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## THE COVID – 19 PANDEMIC AND ITS IMPACT ON THE LABOR MARKET IN THE SLOVAK REPUBLIC AND THE EUROPEAN COUNTRIES\*

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**Abstract.** The outbreak of the worldwide pandemic COVID-19 at the beginning of 2020 prompted almost all governments around the world to implement restrictive measures with social distancing. The dealing with the negative effects of a pandemic on the labor market is different in individual countries. The policy measures can contribute to faster recovery of the labor market, that has been most affected by the pandemic. The main purpose of the article is to analyze changes in labor market of NUTS 3 regions in the Slovak Republic during the pandemic. The aim of the study is to assess the effects of pandemic particular phases on the changes in the labour market in the Slovak republic and the European Union countries. The key method used to analyse these changes is the beta and sigma convergence method, which offers the opportunity to monitor in detail how the labour market situation has changed over time. To fulfil the main purpose of the article, we will work with statistical databases related to pandemic progress and with statistical data of the labour market. The results show that the pandemic has caused labor market changes in the form of rising unemployment, which we attribute mainly to the national lockdown at the beginning of the pandemic.

**Keywords:** labour market; COVID-19 pandemic; region; regional disparities; unemployment

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## **1. Introduction**

The outbreak of the worldwide pandemic COVID-19 (C-19) at the beginning of 2020 prompted almost all governments around the world to implement restrictive measures, with social distancing. The approaches to dealing with the negative effects of a pandemic on the labor market are diverse in individual countries. Many businesses were temporarily closed, and many employed people were confined and isolated to prevent the spread of the virus. For this reason, it is necessary to apply policy measures that will contribute to the faster recovery of those areas on the labor market, that have been most affected by the pandemic. Admission of effective decisions to eliminate the impact of a pandemic on the national economy and the labour market requires a detailed analysis of progress and a comparison of epidemiological data as well as economic and labour market data.

In their research, many authors point to the negative impact of the C-19 pandemic. However, there are several camps where views on the pandemic and its impact on the economy and on the labour market are clearly different. One group of experts argues that the pandemic has negatively affected the economic situation and labour market performance since its inception, and that this situation still persists, which is why they recommend state intervention to offset the adverse effects. On the other side, the second group of experts is of the opinion that the pandemic has negatively impacted the economy as well as the overall labour market, but the situation has come under control over time and therefore state intervention is not fully needed, but only in areas that cannot be compensated other than financially way.

One of these contradictory opinions can only be accepted based on individual country-by-country examinations, as each country and region shows a different degree of pandemic intervention and a different degree of economic development. In this case, however, the situation is very difficult, as even the countries with the strongest economies have succumbed to the fight against the pandemic on several fronts. In addition to high numbers of infected populations and high mortality, experts point to an increase in the unemployment rate, a decline in production in industry or services, as well as an overall decline in gross domestic product, which are the most important factors for the assessing of economic development. Even the most economically advanced countries are struggling with economic and humanitarian problems in a pandemic. The question is how quickly stronger or weaker economies can recover.

The Slovak Republic is one of the most open economies in Europe. Due to its dominance in industrial production, trade is inevitably tied to other countries, which means that if a worsened epidemiological and economic situation in the countries with which the Slovak Republic trades, despite the favourable situation in our country, there would be a decline in revenues. However, the question remains whether the pandemic has really paralysed our economy and the labour market, and if so, when this turning point occurred, how serious this situation was and how it developed over time.

## **2. Literature Review**

The failure to control the C-19 pandemic has had far reaching impacts on the global economy. C-19 is not only a global pandemic and public health crisis, it has also severely affected the global economy and labour market. Significant reductions in income, a rise in unemployment, and disruptions in the transportation, service, and manufacturing industries are among the consequences of the disease mitigation measures that have been implemented in many countries (Pak et. al, 2020; Periokaite, Dobrovolskiene, 2021).

While previous pandemics have typically emerged in poorer countries, C-19 emerged in an important economic hub and has affected countries central to the global economy (Baldwin, Di Mauro, 2020).

The impacts of the disease itself, the policy measures being taken to control its spread (closing businesses and schools, and restricting travel) simultaneously affected supply and demand at multiple points in the economy (Lucas, 2020). According to the latest information from the International Labor Organization (ILO, 2020), more than 436 million companies worldwide face a high risk of serious disruption. These enterprises operate in the most affected economic sectors, of which approximately 232 million in wholesale and retail, 111 million in manufacturing, 51 million in accommodation and food services and 42 million in real estate and other business activities.

In the conditions of the European Union, Pouliakas and Branka (2020), and Fana et al. (2020a,b) that the segment of the workforce that will continue to be most affected by distance measures and practices as a result of the C-19 pandemic are the most vulnerable groups. Such as women, small entrepreneurs and workers working at the minimum wage level, or people with lower education. A range of studies have been conducted on how C-19 has affected different outcomes. A survey conducted by Euro-found (2020) shows that the proportion of people reporting that their working hours have decreased (very or slightly) during the COVID-19 pandemic is above the EU average in all Mediterranean countries.

Biddle et al. (2020), considered the relationship of C-19 to factors such as employment, labour supply, life satisfaction, income, financial distress, and mental health. On the other side, Botha et al. (2020) investigated the impact of C-19 pandemic on the changes on the labour market such as reduction of working hours, earnings, entering into unemployment or having to file for unemployment benefits during the pandemic. Beland et al. (2020) focused on the short-term effects of C-19 on employment and wages in the United States. Their results suggest that the unemployment rate has risen, working hours have decreased and labor force participation has fallen, but this has not had a significant impact on wages. The negative effects on labor market outcomes are greater for men, younger workers, Hispanics and less educated workers.

Other research in the USA was conducted by Kong and Prinz (2020), who looked at how outage policies affected unemployment itself during the C-19 pandemic. They focused on the effects of the so-called six principles of non-pharmaceutical intervention and analyzed how Google searches responded to each of them to obtain an unemployment claim. The authors thus provided estimates of the short-term impact of notifications on state-level anti-pandemic measures on unemployment expectations based on Internet search data.

