Trends in the Czech and Hungarian labour markets from a regional perspective, especially in light of the two recent crises

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The Czech and Hungarian labour markets have undergone significant changes: European Union (EU) accession and various employment and job creation programmes that have all left their mark on employment. The authors analysed the two major economic crises – the 2008 global economic crisis and Covid-19 pandemic – and their impact on the labour markets of the examined countries from a regional perspective. The phases of change in the examined unemployment rates and the reasons for this change have shown that the crises have affected the employment situation in the regions of the countries in different ways, degrees and lengths of time.

Introduction

The Czech and Hungarian labour markets have changed significantly since the fall of communism. The labour market has been influenced by regime change, privatisation, foreign direct investment (FDI) inflows before and after EU accession and various

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public self-financed or co-financed employment and job creation programmes. The authors briefly describe labour market developments in the Nomenclature of territorial units for statistics (NUTS) 2 regions of the Czech Republic and Hungary. They then use long time series of official statistics to analyse the effects of the 2008 economic crisis and the 2020 economic downturn caused by the Covid epidemic. The time-series data showed structural breaks in the evolution of the labour markets in the two countries, so the authors segmented the time series and based their calculations on these segments. The authors sought to answer the following research questions in their study:

Q1. What are the similarities between the economic crisis in 2008 and the Covid-19 crisis in 2020 in the countries studied?

Q2: What are the characteristics of the labour market in Member States of the European Union with similar historical backgrounds and sizes, namely, the Czech Republic and Hungary?

Q3. Are there different labour market trends in the central and other regions?

In connection with the research questions, the following assumptions were made about the development of the Czech and Hungarian labour markets:

H1. The labour market trends of the 2008 economic crisis and the 2020 Covid-19 crisis are similar in the two countries studied.

H2. The specificities of the labour market in Member States of the European Union with similar historical backgrounds and of similar size (the Czech Republic and Hungary) show comparable structures and trends.

H3. Labour market trends in the central and other regions differ.

The analysis was carried out by decomposition time series analysis with the calculation of best-fit trend functions. Seasonality was quantified using seasonal indices as described above.

Labour markets in the Czech Republic and Hungary after the regime change

A dominant feature of the social and economic trends in the years following the change of regime was the emergence of mass and persistent unemployment as well as the significant impact on workers' well-being (Vusal 2022). One could even call this a 'traditional' approach, but the transition in the Czech Republic was quite different from that in other countries of the socialist bloc, such as Hungary. In fact, in 1995, the Czech unemployment rate was not only lower than in all other countries of the former Eastern Bloc but also more favourable than in the major European economies and the United States (US) (Kuchař et al. 2019). The fiscal policy of Czechoslovakia and later the Czech Republic focused on balanced budgets and relatively low inflation. The reform process started in 1990 with the abolition of price controls in most sectors of the economy. By devaluing the Czech koruna and then pegging it to the dollar,

Czech products were made more competitive in the international market, which led to lower unemployment and lower government deficits (Cseh-Papp et al. 2018). In his study, Dębiec (2019) explains the low unemployment rate by the effect of the economic policy in place between 1998 and 2007. The government focused on job creation through foreign exports and investment, thereby reducing the negative effects of the transition and based on the cost competitiveness of low value-added industrial plants.

The rapid decline in employment and the prolonged, shorter or even permanent exclusion of certain groups of workers from the labour market has not affected the different regions of Hungary in the same way. In the early years, extreme regional differences were observed, which can be attributed to short-term specific factors during the period of regime change (Siposné Nándori 2016). The emergence of open unemployment has been accompanied by significant differences in the characteristics of Hungarian labour markets in international comparisons. These differences tend to disappear as educational attainment increases, with higher educational attainment having a positive effect on the entry of firms and even more so of foreign firms. During the period of regime change, privatisation resulted in a weak rate of labour retention and growth in foreign-owned enterprises. As a result of the first ten years of the market economy, in 1998, one-third of the workers in the corporate sector were employed in foreign-owned enterprises.

The share of foreign ownership in employment has risen to over 80% in some sectors (Dabasi-Halász 2012). In the case of the Czech Republic, there have been several hypotheses as to why unemployment rates remained relatively low after the regime change. Among these, it is worth highlighting the almost frequent reference to the Terrel–Sorm (1999) hypothesis, in which the authors describe that this can be explained largely by the relatively slow restructuring of firms through effective labour market policies (Bechný 2019). Around the time of EU accession, labour market disparities between small regions increased significantly. From the postregime change period, the regions that fared best were those of the capital and county centres (including commuter zones), and industrial cities fared better, while spa cities fared less well (Pénzes et al. 2015). The second most important event is seen as the impact of EU accession on changes in the Czech labour market. It expanded the labour market by making it easier and simpler for citizens to work in other member states, with the effect of reducing the risk of unemployment in the country (Maitah–Urbánková 2015).

The 2008 crisis and its consequences

Between 2007 and 2011, global unemployment rose by 27 million to 200 million. This is less than the International Labour Organisation (ILO) had expected in 2009 (the worst-case scenario at the time was 230 million unemployed). The lower-than-

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expected increase in unemployment is due to government policies, both through automatic stabilisers and extra spending programmes to protect employment. It can therefore be seen that, regardless of the extent of the forecast, global employment has improved significantly, interrupted by the 2008 global financial crisis. The unemployment rate is the ratio of the number of unemployed individuals to the total number of employed and unemployed individuals (the economically active population). It reached 5.5 percent globally before the crisis (2007), rising to 6.2 percent in 2009 and approximately 6 percent in 2011 (Artner–Sőreg 2018). Immediately after the change in regime, regional differences in unemployment and labour market employment rates can be traced back to the different industrial structures, educational standards and infrastructure that developed during the socialist period. To a lesser extent, there are also differences in ethnic structure, changing culture and different levels of urbanisation (Krulický et al. 2022).

