the research, which condition the situation on the labour market. The research presented in the paper does not explain the mechanism of the unemployment rate and unemployment duration. Therefore, future studies will attempt to deepen the analysis by taking into account other indicators, such as employment protection legislation (EPL), minimum wage, regulations concerning working hours and the tax wedge. Their influence on the unemployment rate and unemployment duration will be analysed. The analysis will be extended to remaining EU countries.

References

- Abberger, K., & Nierhaus, W. (2010). The Ifo business cycle clock: circular correlation with the real GDP. *CESifo Working Paper*, 3179.
- Abraham, K. G., & Shimer, R. (2001). Changes in unemployment duration and labor force attachment. *NBER Working Paper Series*, 8513. doi: 10.3386/w8513.
- Bieszk-Stolorz, B., & Markowicz, I. (2014). Relationship between duration of job seeking and receiving unemployment benefit. Search theory on labour market. *Acta Universitatis Lodzianensis. Folia Oeconomica*, 3(302).
- Chocholatá, M., & Furková, A. (2018). The analysis of employment rates in the context of spatial connectivity of the EU regions. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 13(2). doi: 10.24136/eq.2018.010.
- Furuoka, F. (2014). Hysteresis effect on unemployment: evidence from the Visegrad Countries. *Ekonomický časopis*, 62(2).
- Giorgino, T. (2009). Computing and visualizing dynamic time warping alignments in R: the dtw package. *Journal of Statistical Software*, 31(7). doi: 10.18637/jss.v031.i07.
- Hadaś-Dyduch, M., Pietrzak, M. B., & Balcerzak, A. P. (2016). Wavelet analysis of unemployment rate in Visegrad countries. In T. Klietnik (Ed.). *16th international scientific conference globalization and its socio-economic consequences. University of Zilina, The Faculty of Operation and Economics of Transport and Communication, Department of Economics, 5th – 6th October 2016. (Part II)*. Zilina: University of Zilina.
- Kwiatkowski, E. (2011). Recent labour market trends in the Visegrad Group countries. *Comparative Economic Research*, 14(2). doi: 10.2478/v10103-011-0009-z.
- Meyer, B. D. (1990). Unemployment insurance and unemployment spells. *Econometrica*, 58(4). doi:10.2307/2938349.
- Mortensen, D. T. (1970). Job search, the duration of unemployment, and the Phillips curve. *American Economic Review*, 60(5).
- Mortensen, D. T. (1977). Unemployment insurance and job search decisions. *Industrial and Labor Relations Review*, 30(4). doi:10.2307/2523111.
- Mukoyama, T., & Şahin A. (2004). Why did the average duration of unemployment become so much longer? *Federal Reserve Bank of New York Staff Reports*, 194.
- Nickell, S. (1979). The effect of unemployment and related benefits on the duration of unemployment. *Economic Journal*, 89(353). doi: 10.2307/2231405.
- Pilc, M. (2015). Determinants of the labour market institutions in post-socialist economies. *Communist and Post-Communist Studies*, 48(2-3). doi: 10.1016/j.postcomstud.2015.06.008.
- Rollnik-Sadowska, E., & Dąbrowska, E. (2018). Cluster analysis of effectiveness of labour market policy in the European Union. *Oeconomia Copernicana*, 9(1). doi: 10.24136/oc.2018.008.

- Szymańska, A. (2017). The labour market in the Visegrad Group countries – selected aspects. *Olsztyn Economic Journal*, 12(3).
- Szymczak, A., & Gawrycka, M. (2013). Labour share in the domestic income compared to different labour markets. *Przedsiębiorstwo we współczesnej gospodarce – teoria i praktyka / Research on Enterprise in Modern Economy – theory and practice*, 4.
- Tvrdon, M. (2011). Unemployment as the macroeconomic problem: the case of Visegrad Group countries. *International Journal of Systems Applications, Engineering & Development*, 2(5).
- Zieliński, M. (2018). Effect of the economic situation on employment and its structure in the Central and Eastern European countries. *Ekonomia i Prawo. Economics and Law*, 17(3). doi: 10.12775/EiP.2018.024.

Annex

Table 1. Pearson product-moment correlation coefficients between the unemployment rate and lagged median unemployment duration

Lag of unemployment duration	Poland	Slovakia	Czechia	Hungary
No lag	0,8615	-0,2849	0,4341	0,5552
1 year lag	0,9600	0,1585	0,7659	0,6716
2 years lag	0,8931	0,4863	0,7959	0,4568
3 years lag	0,6862	0,5623	0,5171	0,1959
4 years lag	0,4244	0,5308	0,2039	-0,0912
5 years lag	0,1707	0,3398	0,0506	-0,2532