Almeida and Santos (2020) focused on the impact of C-19 on the Portuguese labor market. In their research, the authors found that the impact of the pandemic and measures against it in Portugal was asymmetric in terms of regions, age groups, but also sectors of activity. They also identified the most affected areas, but also the individuals whose employment was most affected by the pandemic. At the end of the research, they also discuss measures to mitigate the effects of the pandemic on employment in Portugal (Mitra, Xu, 2020).

The effects of the pandemic on youth employment in Australia were examined in his Churchill study (2020). She worked with data from the Australian Bureau of Statistics where he compared young men and women with their older counterfactual data. And also examined the unemployment rates of men and women in different age categories. The author found that the negative impact of the pandemic on employment did not escape young people either, and their unemployment rate also increased significantly. C-19's economic impacts are broader and more severe than most past crises. The disease has been highly infectious in comparison with past major disease outbreaks, spreading rapidly to reach almost every country in the world (Lucas, 2020). However, it is important to note that the intensity of the economic impact depends to a greater extent on the specialization of the country. The countries most affected are those that rely on low-productivity, low-employment activities (Fana et al., 2020a,b).

The Slovak Republic was no exception and was also significantly affected by the C-19 pandemic and its consequences. This was mainly reflected in the economic downturn and employment, which disrupted the

ongoing labor market developments. After a long-term declining employment rate, it began to grow rapidly from March 2020. Svabova et al. (2021) focused on the growth of unemployment in the context of the C-19 pandemic. Based on analyzes of the unemployment rate and the influx of newly registered jobseekers, they found that they have even completely stopped some sectors. In the context of the Slovak Republic, it was mainly the accommodation and catering sector, real estate activities, administrative and support services, arts, entertainment and recreation, but also other business activities. The Government of the Slovak Republic is trying to eliminate the effects of these anti-pandemic measures by introducing interventions that should help entrepreneurs survive and at the same time be able to retain their employees. However, according to this research, the number of unemployed in these sectors continues to grow and is an almost immediate response to the measures in place. This phenomenon was caused not only by the pandemic itself, but also by forced restrictions in the business sector and a reduction in consumer demand.

As a result of the above factors, employers have begun to compensate for cost reductions through collective redundancies in their companies (Baliak, Belin, 2020). Another manifestation was the transition to a home office "telework" which is characterized by two factors. On the one hand, we are talking about distance, as the teleworker works in a different place than the employer's premises, but also communication between the parties, for which IT-computer tools are needed today (Baruch, 2000).

In connection with this issue, a study by Karáčsovy (2021) was created, which focuses on the impact of teleworking and the satisfaction of Slovak employees in the C-19 era. The results of this study show a 7 - fold increase in the number of people currently working remotely. At the same time, it pointed out the important relationship between teleworking and its implementation and job satisfaction. A significant number of respondents (workers) would continue to work remotely even after the end of the C-19 pandemic.

Based on these answers, he said, it is necessary to consider teleworking at the organizational level for higher productivity as well as a better work-life balance. In addition to the positive effects of teleworking, management must pay sufficient attention to the negative consequences, such as the development of a sense of isolation, barriers to the transfer of information and knowledge, but also the loss of individual career opportunities, etc. It is therefore important to find a balance between the positive and negative aspects of teleworking and to use new innovative technologies to create a work environment that can meet the psychological needs of individuals for autonomy, motivation and work atmosphere. But this was also reflected in the health care system, where even before the outbreak of the global C-19 pandemic in 2020, experts warned of a critical shortage of health workforce in the country. It was mainly a lack of supportive medical staff, such as nurses and nurses, but also a lack of doctors. In this case, the pandemic began to exacerbate these shortcomings, but also revealed the fragility of the entire health care system in Slovakia (European Commission, 2021).

### **3. Data and Methodology**

The main purpose of the paper is to analyze changes on the labor market of NUTS 3 regions in the Slovak Republic during the Pandemic of C-19 and the European Union countries. We are focusing on finding out whether there is a convergence or divergence in the unemployment rate of the NUTS 3 regions in the Slovak Republic in the period before and during of pandemic.

The aim of the study is primarily to monitor changes in behaviour of the labour market during a pandemic, in order to find effective tools that will to help the labor market to better respond in crissis situations such as the pandemic is.

Before calculation of beta-convergence is necessary to perform a normality test of selected data, using the Shapir-Wilk data normality test and the Dixon's Q test for outliers. For the calculation of Beta-convergence we must

calculate the unemployed share out of the economic active population before and during the pandemic. Then, we must calculate the logarithm of the initial values and the average growth coefficients also. From the calculated average growth coefficients, we must calculate the logarithm of the average growth coefficients.

As the analyzed periods, we choosed:

- I. Period (SR before the Pandemic of C-19): 08/2019 - 02/2020
- II. Period (1st Wave of the Pandemic C-19 in the SR): 03/2020 - 09/2020
- III. Period (2nd Wave of the Pandemic C-19 in the SR): 10/2020 - 04/2021
- IV. Period (3rd Wave of the Pandemic C-19 in the SR): 05/2021 - 11/2021

Beta-convergence is one of the methods for measuring regional convergences, respectively regional divergences. It is based on the assumption that the observed data in the regions are converging in the given time horizon, we are talking about convergence. If, in a given time horizon, the data in the regions are dissipating, then we are talking about divergence. In our case, the regions are the individual areas NUTS 3 (self-governing regions) of the Slovak Republic. A similar method was applied to calculate beta-convergence for the European Union.

Shapiro-Wilk Test of Normality:

$$W = \frac{(\sum_{i=1}^n a_i^{(n)}(x_{n-i+1} - x_i^*))^2}{\sum_{i=1}^n (x_i - \bar{x})^2} \quad (1)$$

Dixon's Q Test for outliers:

$$Q_n = \frac{x_n - x_{n-1}}{x_n - x_1} \quad (2)$$

$\beta$ - convergence:

$$k = n \sqrt{\frac{y_n}{y_0}} \quad (3)$$

When:

n – in our case is 7, because we compared the time (months in 3 periods)

$y_n$  – in our case, the share of unemployment of the population at the end of the reference period

$y_0$  – in our case, the share of unemployment of the population at the beginning of the reference period

By the least squares method is determined the equation of a regression function with a dependent and independent variable. The dependent variable is a logarithm of the average growth coefficients and an independent variable is the logarithm of the initial values. If the regression function is declining, it is about convergence, on the other side if the linear regression function is rising, it is about divergence. An important step is the calculation of the value of the coefficient of determination in percentage.