Spatial disparities in employment and unemployment increased in the years following the change in regime, and this trend has not changed since the turn of the millennium: Hungary remains highly polarised. A relatively well-developed region of Central and Western Transdanubia has emerged, and a low-employment region with a rigid employment structure in Southern Transdanubia, the Lowlands and Northern Hungary. Regional disparities were also reflected in regional differences in employment rates, which ranged from 46.9% to 63%. The average number of registered unemployed persons in 2008 was approximately 442 thousand, representing 6% of the population aged 15-64. These figures continued to deteriorate - with perhaps a temporary improvement in autumn 2010 - until February 2011, when nearly 682 thousand people were unemployed, representing an unemployment rate of more than 13% (Dabasi-Halász–Hegyi-Kéri 2014).

The economic recession affects aggregate demand within the economy and total output and has a negative impact on the labour market and on the employment rate of the economically active population. In the Czech Republic, Maitah–Urbánková (2015) focused their study on structural unemployment. The economic crisis that unfolded in the second half of 2008 did not spare the Czech labour market. At the national level, the number of economically active persons decreased by approximately 110,000 in 2009-2010, a rate that is also visible in the number of economically active persons (Janičko 2012). The analysis of unemployment rates in NUTS 2 regions confirms the conclusions of several studies, such as Adámek–Rybková (2015) and Čabla–Malá (2017), that the history of Czech unemployment shows periods of outstanding growth and less successful periods, such as the spillover effect of the 2008 economic crisis.

The impact of the crisis on the Hungarian labour market has been felt to varying degrees and intensities across the regions. Initially, the most developed rural areas, including commuter resource areas, suffered the most from export-oriented (industrial) enterprises. Later, however, the general effects (currency crisis, credit

crunch, fall in domestic demand) led to an increase in unemployment becoming a general phenomenon and a more backwards, initially less favourable labour market situation even in regions with initially poorer employment conditions. Geographical location and settlement structure did little to differentiate changes. Overall, there was a slight easing of the spatial distribution of labour market segmentation up to the trough of the crisis, which can be captured spatially. Only one of the most developed regions of the country improved its situation, while the capital – and the metropolitan agglomeration – and the rest of the country did not disappear at all. Moreover, inequalities have probably only temporarily decreased (Lőcsei 2010). Despite EU accession, labour market problems continued to intensify. By 2008, regional disparities had widened, and inequalities had increased (Lipták 2011, 2014).

In contrast to Hungary, the change (increase) in unemployment rates in the Czech Republic as a result of the economic crisis differed significantly at the regional level. While in the Ostrava region, the rate was close to 12%, in Prague (the capital), the figure was only 4.5%. The same dichotomy can be seen in Stredni Morava and the Central Bohemian Region. Hungary – unlike Estonia, for example, which is boosting productivity – has chosen a completely different strategy. Hungary has paid particular attention to the risks of macroeconomic imbalances. The post-2010 economic strategy focused on restoring macroeconomic balance and increasing employment. The availability of an independent monetary policy played a key role in rebalancing, providing cheap funds for investment by lowering interest rates and contributing to the weakening of the forint exchange rate, thereby increasing the cost competitiveness of exports and improving the balance of payments (Győrffy 2021). Employment was boosted by reforms of the tax system and social support, as well as the deregulation of the labour market, which also contributed to fiscal adjustment. Following the crisis, employment in Hungary increased significantly as the economy grew. The employment rate climbed from a low of 48% in 2011-2013 to over 60% in 2019. This has led to labour shortages in many sectors and regions.

The reasons for labour shortages are the lack of skilled labour, labour mobility and related wage differentials across Europe, and rapid technological progress (Szeiner et al. 2021). Looking back at the Czech Republic's surprisingly low unemployment rate after the regime change, it peaked in 2010, reaching a peak of approximately 7.3%. Compared to the EU average, the Czech Republic started from a lower rate and ended the unemployment crisis during the economic crisis at a much lower rate (Zieliński 2015). It can be said that the country recovered much faster than other Member States with similar circumstances. The fluctuations of the business cycle were more moderate than in Hungary during the global financial and economic crisis (Flek et al. 2022).

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Covid-19 epidemic in the labour markets of the two countries

One of today's biggest challenges is to effectively manage the economic downturn caused by the Covid-19 epidemic. Covid-19, officially known as the SARS-CoV-2 virus, is a new type of coronavirus outbreak that started in December 2019 in the Chinese city of Wuhan and spread worldwide through droplet infection. The outbreak of Covid-19 was initially localised to China and then spread rapidly around the world as people moved around (Dániel et al. 2021). In addition to the health risks, the coronavirus outbreak has had the greatest impact on the economies of nations and on labour market trends (Szakálné et al. 2022). Strict protection measures implemented by national governments brought economic activity worldwide to a virtual standstill in the first half of 2020. Economic growth in the European Union slowed in 2020 and did not recover until 2021. The European Commission reports that the EU economy contracted by 6.3% in 2020 and 3.8% in 2021.

The impact of the QEW has been felt in the EU labour market in many ways, with sectors forced to close or in recession, especially those economic activities and sectors that require a personal presence for production or that rely heavily on inputs from global supply chains (Wolski–Wruuck 2020). In addition, there have been sectors where traditional work has been replaced by teleworking, and thus, digitalisation has allowed them to maintain continuity of operations, reducing the risk of unemployment. Finally, some sectors (e.g., e-commerce, information technology (IT), food processing) have been positively affected by the currency crisis, as demand for services or products in this sector has increased. This implies that sectoral exposure and differences in economic activities are structural factors that influence individuals' unemployment concerns and risks (Karácsony–Pásztó 2021).

