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Influence of COVID-19 Pandemic on the Economy of Chosen EU Countries

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Abstract: The recent outbreak of coronavirus disease (COVID-19) is the worst global crisis, having a considerable influence on the economy of individual states and whole regions. The present paper focuses on the evaluation of macroeconomic indicators influencing the economic development of selected EU countries due to the pandemic situation. The evaluation focuses on the Visegrad group countries through the TOPSIS method, providing a way to find out the best and the worst economic situation of the evaluated countries. Based on the results of the selected indicators in the countries, we found the trend of the economic development in the analyzed period, characterized by development disparities. According to the analyzed data, we constructed the order of the economic development in the countries. The results serve for the prediction of the economic development in the EU due to the pandemic situation from the perspective of the GDP and employment trend, as well as for the creation of future monetary and fiscal policies in the states. The results could also serve for possible scenarios of future pandemic impacts on the economies.

Keywords: Gross domestic product; unemployment; state economy; Visegrad group; TOPSIS method; ranking of the countries

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1. Introduction

The current situation is largely influenced by the global COVID-19 pandemic, which has not subsided, even after being present for two years. This pandemic has an overall global impact on the economies of countries. Even at the beginning of the pandemic, the predictions were too negative, and some even expected a greater economic crisis than in 2009. Since the beginning of the pandemic, a large number of people have lost their jobs, especially in industrial sectors. The year 2020 was a special year for the EU economy, as the world was ruled by a coronavirus pandemic. Strict measures have taken place in several EU countries, mainly to restrict movement, which has led to a sharp economic downturn in the first half of 2020. Economic activity stabilized in the following half of the same year. However, despite these facts, this economic activity developed unevenly. This inequality was caused by the pandemic and the measures taken to combat COVID-19. The average GDP in the euro area fell by 6.6% in 2020 compared to 2019. The COVID-19 pandemic also had a significant impact on price developments, with the average inflation in the euro area falling to 0.3% in 2020, compared with 1.29% in 2019. This decrease was also caused by other factors, such as a temporary reduction in the German VAT rate [1]. In several other advanced economies, the second wave of the pandemic, as well as the introduction of measures, have caused a significant slowdown in GDP growth. In the larger market economies, growth was negative in the second quarter of 2020, mainly due to a declining output in the services sector, which could be most affected by the measures. In the second half of 2020, GDP growth clearly picked up. International trade and global supply chains have also been severely disrupted by pandemics. Trade tensions between China and the United States remained due to several international measures that were only partially lifted. This increased trade tensions, which, together with the pandemic, have

resulted in a sharp drop in trade, and growing uncertainty and poor economic sentiment have hampered more investment. Various job retention programs have been applied to support employment. In the first half of the year, the overall decline in employment was 15%, which is about 5 million positions. The workforce decreased by almost 7% for low-qualified workers and by 5.4% for medium-qualified workers, but increased by 3.3% for high-qualified workers [1].

The recent outbreak of coronavirus disease (COVID-19) is the worst global crisis [2]. Since the beginning of the COVID-19 pandemic, a number of authors started to follow up its influence on the economy and industries worldwide. China was the first country to face the COVID-19 coronavirus pandemic. Vasiev et al. (2020) shows COVID-19's influence on key industries in China, showing the possibility that not only Chinese but also other countries could have the least possible negative impact from the pandemic and the fastest possible recovery of the economy [3]. Al-Mansour and Al-Ajmi (2020) reported COVID-19 influences on global business, arguing that businesses need to revive business strategy to overcome negative influences [4]. The most sensitive sectors to the pandemic are transport, tourism, retail, and entertainment, which could lose up to 18% of their results [5,6]. The influence of the COVID-19 pandemic is also studied from the point of view of single corporate performance (for example, [7]). Such studies found that COVID-19 has affected all firm characteristics, including firm performance, governance structure, dividends, liquidity, and leverage level. Further, Kells (2020) pointed out that COVID-19's influence has to be studied individually in the public and private sectors, the profit and not-for-profit sectors, and different industries [8]. Many articles have been written in the medical field that relate to the COVID-19 outbreak, as well as in the field of stock markets. Zhang and Hu (2020) analyze the country and industry, influenced by the pandemic, mainly from the viewpoint of country-specific risks and systemic risks in the global financial markets [9]. Gnahe et al. (2022) analyzed the effect of COVID-19 on the selected stock market, implying that governments should consider a regulatory mechanism to reduce the stock market slowdown induced by the COVID-19 pandemic [10]. Ashraf (2020) found that social distancing measures in particular have a direct negative effect on stock market returns due to their adverse effect on economic activity [11]. Additionally, the literature regarding COVID-19's influence on the banking area is still developing [12]. However, its environmental and energy impacts have not been sufficiently studied. In this area, Eroglu (2021) examined the effects of COVID-19 on the environment and renewable energy sector in the literature [13]. There is a future need to search for influences across individual countries.