Figure 1. Unemployment rate in the Visegrad Group countries in years 2001–2017

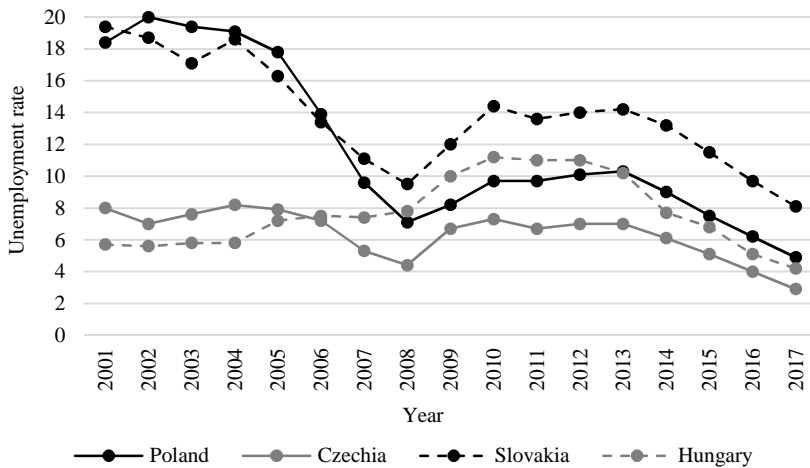


Figure 2. Median unemployment duration (months) in the Visegrad Group countries in years 2001–2017

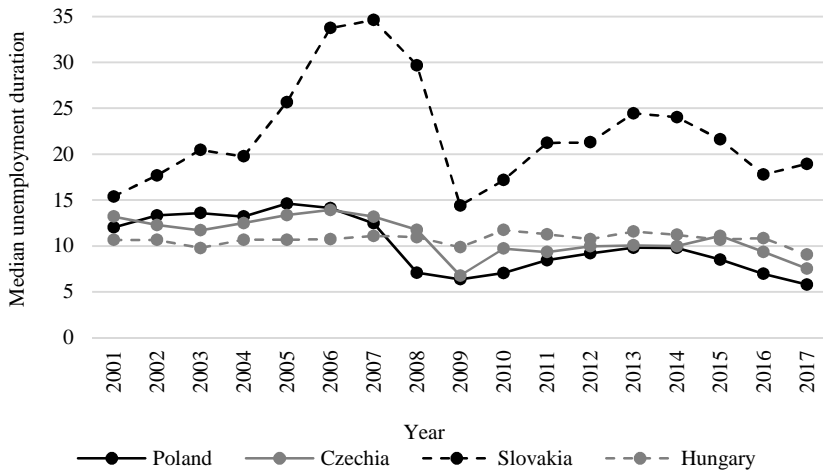


Figure 3. Relation between the unemployment rate and the median unemployment duration for the Visegrad Group countries in years 2001–2017

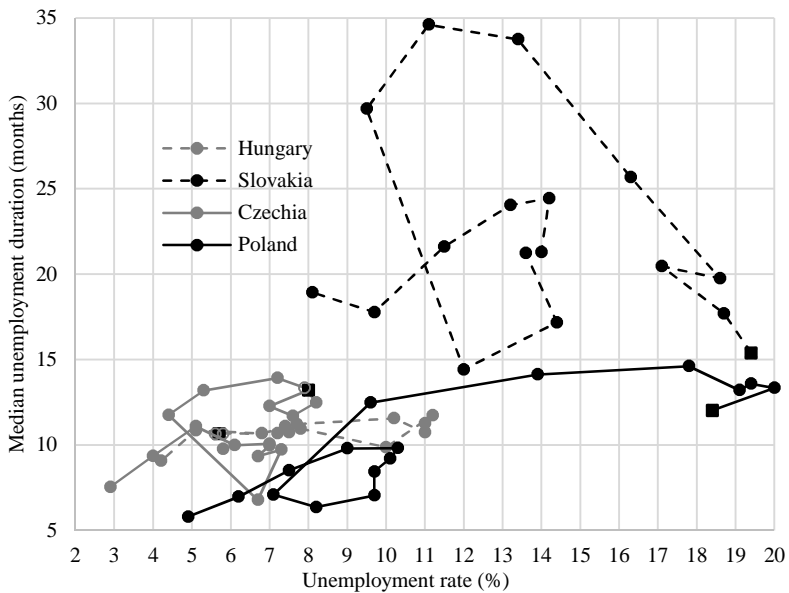


Figure 4. Relation between the unemployment rate and the median unemployment duration in Poland in years 2001–2017

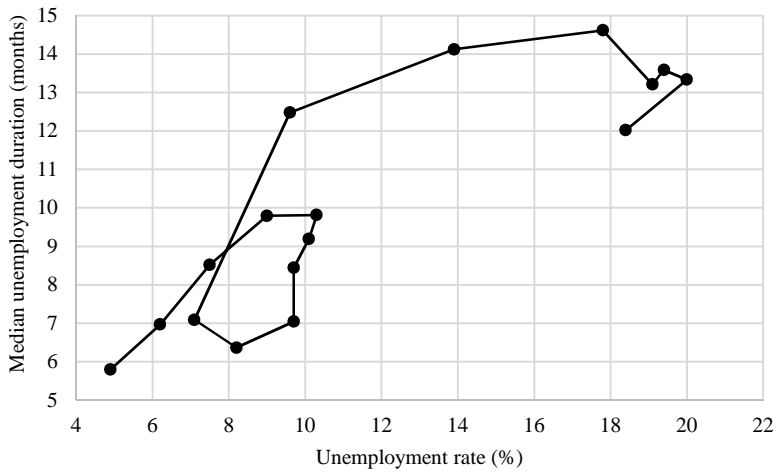


Figure 5. Relation between the unemployment rate and the median unemployment duration in Czechia in years 2001–2017