The coefficient of determination explains how many percent of total variability is explained by the used model. If the value of the determination coefficient is closer to 100, it is considered significant, if approach 0 is considered insignificant. If the results of convergence are insignificant, a correlation diagram is used.

The correlation diagram is divided by two lines into a four quadrants. In the first quadrant are located the regions with above-average of initial value and an above-average growth coefficient. In the second quadrant are located the regions with below-average of initial value and an above- average growth coefficient. The third quadrant includes the regions with below-average of initial value and a below-average growth coefficient. The fourth,

quadrant includes the regions with above-average of initial value and a below-average growth coefficient (Minařík, Borůvková, Vystrčil, 2013).

The  $\sigma$ -convergence method is a supplement to the calculation of  $\beta$ -convergence calculation, it is a calculation of the standard deviation of the logarithmized values of the observed time period.

$\sigma$ -convergence:

$$\log \bar{k} = \alpha + \beta \log y_0 \quad (4)$$

The sigma convergence method is used in case of non-demonstration of convergence resp. divergence by using of  $\beta$ -convergence (Minařík, Borůvková, Vystrčil, 2013). Regression and correlation analysis is a very suitable method to identify hidden relationships between the indicators examined (Markechová, 2011).

Regression Analysis:

$$y_i = \beta_0 + \beta_1 x_i + \varepsilon_i \quad (5)$$

The purpose of applying the method of regression and correlation analysis is to point out the fact that the increase in the number of C-19 cases affects the increase in the number of unemployed. In our conditions, it is an application of linear regression analysis.

### 3. Results and Discussion

The Pandemic of C-19 has seriously threatened not only society but also the health systems of individual countries. The crisis caused by the pandemic has affected the whole world, but Europe as the oldest continent in particular. As can be seen in the figure 1 the Czech Republic, Slovenia and Luxembourg are the most affected countries in terms of mortality from the C-19 disease so far, with a morbidity rate of more than 11%.

By contrast, the least affected countries in Europe so far are Norway and Iceland. The highest mortality rates during the three waves of the pandemic were identified in Bulgaria, Hungary and Romania, at more than 3%. However, the Slovak Republic also has a relatively high mortality rate for this disease, the mortality rate reaching almost 2% at the end of the observed period in 2021. Norway and Iceland are again among the countries with the lowest mortality rates on the European continent.

At the sight of vaccination rates of the population, we can see that the population of Portugal, Spain and Malta is among the most vaccinated, where we record more than 85% of those vaccinated. By contrast, the least vaccinated countries are Bulgaria, Romania and Slovakia, where the number of vaccinated is below 50%.



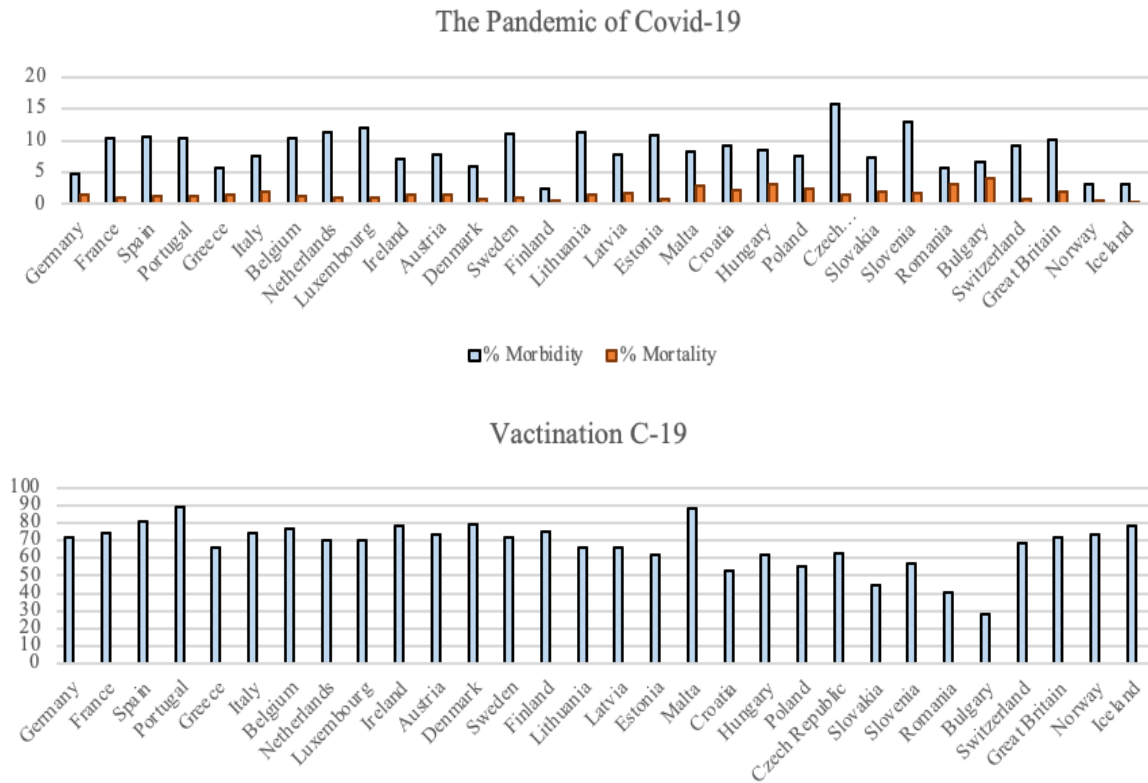
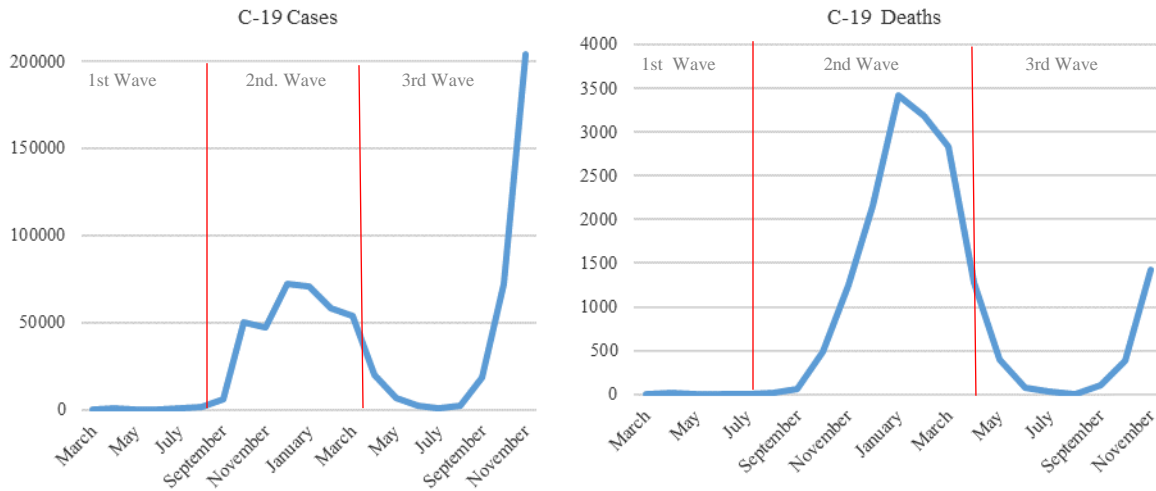