Globalisation, which took place mainly in the context of market coordination, has been replaced in recent months by deglobalisation, with new regulations, restrictions, closed economies and national economic development policies and programmes to address the crisis. From a labour market perspective, one of the key questions surrounding the first wave of the viral crisis is how long these steps and processes will last and whether the world will return to business as usual once the crisis is over. There are many arguments for and against deglobalisation and/or reglobalisation, but we believe that the crisis of recent months will not pass without a trace and that the future is likely to be a mix of deglobalisation and reglobalisation (Zádori et al. 2020).

After a low unemployment rate and an economic recovery in the Czech Republic, by spring 2018, the number of vacancies had exceeded the number of unemployed, forcing companies to refuse some orders and rendering them uncompetitive as wages rose. The rise in wages has also had a stimulating effect on inflation, and it is now apparent that the Czech Republic's economic growth is expected to slow from 4.4% in 2017 to 2.5% in 2018 (Dębiec 2019). This is perhaps the best way to describe the economic situation in the Czech Republic before Covid-19. The onset of the

pandemic caused a sharp fall in gross domestic product (GDP), with recovery stalling in all member countries.

Unemployment also started to rise with the coronavirus epidemic crisis, although it remains significantly low by international standards. Supporting the transition of jobseekers into new jobs and helping those on the periphery of the labour market is seen as crucial (OECD Economic Surveys 2020). Unemployment rates peaked in NUTS 2 regions in the first quarter of 2021, after which significant government support had a stronger than expected positive impact. Of course, it should also be borne in mind that, like Hungary, the Czech Republic is more exposed to further effects due to its open economy and possible disruptions in the international automotive supply chain.

According to Hungarian Central Statistical Office (HCSO) labour market data in 2020, labour market indicators in Hungary have been showing an improving trend in recent years, with economic activity and employment increasing steadily since 2011. The number of employed persons in the last quarter of 2019 was 4,520,000, with an employment rate of 70%. This represents an increase of 15 percentage points over 10 years. In 2019, the number of people in public employment decreased, while the number of people employed in the primary labour market increased. More people worked abroad than in the previous year. In total, nearly 100 employers announced collective redundancies between April 2020 and the end of July 2020, affecting more than 7,000 workers due to the coronavirus epidemic (Szeiner et al. 2022). A 99% drop in the number of guest nights and a 97% drop in revenues were reported in April 2020. The decline is clearly explained by the epidemic situation (Dániel 2021).

The labour market has tried to adapt to the circumstances, and this is reflected in the rapidity of the shift to the home office. Teleworking has been retained to some extent even after the closures, and there is a willingness on the part of employees to do so (Lipták–Musinszki 2022). The extent to which this is done and how it is done depends to a large extent on how the organisation's diminishing organisational culture (Balogh et al. 2021) is reflected in the supply side of the labour market. Unlike in the past, the current crisis was caused by an external factor, an epidemic (pandemic). While the direct impact of the November 2020 restrictions was mainly felt in the tourism, hospitality, hotel and event management sectors, the indirect effects are more widespread. The uncertain financial situation of businesses and households could have a restraining effect on employment, investment and consumption decisions. Overall, shorter working hours introduced by businesses (Balleer et al. 2016), public wage compensation and tax incentives may help to retain workers, but significant improvements are only expected once the epidemic has passed (Csehné Papp–Varga 2021).

Developments throughout world history have left a strong mark on both the Czech and Hungarian labour markets. Social and economic processes have led to decisive trends such as unemployment. The analysis of the unemployment situation

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in the two countries has shown that the two Visegrad countries (V4) Member States have reacted in completely different ways to the effects that have occurred. While the Czech Republic has been able to overcome the effects more easily, Hungary will find it somewhat more difficult to return to precrisis trends. In the case of the Czech Republic, fiscal policy focused on a balanced budget and relatively low inflation and then managed to reverse the trends of the time, i.e., the high unemployment rate, through additional instruments such as price controls and job creation. The short, long or even permanent exclusion of certain groups of workers from the labour market and the rapid reduction of employment did not occur uniformly in the NUTS 2 regions of Hungary. Initially, there were extreme differences between the years under examination, which could be attributed to short-term specific effects. This effect was further accompanied by differences in labour market characteristics.

The economic crisis that unfolded in the second half of 2008 did not spare the labour markets of either the Czech Republic or Hungary. The impact of the crisis on the labour market was felt to varying degrees and intensities in different regions. The variation (increase) in unemployment rates as a result of the economic crisis varied considerably at the regional level. Similar conclusions can be drawn for the Covid-19 epidemic that unfolded in 2019. Economic growth in the European Union slowed in 2020 due to the coronavirus and did not recover even in 2021. The European Commission reports that the EU economy contracted by 6.3% in 2020 and 3.8% in 2021.). It can be said that the global economic crisis of 2008 mainly affected the economy and the living standards of the population, and the crisis caused by the Covid-19 epidemic also affected the free movement of people. In this sense, the two crises under examination are also different in this respect (Fekete-Fábián–Jánosi 2022).

Unemployment has also started to rise with the coronavirus crisis, although it remains significantly low in the Czech Republic by international standards. In Hungary, nearly 100 employers announced collective redundancies between April 2020 and the end of July 2020, affecting more than 7,000 workers due to the coronavirus epidemic. It can be seen, therefore, that unemployment trends in the two EU Member States have evolved very differently since the 1989-90 regime change. In the theoretical analysis of unemployment, it should also be mentioned that the migration trends of the two examined countries are also different, so Hungary is on the wrong side in this respect.