Figure 6. Relation between the unemployment rate and the median unemployment duration in Slovakia in years 2001–2017



Figure 7. Relation between the unemployment rate and the median unemployment duration in Hungary in years 2001–2017

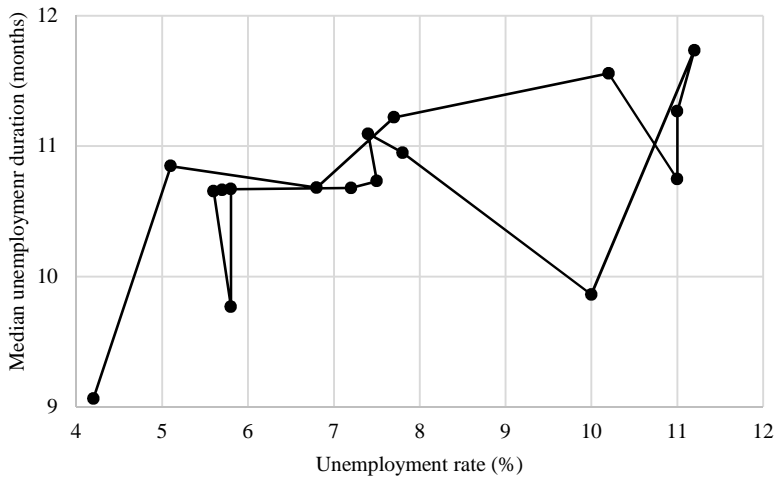


Figure 8. Alignment plots for the unemployment rate and lagged median unemployment duration for Poland

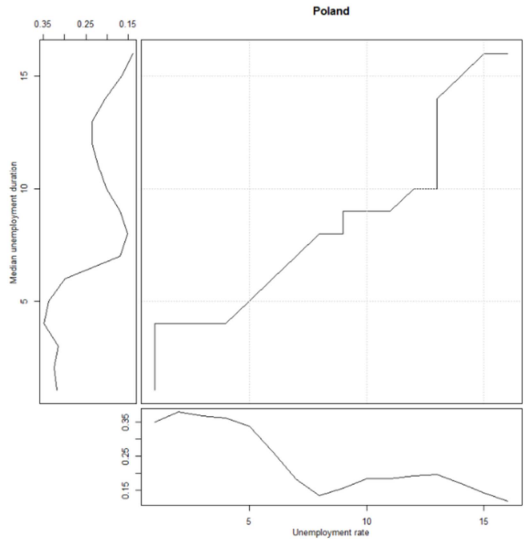


Figure 9. Alignment plots for the unemployment rate and lagged median unemployment duration for Czechia

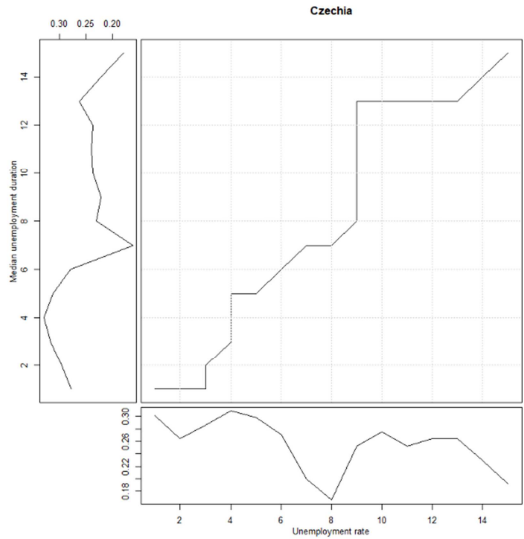


Figure 10. Alignment plots for the unemployment rate and lagged median unemployment duration for Slovakia

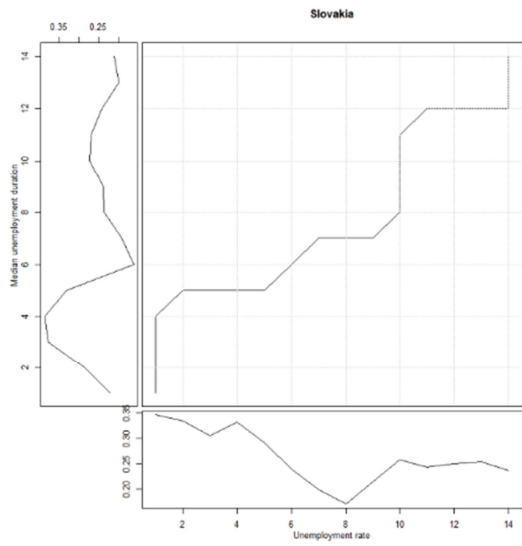


Figure 11. Alignment plots for the unemployment rate and lagged median unemployment duration for Hungary