Figure 1. The Pandemic of C-19 disease in European Countries 2019-2021

Source: [www.ourworldindata.org](http://www.ourworldindata.org)

The C-19 pandemic endangered Slovakia not only in terms of the overall health of the population, but also significantly disrupted the economy and the functioning of the labour market.

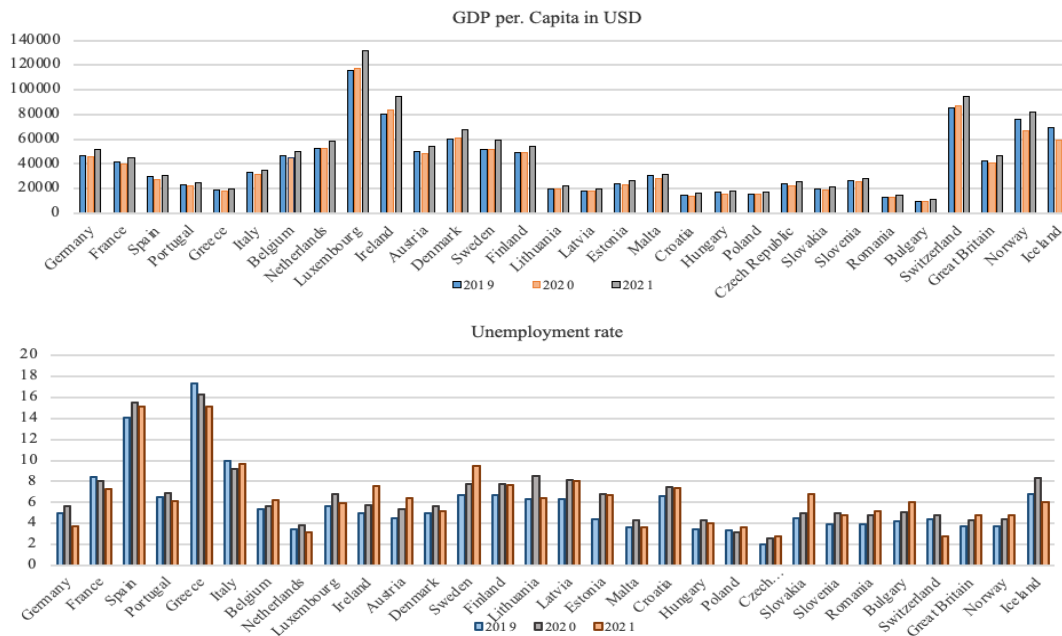
In Slovakia, the C-19 pandemic has begun in March 2020. While the first wave of the pandemic (March - September 2020) was handled very well by the Slovak Republic, the following waves of the pandemic moved Slovakia among the most affected countries in the world in terms of the number of deaths. We can see (Figure 2) that the highest number of recorded cases of new disease was identified in the third wave (May - November 2021) of the pandemic, in the month of November 2021, when the number of cases exceeded 200,000 cases per month. The highest number of deaths was recorded in Slovakia in the second wave of the pandemic, in January 2021, when the number of confirmed deaths from this new disease exceeded 3400. In addition to the high rate of reported cases and high mortality rates, the Slovak Republic continues to struggle with high number of hospital admissions, which puts enormous pressure on the healthcare system. In the third wave of the pandemic, the number of hospitalizations exceeded 2,400 (www.korona.gov.sk, 2021 online report). The constant expansion of covid departments adversely affects the implementation of white medicine interventions and, ultimately, the quality of the provision of routine health care.



**Figure 2.** The Pandemic of C-19 disease in the SR during the three periods 2019-2021

Source: [www.korona.gov.sk](http://www.korona.gov.sk)

GDP, as one of the most important indicators of economic performance, initially experienced a significant decline in the vast majority of European countries due to the pandemic. In most countries, a decline in GDP was identified during the period 2019 - 2020. Exception were countries such as Luxembourg, Denmark and Sweden. This is probably due to the shortest duration of restrictions compared to other European countries (Figure 3).