Material and methodology

The authors analysed unemployment data for the Czech Republic and Hungary by NUTS 2 regions on a quarterly basis from the first quarter of 2001 to the third quarter of 2021. The aim of the studies was to compare the regions, to measure seasonality in relatively long time series and to shed light on possible differences between the two

crises (financial crisis of 2008 and Covid-19 crisis of 2019) in the two countries in terms of unemployment rates. The methodology used for the calculations was the so-called decompositional (deterministic) time series analysis, where the values of the time series are shaped by the persistent underlying trend, the periodic fluctuation (this could be cyclicality, for which the time series was not long enough to quantify, but it was long enough to measure seasonality, so the authors used this indicator) and the random effect (Molnár 2007).

When quantifying the persistent baseline trend, the linear trend showed the best fit among the available function types (linear, exponential, power, polynomial, saturation, hyperbola, etc.), so the authors chose the linear function type for the analyses based on the posterior function specification - function selection. The authors quantified the fit in terms of the so-called fit errors (standard error of fit and relative error of fit). In all cases, the significance level of the model run was adequate (a first-order error of less than 5% was typical), and this was tested by the authors using analysis of variance (ANOVA), where Fisher's "F" value indicated the reliability of the fitted functions. Among the parameters, the reliability of the coefficients β for the directional tangent of the function was tested using Student's t test, which also yielded significant results in all cases ($\alpha < 5\%$).

Among the periodic fluctuations, the quantification of cyclicality was discarded because the time series was not long enough (see above), so intra-annual fluctuations and seasonality were investigated. The authors had two options for doing this based on the baseline data. On the one hand, assuming a multiplicative time series model, seasonal indices (SSIs) could be used, and on the other hand, considering an additive time series model, quantification of seasonal deviations (SEs) could be used to measure seasonality. Due to the nature of the time series, the authors opted for the former and thus used the multiplicative time series model to calculate so-called seasonal indices for the period under study in both countries. The seasonal indices show the average deviation from the trend in the four quarters as a percentage.

Before defining the methodology of their research, the authors examined a number of studies by Czech and Hungarian authors on the way in which they examined unemployment in the two countries. Table 1 shows the results of these studies.

It can be seen that the work of the authors presented in the table is very closely related to the subject of this study. The authors downloaded the time series in tabular form from the websites of the Czech Statistical Office (CZSO) and the HCSO, fitted linear trend functions to them using Excel and SPSS, and then used the ratios of the original and the resulting function values to produce the abovementioned seasonal indices by region and by section. Phasing was necessary because for each region, several distinct phases were observed for both the Czech and Hungarian regions. Unemployment rates in the regions of the two countries showed different trends, which are presented in detail in the analytical and summary sections of the study. For

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ease of comparison, the authors have broken down the country's territory into eight planning-statistical regions for the entire period under study, regardless of the fact that the new legislation entered into force only on 1 January 2018 [1].

Table 1

Studies in the area of unemployment

Studies	Aim	Subject of the investigation	Applied method
Uzzoli (2011)	Investigating the relationship between health, in particular life expectancy and unemployment	Relationship between social and economic indicators	Correlation and regression analysis
Löster–Langhamrová (2011)	To analyse the level of long-term unemployment from different perspectives	Long-term unemployment rate in the Czech Republic	Descriptive statistics
Branis–Linhartova (2012)	To analyse the role of unemployment as a macroeconomic indicator	Indicators examined: GDP, consumption and invest-ment, employment, unem-ployment, inflation rate	Correlation analysis, T test
Csorba (2014)	To examine the economic transformation associated with regime change	Registered unemployed persons	Analysis
Dănăcică–Mazilescu (2014)	To present an empirical analysis of long-term unemployment in the Romanian and Hungarian male population	For the empirical analysis, the authors used two datasets of closed unemployment data	Descriptive statistics (mode, median), Cox model
Kaderabkova–Jasova (2016)	To examine the relationship between the minimum wage and unemployment and the impact of the minimum wage on the studied unemployment indicators	Unemployment data for the Czech Republic and Slovakia	Time series analysis of the minimum wage in purchasing power parity terms
Železná–Kreidl (2016)	To examine the labour market situation of older workers through the transition between employment and unemployment	Czech workers aged 50 and over (based on EU SILC)	Panel survey
Netrdová–Blažek (2019)	To demonstrate and visualise the evolutionary dynamics of unemployment. The emphasis is on analysing and mapping the spatial and temporal patterns of unemployment	Time series of monthly unemployment data for the Czech Republic (at regional level)	Spatial autocorrelation
Kapas (2022)	To examine whether the Covid-19 epidemic will have a long-term impact on unemployment rates	Unemployment data of 4 countries: United States (US), Canada, Germany, Austria	ARIMA model
Vojtko (2022)	To assess the dynamics and sensitivity of regional unemployment to business cycles	Spatial patterns of Czech regional unemployment and its sensitivity to the business cycle	Presentation of different methods such as descriptive statistics, stochastic frontier model, dynamic spatial econometric models

Results of the comparison of Czech and Hungarian labour markets

The authors started looking at Czech and Hungarian unemployment data from the first quarter of 2001 onwards. The literature background of the study also highlighted the fact that the two V4 countries reacted very differently to the 2008 global crisis and the coronavirus epidemic starting in 2020. To support this, the authors of the study conducted a longitudinal decomposition (deterministic) time series analysis. Figure A1 in the Appendix shows that the unemployment rates of the Hungarian regions show almost identical characteristics. In the first half of the period under review, from 2001, an upwards trend was observed in all regions, followed by a hectic 'plateau phase' until approximately 2008, i.e., the beginning of the global economic crisis. Thereafter, there was a decline until 2009, when, apparently due to the Covid-19 epidemic, there was a renewed upwards trend, but at a lower rate than before.