**Figure 3.** Economics and Labour market of European Countries

Source: [www.ourworldindata.org](http://www.ourworldindata.org)

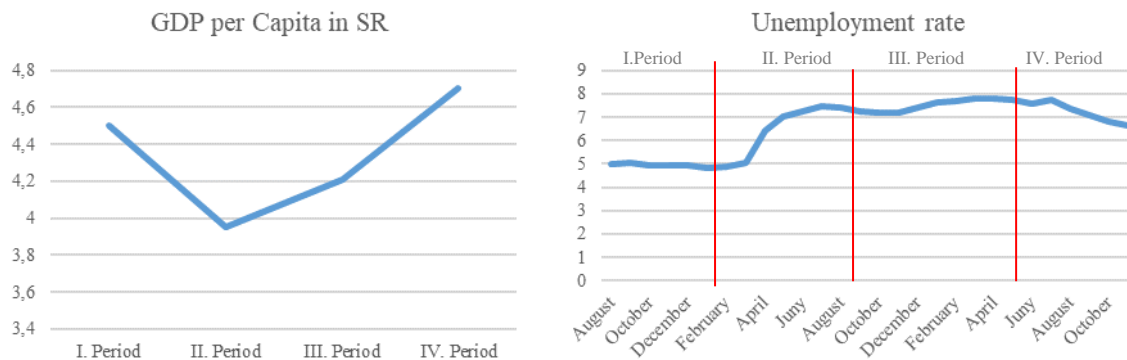


Until November 2021, the Slovak Republic found itself in a nationwide "lockdown" twice, which is a result of a slight economic decline. The most significant decline in GDP since the beginning of the pandemic has been identified in countries such as Germany, France, Spain and Italy.

The economic decision was inevitably caused by limited movement and work activity. These restrictions have also largely affected changes in the unemployment rate. From a global perspective, we can see that the unemployment rate is on the rise (Figure 3).

The most significant increase in the unemployment rate was recorded in the first stage of the pandemic (2019-2020) within the European area in Lithuania and Estonia + 2%. On the contrary, despite the unfavorable socio-economic situation, Italy, France and Greece recorded a decline in the unemployment rate -1%. In the second stage of the pandemic (2020-2021), the situation improved slightly in the vast majority of countries. However, even in the second stage of the pandemic, the Slovak Republic ranks among the countries with an ever-increasing tendency of the unemployment rate. Regarding the progress of the economic situation in the conditions of the Slovak Republic, we can see that before the pandemic, the level of GDP per capita was 4,5 thousand EUR. With the advent of the pandemic, the level of GDP dropped significantly to approximately 3.95 thousand EUR per capita. In the second and third waves of the pandemic, GDP recorded growing trends, despite the unfavorable epidemiological situation. At the end of the period under review, the level of GDP per capita reached 4.7 thousand EUR.

Looking at the trends progress of the unemployment rate as a key indicator of the labor market, we can see (Figure 4), similarly to the growth of GDP, that with the advent of the pandemic there was the most significant increase in the unemployment rate. In the period before the pandemic, the unemployment rate was around 4.92%. In the first wave, of the pandemic increased to around 6.84%. In the second and third waves, the level of the unemployment rate gradually decreased, reaching 6.64% at the end of the period under review.



**Figure 4.** Economics and Labour market in Slovak Republic  
 Source: [www.upsvr.gov.sk](http://www.upsvr.gov.sk), [www.datacube.statistics.sk](http://www.datacube.statistics.sk)

The outbreak of the Covid-19 pandemic has led to significant economic changes that countries will continue to face. Due to significant limitations, the number of inhabitants lost their jobs, which was also considerably reflected in the quality of their life. Effective tools and measures will be needed to eliminate the degrading effects of a pandemic in individual countries. This is the reason that it is necessary to pay attention to monitoring of the changes that take place in the labor market during a pandemic.

One of the intensively used methods for examining changes in the labor market is the  $\beta$ -convergence method. Baddeley, Martin, and Tyler (2000) used this method in their survey to identify the nature of unemployment disparities between regions in Europe and USA. The main purpose of using the  $\beta$ -convergence method is to identify the of disparities between NUTS 3 regions of SR in terms of the unemployment rates over four defined periods.

Before proceeding to perform the calculations themselves, we test the normality of the data using the Shapir - Wilk test. The value of the normality test reached  $0.8 > \alpha 0.05$  for the groups at the beginning of the reference period and  $0.8 > \alpha 0.05$  at the end of the reference period, ie both sets come from a normal distribution (Table 1).

**Table 1.** Shapiro-Wilk Test of Normality

<i>Shapiro-Wilk Test of normality</i>			
<i>The beginning of the reference period</i>		<i>The end of the reference period</i>	
I. Period	0,805	I. Period	0,805
II. Period	0,815	II. Period	0,831
III. Period	0,823	III. Period	0,822
IV. Period	0,817	IV. Period	0,792

*Source:* own calculation of authors based on UPSVR data, StatGraphics

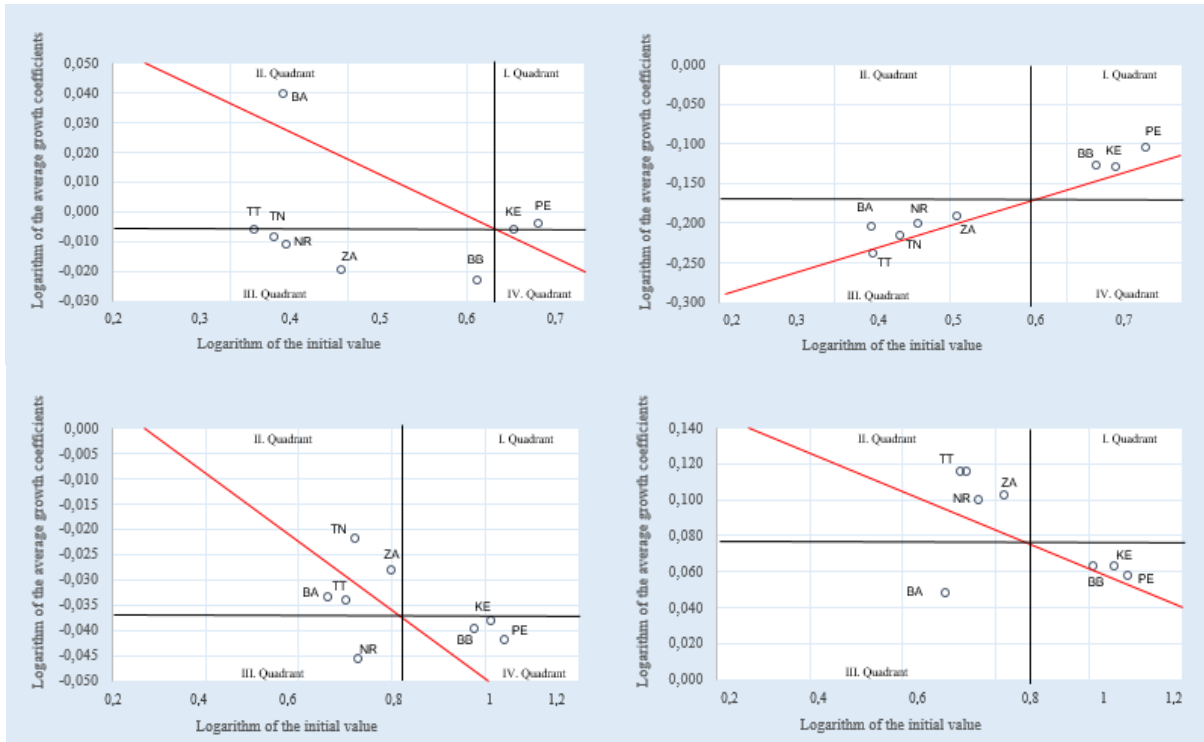
In the case of performing the Dixon’s test to identify outliers in the set of data, we identified no significant outliers (Table 2).

**Table 2.** Grubbs Test for outliers

<i>Dixon’s Q Test for outliers</i>			
<i>The beginning of the reference period</i>		<i>The end of the reference period</i>	
I. Period	<i>Not sig.</i>	I. Period	<i>Not sig.</i>
II. Period	<i>Not sig.</i>	II. Period	<i>Not sig.</i>
III. Period	<i>Not sig.</i>	III. Period	<i>Not sig.</i>
IV. Period	<i>Not sig.</i>	IV. Period	<i>Not sig.</i>

*Source:* own calculation of authors based on UPSVR data, StatGraphics

We expressed the results of  $\beta$  - convergence by means of a linear regression function obtained from data on the unemployment rate, in individual NUTS 3 regions of the Slovak Republic. The logarithm of the initial values of the unemployment rate was determined as an independent variable and the logarithm of the average growth (decrease) coefficient was determined as the dependent variable. The average growth (decrease) coefficient of the analyzed regions reached 0.98 ‰ for the first period, 0.66 ‰ for the second period, 0.92 ‰ for the third period and 1.21 ‰ for the fourth period. In this case, the coefficient of determination reached 0.07 for the first period, 0.95 for the second period, 0.20 for the third period and 0.31 for the fourth period. For relatively low values of the coefficient of determination (with the exception of Period II), the result of the analyzes cannot be considered conclusive. In this case, a correlation diagram is given (Figure 5), which divides the examined regions into four quadrants, based on the logarithm of the initial value and the logarithm of the average growth (decrease) coefficient.



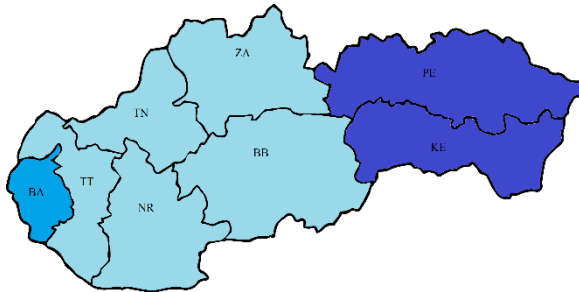
**Figure 5.**  $\beta$ -convergence and correlation diagram

Source: own calculation of authors based on UPSVR data, MS Excel

The regions located in the first quadrant tend to move away from the others, as they show an above-average value of the logarithm of the initial values, but also an above-average logarithm of the average growth (decrease) coefficient. In the second quadrant, there are regions that tend to approach the regions in the first quadrant. They show an below-average logarithm of the initial values, but on the contrary an above-average logarithm of the average growth (decrease) coefficient in the unemployment rate. In the third quadrant there are regions that tend to lag behind and thus none of them shows a below-average logarithm of the initial value and a below-average logarithm of the average growth coefficient. In the fourth quadrant, there are regions that showed an above-average logarithm of the initial values, but on the other hand show a below-average logarithm of the growth rate in the unemployment rate.

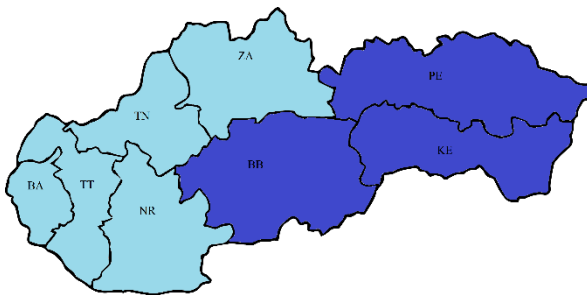
Figure 6 provides a graphical overview of the distribution of regions in the four quadrants. The aim of the  $\beta$ -convergence was to monitor changes in the behavior of the unemployment rate in the regions over four periods. The main goal was to find out whether the pandemic caused more fundamental changes on the labor market, while the monitored indicator on the regional labor markets was the unemployment rate. From the results of  $\beta$ -convergence it can be stated that during the observed period there was mostly convergence between the regions in terms of the unemployment rate progress, with the exception of II. period when divergence occurred (the curve in the correlation diagram is increasing).