Due to different levels of development and regional characteristics, the timing of unemployment peaks, which are reported in Table 2, varies slightly from region to region.

Table 2

Maximum unemployment rates in Hungarian NUTS 2 regions between 2001 and 2021

NUTS 2 regions	The maximum unemployment rate date
Budapest	Q2 2012
Pest	Q1 2013
Central Transdanubia	Q1 2010
Western Transdanubia	Q3 2010
Southern Transdanubia	Q1 2011
Northern Hungary	Q1 2012
Northern Great Plain	Q1 2011
Southern Great Plain	Q1 2013

The authors' next observation was that the so-called plateau phase occurred at different times and with different lengths in different NUTS 2 regions. This is presented in Table 3.

The data shown in Table 2 indicate that the underdeveloped regions (Southern Transdanubia, Northern Hungary, Northern Great Plain, Southern Great Plain) have reached their peak with higher unemployment rates and that high unemployment rates have affected these regions for a longer period (last column of Table 3).

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Table 3

Maximum unemployment rates and time intervals
in NUTS 2 regions in Hungary

NUTS 2 regions	Start of plateau phase, quarter	Unemployment rate at the start of plateau phase, %	End of plateau phase	Unemployment rate at end of the plateau phase, %	Length of plateau phase, quarter
Budapest	Q1 2010	9.2	Q2 2012	10.5	10
Pest	Q2 2010	9.2	Q1 2013	10.3	12
Central Transdanubia	Q1 2010	11.4	Q1 2013	10.6	13
Western Transdanubia	Q4 2009	9.3	Q1 2013	9.0	14
Southern Transdanubia	Q1 2010	13.9	Q1 2012	14.0	9
Northern Hungary	Q1 2009	15.9	Q1 2012	17.6	13
Northern Great Plain	Q1 2009	15.4	Q1 2013	16.7	17
Southern Great Plain	Q2 2009	10.6	Q1 2013	12.5	16

An important component of the analysis was also the examination of seasonality, which the authors carried out on a region-by-region basis. As the unemployment data showed a so-called structural break, the deterministic trend calculation needed a segmentation of the database to achieve a better fit and a sufficient significance level. The authors assumed a first, rising period until the unemployment rates reached a maximum and then a second period with a downwards trend. Based on the ex post specification (choice of function type), it was appropriate to use a linear trend. In each case (that is, for eight regions, two per region, for a total of 16 functions quantified), significant results were obtained, both for the function and its parameters (α and β). This is not even called into question by the fact that although the fitting errors were still at an acceptable level (below 30%), the ideal relative fitting error, below 10%, was found in only a few places. This was mostly because the plateau phase was usually prolonged, which worsened the numerical fit of the functions.

From the trend functions, it was possible to calculate seasonal indices. These showed the average relative deviation from the sustained baseline trend by season. The seasonal indices by region are shown in Table 4.

Table 4

Evolution of unemployment rate seasonal indices in the Hungarian NUTS 2 regions

Regions	Evolution	Q1	Q2	Q3	Q4
Budapest	Ascending branch	1.009	0.987	1.009	0.970
	Descending branch	0.995	1.029	1.019	0.953
Pest	Ascending branch	1.028	0.981	0.989	0.975
	Descending branch	0.982	0.997	1.039	1.039
Central Transdanubia	Ascending branch	1.076	0.923	0.989	0.963
	Descending branch	1.041	1.101	1.122	0.990
Western Transdanubia	Ascending branch	1.030	0.981	0.992	0.957
	Descending branch	0.999	1.032	1.078	0.962
Southern Transdanubia	Ascending branch	1.060	0.980	0.962	0.985
	Descending branch	1.057	0.987	0.982	0.978
Northern Hungary	Ascending branch	1.060	0.988	0.985	0.962
	Descending branch	0.988	1.002	1.064	0.945
Northern Great Plain	Ascending branch	1.091	0.985	0.944	0.959
	Descending branch	1.041	0.996	1.005	0.943
Southern Great Plain	Ascending branch	1.071	0.982	0.959	0.971
	Descending branch	1.007	0.997	1.000	0.937

By the end of the period under review, the regions reacted differently in terms of unemployment, probably due to the impact of the Covid-19 epidemic. The downwards trend in unemployment rates in the regions stopped or started to rise in a saw-tooth fashion, with several regions seeing a spike. In this respect, 3 groups can be distinguished. The first group includes the more developed regions, of which one region is highlighted in Figure A2 in the Appendix, which shows the evolution of the unemployment rate in Budapest. A local peak was reached in the second quarter of 2020 (4.1%), but the indicator then declined. The regions of Pest, Central Transdanubia, Northern Great Plains and Western Transdanubia also show similar characteristics.

The second group includes regions with a double peak in the unemployment rate at the end of the period. Figure A2 in the Appendix shows a graph of the unemployment rate for the Southern Transdanubia region, where a spike in unemployment occurs in Q1 2020 (6.3%) and Q1 2021 (5.4%). The same phenomenon was observed for the Southern Great Plains region. Finally, there is only one region (Northern Hungary) in the third group where the unemployment rate at the end of the period under review shows an upwards trend.

In contrast to the Hungarian regions, the unemployment rates of the NUTS level 2 regions in the Czech Republic were quite different. There was a decline in all regions until the end of 2008, followed by a relatively steep rise (obviously reflecting the spillover effects of the global economic crisis) and then a downwards trend.

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This period was replaced by another upturn due to the Covid-19 epidemic in 2019. However, the latter increase was smaller than the steep upwards trend in 2008. The authors present the unemployment graphs for the Czech regions in Figure A3 in the Appendix.