Before the Pandemic C-19 (August 2019 – February 2020)



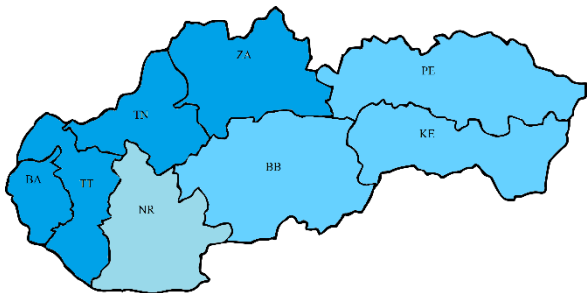
- 1<sup>st</sup> Quadrant: Prešov Region (PE), Košice Region (KE)
- 2<sup>nd</sup> Quadrant: Bratislava Region (BA)
- 3<sup>rd</sup> Quadrant: Trnava Region (TT), Trenčín Region (TN), Nitra Region (NR), Žilina Region (ZA), Banská Bystrica Region (BB)
- 4<sup>th</sup> Quadrant: No Region

1<sup>st</sup> Wave of the Pandemic C-19 (March 2020 – September 2020)



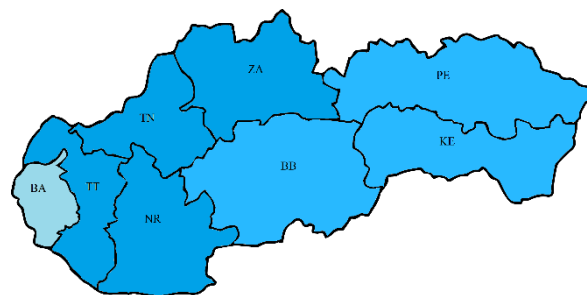
- 1<sup>st</sup> Quadrant: Prešov Region (PE), Košice Region (KE), Banská Bystrica Region (BB)
- 2<sup>nd</sup> Quadrant: No Region
- 3<sup>rd</sup> Quadrant: Bratislava Region (BA), Trnava Region (TT), Trenčín Region (TN), Nitra Region (NR), Žilina Region (ZA)
- 4<sup>th</sup> Quadrant: No Region

2<sup>nd</sup> Wave of the Pandemic C-19 (October 2020 – April 2021)



- 1<sup>st</sup> Quadrant: No Region
- 2<sup>nd</sup> Quadrant: Trenčín Region (TN), Žilina Region (ZA), Trnava Region (TT), Bratislava Region (BA)
- 3<sup>rd</sup> Quadrant: Nitra Region (NR)
- 4<sup>th</sup> Quadrant: Banská Bystrica Region (BB), Prešov Region (PE), Košice Region (KE)

3<sup>rd</sup> Wave of the Pandemic C-19 (May 2021 – November 2021)



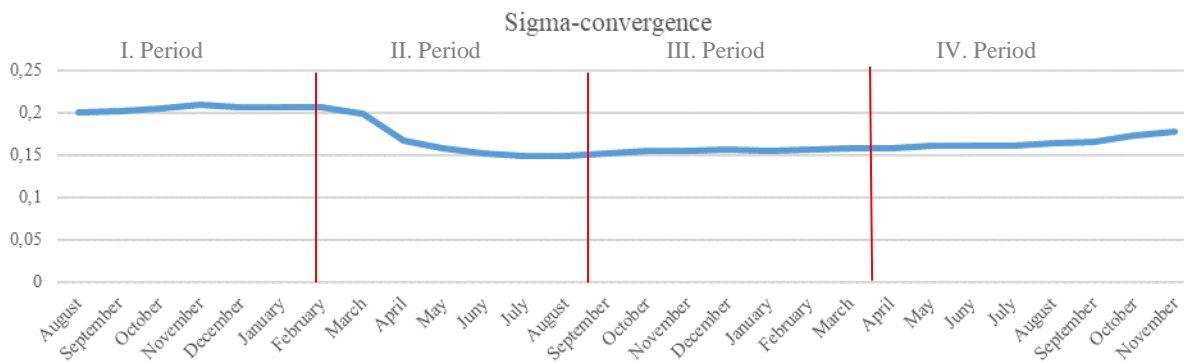
- 1<sup>st</sup> Quadrant: No Region
- 2<sup>nd</sup> Quadrant: Trenčín Region (TN), Žilina Region (ZA), Trnava Region (TT), Nitra Region (NR)
- 3<sup>rd</sup> Quadrant: Bratislava Region (BA)
- 4<sup>th</sup> Quadrant: Banská Bystrica Region (BB), Prešov Region (PE), Košice Region (KE)

**Figure 6.** Regional results of the  $\beta$ -convergence calculation  
 Source: own calculation of authors based on  $\beta$ -convergence data

We can see that during the observed period there was mostly divergence between NUTS 3 regions, with the exception of period II. periods when convergence occurred (the curve is decreasing).

As the coefficients of determination reach relatively low values, we supplement the  $\sigma$ -convergence analysis with a  $\sigma$ -convergence analysis, which confirms the previous results. In the observed period, there was mostly convergence in the unemployment rate progress between the regions of the Slovak Republic, with the exception of II. periods when divergence occurred (Figure 7).

Given the results of beta-convergence, which showed the onset of changes in the labor market with the advent of the pandemic, we supplement the issue with the results of regression and correlation analysis, which points to the relationship between the variables examined (independent variable is C-19 and independent variable is unemployment rate). A linear regression model was used to calculate the regression and correlation analysis, which shows low values of the correlation index and the determination index in all monitored regions. The values of the Durbin-Watson characteristic index (0.325) indicate a positive autocorrelation of the data, which confirms the unsuitability of the model to describe the investigated dependence.



**Figure 7.**  $\sigma$ -convergence – unemployment rate August 2019 – November 2021  
 Source: own calculation of authors based on UPSVaR SR data, MS Excel

From the results of the regression analysis we can see that the highest value of the correlation index (Multiple R) is reached by the Košice region, the Banská Bystrica region and the Prešov region (Table 3). On the contrary, the lowest value is reached by the Nitra region. The determination index (R Square) reaches a very low value in all cases, which means that the used regression model does not explain more than 16% of the variability of the examined data (Košice region).

**Table 3.** Regression Statistics

REGION	Bratislava	Trnava	Trenčín	Nitra	Žilina	Banská Bystrica	Prešov	Košice
Multiple R	0,34	0,36	0,24	0,12	0,39	0,39	0,32	0,40
R Square	0,11	0,13	0,06	0,01	0,14	0,15	0,10	0,16
Adjusted R Square	0,053	0,071	-0,008	-0,056	0,088	0,089	0,037	0,101
Standard. Err.	0,054	0,588	0,588	0,633	0,633	0,748	0,845	0,898

Source: own calculation of authors based on UPSVaR SR data, MS Excel

It cannot be said that this is due to an increase in new cases, but due to the introduction of a nationwide lockdown at the beginning of the pandemic.