The maximum unemployment rates for the Czech regions are shown in the table above (Table 5). These peaks were typically reached in the first quarter of 2010, with the exception of the Capital Region and Severovychod regions. It is important to highlight that for the two regions, the crisis did not lead to an increase in values above the precrisis period.

Table 5

Date of the maximum unemployment rate in Czech regions

NUTS 2 regions	The maximum unemployment rate date
Prague	Q2 2011
Central Bohemia	Q1 2001
Jihozapad	Q1 2010
Severozapad	Q1 2010
Severovychod	Q1 2013
Jihovychod	Q1 2010
Stredni Morava	Q4 2004
Ostravsko	Q1 2004

The first important thing that can be seen from the figures is that unemployment rates peaked in all regions between 2010 and 2013 (except in two Czech regions, where the peak was in the early 2000s). Therefore, it is mainly linked to the global financial and economic crisis of 2008 and not to the recession caused by Covid-19. For the Czech NUTS 2 regions, the plateau phases have been plotted separately. As seen in the figure above (Figure A4 in the Appendix), in each region, the plateau period started at the same time and ended at the same time. It is worth noting that the plateau phase in the Czech region is significantly longer than that observed in the Hungarian region. However, it should also be noted that, compared to the precrisis period, unemployment rates have not increased as much as in the Hungarian regions. In all cases, the beta of the fitted linear trend functions is negligible, so that the trend can be regarded as constant over the period under examination.

The second phase of the rising unemployment rate in the Czech Republic (increase due to Covid-19) shows almost identical results for the regions, with an upwards trend until Q1 2021. There are only two exceptions to this: in the Stredni Morava region, the peak is already visible in the quarter before (Q4 2020), and in the Ostrava region, it is in the second quarter of 2021.

Table 6

Main indicators for plateau phases in the Czech NUTS 2 region

NUTS 2 regions	Start of plateau phase, quarter	Unemploy- ment rate at the start of plateau phase, %	End of plateau phase	Unemploy- ment rate at end of the plateau phase, %	Length of plateau phase, quarter
Prague	2008 Q4	0.97	2015 Q1	1.26	26
Central Bohemia	2008 Q4	1.53	2015 Q1	1.51	26
Jihozapad	2008 Q4	1.54	2015 Q1	1.46	26
Severozapad	2008 Q4	0.93	2015 Q1	1.20	26
Severovychod	2008 Q4	2.06	2015 Q1	1.58	26
Jihovychod	2008 Q4	2.26	2015 Q1	2.18	26
Stredni Morava	2008 Q4	3.41	2015 Q1	2.72	26
Ostravsko	2008 Q4	3.12	2015 Q1	3.77	26

In the latter region, there was a significant drop in the unemployment rate in the fourth quarter of 2020. Following the peaks, unemployment fell in all regions, most notably in the Stredni Morava region (Figure A5 in the Appendix).

Discussion

Examining unemployment data for the Czech Republic and Hungary at the regional level, the authors draw the following conclusions based on the assumptions made. In the first hypothesis, it was assumed that *"the labour market trends of the 2008 economic crisis and the 2020 Covid-19 crisis are similar in the two countries studied".*

Of the two crises that erupted in the period under review – the one caused by the 2008 financial and economic crisis and the one caused by Covid-19, which will hit Europe in 2020 – the first played a greater role in both countries examined. The financial and economic crisis resulted in high levels of unemployment, with significant unemployment rates even in developed regions. For example, the unemployment rate was 10.5% in Budapest, 11.4% in Central Transdanubia and 9.8% in Western Transdanubia. The authors found even higher rates in the underdeveloped regions (17.6% in northern Hungary and 16.7% in the northern Great Plain). The impact of the coronavirus epidemic is also characterised by spatial inequality. The plateau phase lasted longer in underdeveloped regions than in more developed regions. After the so-called plateau phase, unemployment rates improved in all regions. Looking at the parameters β of the fitted functions, the decrease was larger than the increase in the upwards branches for all regions.

When the seasonal indices were quantified, it was observed that the index value was above 1 in all regions in the ascending branch, while no such regular phenomenon was observed in the descending branch. The analysis of the authors shows that unemployment rates in the two countries have evolved differently over the examined period. In Hungary, all eight NUTS 2 regions showed a steep increase from 2001 to

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2008. Here, we observed a "plateau phase" until approximately 2013, followed by a marked decline until 2018, when the Covid-19 epidemic broke out. From then on, we again experienced a marked increase. In the Czech Republic, the authors found lower unemployment rates during this period. Typically, they were between 2% and 12% (the lowest in the Prague region and the highest in the Stredni Morava region). Unemployment caused by the Covid-19 epidemic was not as high as in the 2008 crisis in any country. However, it was also shown that unemployment rates were much lower in developed regions in both cases (Uzzoli et al. 2022). *On this basis, the first hypothesis could not be confirmed.*

In the second hypothesis, the authors sought to show that *"the specificities of the labour market in Member States of the European Union with similar historical backgrounds and of similar size (the Czech Republic and Hungary) show comparable structures and trends".*

The labour market characteristics of two EU Member States of similar size and with many similarities in history would be expected to show similar structures and trends. However, the authors' studies showed that this fell far short of expectations. The unemployment rate in the Czech Republic was on average much lower than that in Hungary over the whole period, and the trends were very different. While in Hungary, there was an increase in the first part of the period, by contrast, in the Czech Republic, there was a decline. What is similar is the slight increase in the unemployment rate at the end of the period under review due to Covid-19. It can be argued that the different impacts of the crisis could be attributed to the nature of the crisis (liquidity-structural vs. closures) and the different economic states of the domestic labour market.

The transition in the Czech Republic has been very different from that in other countries of the socialist bloc, such as Hungary. In fact, in 1995, the Czech unemployment rate was not only lower than that of any other country in the former Eastern bloc, but it was even better than that of the major European economies and the US. At the same time, the rapid decline in employment and the prolonged, shorter or even permanent exclusion of certain groups of workers from the labour market in our country did not affect the different regions in the same way. In the early years, extreme regional disparities were observed, which can be attributed to short-term specific factors during the period of regime change. *On this basis, the second hypothesis is not confirmed.*

In the third and last hypothesis, the authors of the study examined the labour market trends in the central and other regions studied and formulated the following hypothesis: *"labour market trends in the central and other regions differ".*

Central regions in the EU Member States tend to behave differently from other NUTS level 2 regions in all the indicators examined. This is not different in the case of unemployment. In Hungary, the rate followed the trend of the other regions (rising phase, plateau phase, decline and then a slight rise) but with a much lower unemployment rate than the other regions. In the Czech Republic, the same trends

were observed in the central region (Prague and surroundings) as in the other Czech regions. Here, unemployment rates were also lower than in the other regions. *Based on the tests, the authors have confirmed the third hypothesis.*

Conclusions

Over the past decades, the labour markets of the European Union Member States have undergone very significant changes. This transformation trend is particularly true for both the Czech and Hungarian markets. Changes of great historical significance, such as the change of regime in Hungary in 1989-1990 or the break-up of Czechoslovakia in 1993, have caused very different shifts in the economy and thus in the structure of employment in the country concerned. Of course, we should also bear in mind that over the past 14 years, the member states under review have been hit by very strong shocks, such as the 2008 global economic crisis or the Covid-19 pandemic, which have had very different impacts on the labour market. Related to these effects, we cannot forget the migration factor, which also has a significant impact on the unemployment rates of the two countries. The various employment and job creation programmes have left their mark on the employment statistics of the countries surveyed.

In their research, the authors analysed how the phases of change in the unemployment rate have evolved, leading to significantly negative effects during the 2008 global economic crisis, as during the pandemic. The trends in the Czech and Hungarian labour markets are not similar but divergent, although the more developed regions have been similarly less affected by the crisis than the less developed ones. That countries with similar levels of development and history show similar labour market structures and trends cannot be justified. However, the NUTS 2 regions of the two countries share similar characteristics in terms of unemployment. Unemployment rates in both the Czech Republic and Hungary followed the trend in other regions. The main conclusion is that countries may share a common history or may have undergone similar historical changes, but this does not necessarily mean that they react in the same way to economic shocks in the present. In addition, we must not forget the following threat to the unemployment rate. The bigger problem is that the fragile economy in the current situation has not yet recovered, but the next economic crisis – with unpredictable consequences – is already knocking, as a result of the Russian-Ukrainian conflict that started a few months ago and the response to it.

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Appendix
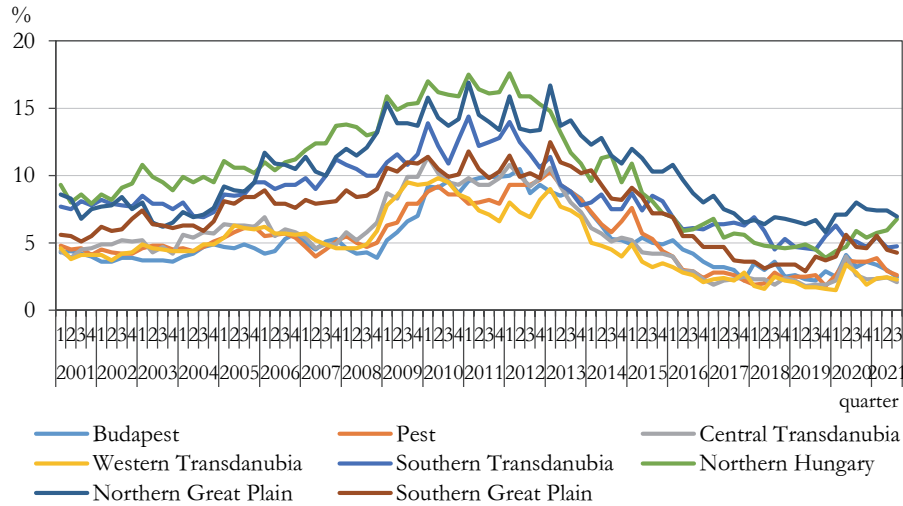
Unemployment rates in Hungarian NUTS 2 regions