The C-19 pandemic did not cause changes in the labor market, only in the conditions of the Slovak Republic. Many people around the world have lost their jobs as a result of its spread. To show the changes in the labor market due to the C-19 pandemic, we decided to monitor the development of the unemployment rate in the European area as well (Figure 8). In this case, we monitored changes over the time horizon, 2019 (before the pandemic outbreak) after the end of 2021. We can conclude that, as in the case of the Slovak Republic, in individual countries, the most significant increase in the unemployment rate occurred precisely at the time of the toughest lockdown, later the situation on the labor market stabilized, but not to the state we recorded before the C-19 pandemic.



**Figure 8.**  $\beta$ -convergence – unemployment rate August 2019 – November 2021

*Source:* own calculation of authors based on Eurostat data, MS Excel

The countries located in the first quadrant tend to move away from the others, as they show an above-average value of the logarithm of the initial values, but also an above-average logarithm of the average growth (decrease) coefficient. In the second quadrant, there are countries that tend to approach the countries in the first quadrant. They show an below-average logarithm of the initial values, but on the contrary an above-average logarithm of the average growth (decrease) coefficient in the unemployment rate. In the third quadrant there are countries that tend to lag behind and thus none of them shows a below-average logarithm of the initial value and a below-average logarithm of the average growth coefficient. In the fourth quadrant, there are countries that showed an above-average logarithm of the initial values, but on the other hand show a below-average logarithm of the growth rate in the unemployment rate. The conclusion is that although the advent of the pandemic has caused



significant changes in the labor market in the form of rising unemployment, it cannot be said that this is due to an increase in new cases, but due to the introduction of a nationwide lockdown at the beginning of the pandemic.

## Conclusions

In this paper, we set the main goal to analyze changes in the labor market of NUTS 3 regions in the Slovak Republic during the C-19 pandemic and the European Union countries. We wanted to find out whether there is convergence or divergences in the unemployment rate of these NUTS 3 regions in the conditions of the Slovak Republic, in the period before and during the pandemic. Using the Shapir-Wilk test, we tested the normality of the data, as the value we found reached  $0.8 > \alpha 0.05$  for the groups at the beginning of the reference period and  $0.8 > \alpha 0.05$  at the end of the reference period. We could find that both of these files came from a normal distribution. Subsequently, based on the B-convergence examination, we identified disparities between NUTS 3 regions of the Slovak Republic in terms of the unemployment rate over four defined periods. In the article, we also worked with important data such as the unemployment rate and GDP. Here we wanted to find out what condition the Slovak Republic was in before and during the COVID-19 pandemic. From the economic situation progress in the Slovak Republic, we could see that before the pandemic, the level of GDP per capita was 4.5 thousand. EUR. Subsequently, with the advent of the pandemic, the level of GDP dropped significantly to about 3.95 thousand. EUR per capita. In the second and third waves of this pandemic, GDP had a growing trend, despite the unfavorable epidemiological situation. At the end of the period under review, the level of GDP per capita reached 4.7 thousand. EUR.

The sharp decline in GDP levels and the economic slowdown can clearly be attributed to the radical measures related to the C-19 pandemic, and especially during its first wave. Immediate losses occurred due to the closure of shops and operations as well as manufacturing companies. The production of goods and services was quite limited. By easing measures, especially in industrial sectors, it is possible to register a gradual growth of GDP, especially demand and needs of foreign countries.

Based on the B-convergence survey, we identified disparities between NUTS 3 SR regions in terms of the unemployment rate over four defined periods. We found that the characteristics of works. cities and business structure remain key and play an important role. Therefore, even within our results, we can state that the Košice, Prešov and Banská Bystrica regions were worse off than the regions of western Slovakia, where key industry and trade are concentrated. The stronger industrial regions started faster. On the contrary, regions built mainly on services and trade, such as catering facilities, retail, accommodation services, etc., were in a worse situation. Measures against C-19 significantly reduced their activities and attractiveness. While before the pandemic there was a shortage of staff in those sectors, during the pandemic they became the most critical in the system.

In order to eliminate the damage to the unfavorable progress of the economy and unemployment, it is necessary to approach the issue sensitively and responsibly. It is important for the economy to build a favorable environment that will be ready to respond even in times of pandemics and other crises and to minimize adverse events. Here it is particularly important to think of small and medium-sized enterprises, which are the pillars of the economy, but also the most vulnerable category of the whole system and employees. It is important for these entities that the state is able to support and retain them. There is a need to set clear and legible rules that will be communicated to the professional community and the private sector well in advance. Related to this is the responsible development of crisis and strategic scenarios, models and procedures that mobilize funds and resources in times of adverse economic and other conditions, as well as the setting up of support mechanisms such as compensation, subsidies, etc., which will help overcome these particularly challenging periods. In addition, in connection with health crises, there is a need for a significant involvement of the state in the protection of its citizens, ie its socio-economic status. Uniform rules, procedures and common solutions to such situations and situations should be established for crisis situations caused by a pandemic, not only within the

country but also within the EU community. This would promote the idea of unity, solidarity or social responsibility of all Member States, which would also have a positive impact on the socio-economic development of the EU.

During the implementation of the research, we encountered several limitations such as. problem in the processing of data related to mortality from C-19 disease in the Slovak Republic, while from the first available data it is not clear whether the deceased died directly from C-19 disease, or this disease was only an accompanying and the cause of death was caused by another disease. Another limitation in the research is the absence of the possibility of a clear quantification of the impact of the pandemic, i.e. an increase in the number of identified cases on changes in the labour market, i.e. on growth, respectively a decrease in the number of jobs or the employment rate itself, respectively unemployment rate. If the direct impact of the spread of the pandemic and thus its quantification could be more clearly described using statistical methods, the survey could be extended to examine specific changes not only in the labour market as such but also in its specific sectors.

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