Quarterly unemployment rate trends in Budapest,
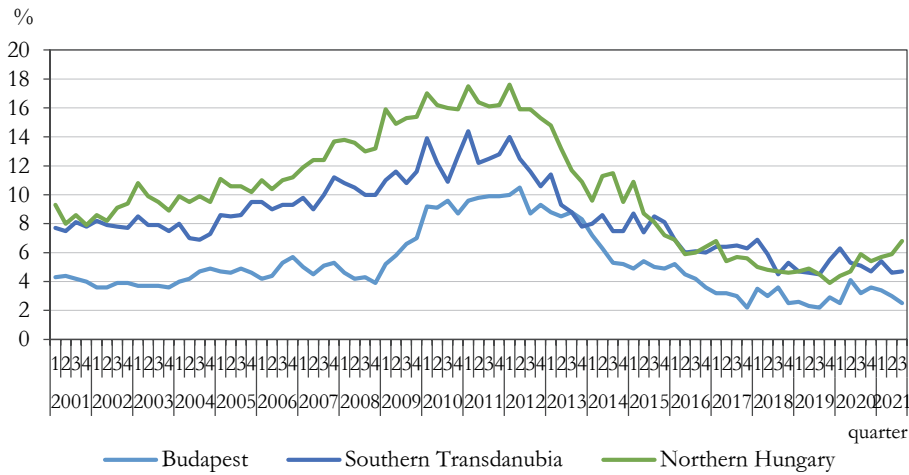### Southern Transdanubia and the Northern Hungarian region
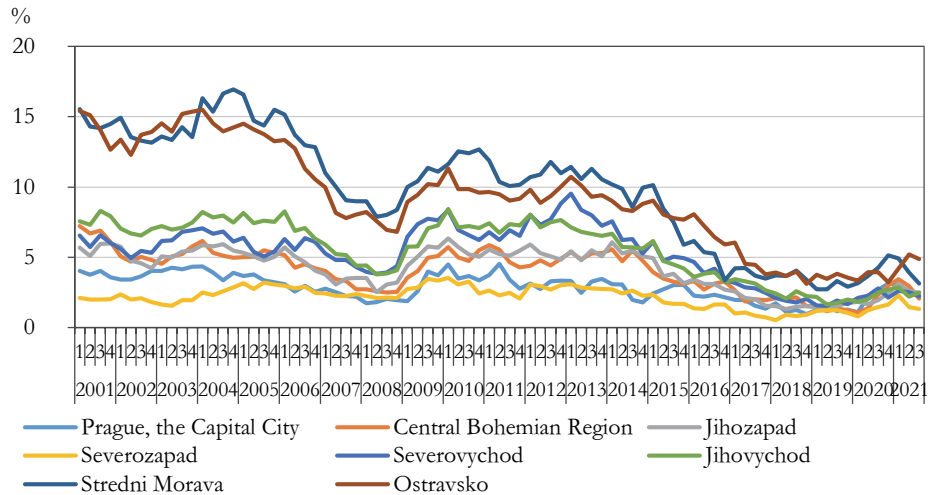
Figure A3

Unemployment rates in Czech regions

Legend: Prague, the Capital City; Central Bohemian Region; Jihozapad; Severozapad; Severovychod; Jihovychod; Stredni Morava; Ostravsko

Figure A4

Representation of the plateau of the Czech regions and the fitted trends

Legend: Prague, the Capital City; Central Bohemian Region; Jihozapad; Severozapad; Severovychod; Jihovychod; Stredni Morava; Ostravsko

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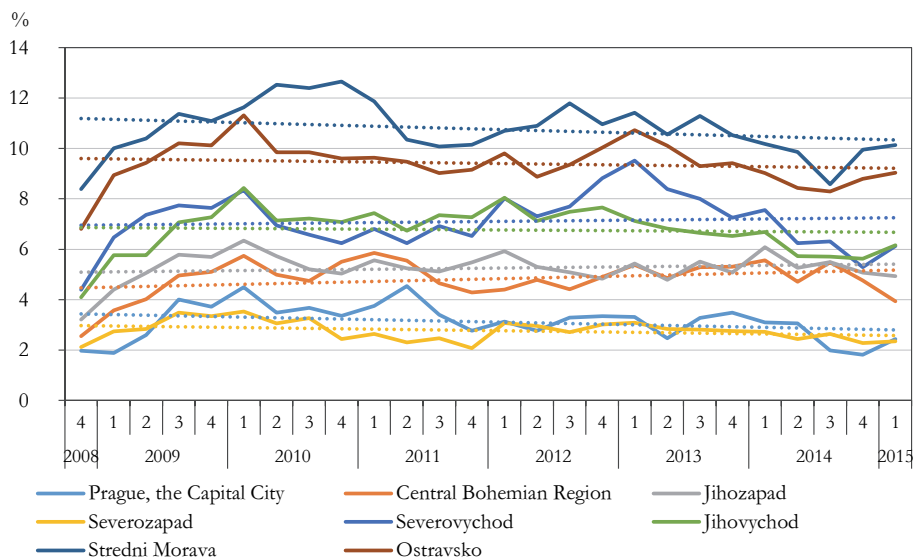
Figure A5

Unemployment rates in Czech NUTS 2 regions during the Covid-19 epidemic
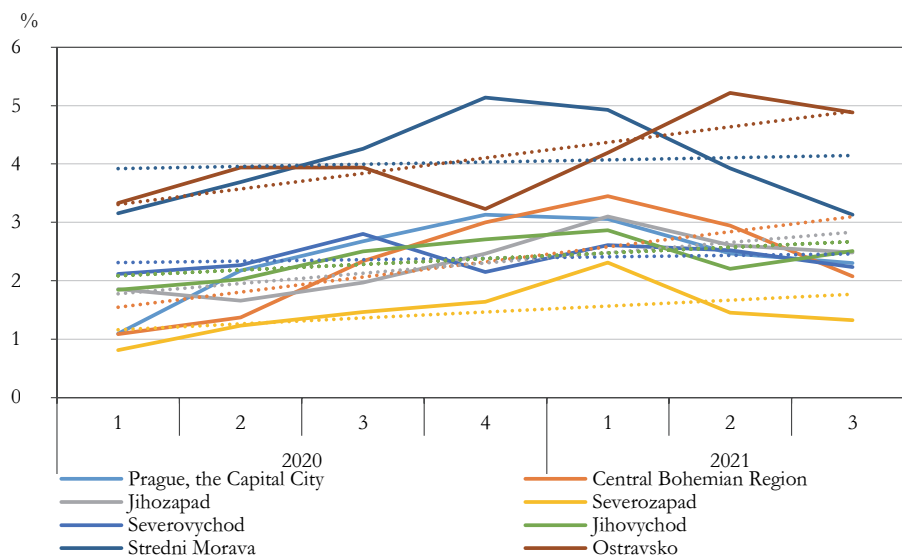
Legend:
- Prague, the Capital City
- Jihozapad
- Severovychod
- Stredni Morava
- Central Bohemian Region
- Severozapad
- Jihovychod
- Ostravsko

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