All these factors contributed to the development and state of the economy. A number of studies analyzed the economic situation in Visegrad group countries and are already available for the period previous to COVID. Therefore, in this paper, we focused mainly on macroeconomic indicators, based on which we can assess the impact of the pandemic situation on the economic development of selected EU countries through the TOPSIS method. The result of the survey is an assessment of the impact of the pandemic situation on the economic development of selected EU countries in terms of selected macroeconomic indicators of economic development such as inflation, GDP, GNP, employment rate, minimum wage development, but also exports and imports of goods and services. The aim of the present paper is to cover the gap in the literature in terms of the region of V4 countries from the perspective of chosen macro-economic indicators' development caused by the pandemic.

2. Materials and Methods

For the purposes of the evaluation of the COVID-19 influence on the economic development, we chose countries from the V4 region. These are all countries in the Central European region that have common interests. All these selected countries are pursuing common goals in the fight against the COVID-19 pandemic. The basic characteristics of the countries are given in Table 1.

In the evaluation of the pandemic's impact on the economic development of selected EU countries, we used analysis, synthesis, simple observation, and comparison. In this way, we identified the developmental trends of selected economic indicators of economic development, including GDP, GNP, minimum wage, unemployment rate, exports and imports of goods and services, and selected social indicators of economic growth, among which we included: population, mortality, and birth rate in the chronological range of 2016–2021.

Table 1. Basic characteristics of the analyzed countries.

Country	Basic Characteristics
Slovakia (SR)	Formation—1.1.1993 Capital city—Bratislava Area—49,036 km^2 Number of inhabitants—5459 mil. Population density—111.3/km^2
Czech Republic (CR)	Formation—1.1.1993 Capital city—Prague Area—78,886 km^2 Number of inhabitants—10,702 mil. Population density—134/km^2
Poland (PR)	Formation—11.11.1918 Capital city—Warsaw Area—312,696 km^2 Number of inhabitants—38,433 mil. Population density—123/km^2
Hungary (HR)	Formation—16.11.1918 Capital city—Budapest Area—93,030 km^2 Number of inhabitants—9693 mil. Population density—105.1/km^2

Source: own processing according to [1].

The data obtained were used in the multicriteria method TOPSIS (Technique for Order Preference by Similarity to Ideal Solution). In this way, we evaluated the country with the best economic development. The TOPSIS method was used due to being one of the objective multicriteria methods, based on the variant selection that is closest to the ideal variant (country with the best economic development) and at the same time farthest from the basic variant (economic situation of the country at the beginning of the analyzed period) [14]. The TOPSIS method's use is well-known, and the following part describes the process of using it during the research. In the first step, we created, according to the criterial matrix, a normalized criterial matrix according to the relation:

$$R_{ij} = \frac{y_{ij}}{\sqrt{\sum_{i=1}^{m} y_{ij}^2}} \quad (1)$$

where i—variant and j—criteria.

In the second step, we transformed matrix R into matrix Z, by which $j = 1,\ldots, n$ is quantified according to Equation (2):

$$z_{ij} = w_j r_{ij} \quad (2)$$

where w_j presents a normalized weight for j criteria. Through elements from matrix Z, we created the "ideal variant" ($h_1,\ldots,h_n$) and "basal variant" ($d_1,\ldots,d_n$), in which for $j = 1,\ldots,n$ is quantified following Equations (3) and (4):

$$h_j = \max_{i=1,\ldots,m} z_{ij} \quad (3)$$

$$d_j = \overset{min}{i=1,\ldots,m} z_{ij} \tag{4}$$

For any $i = 1,\ldots, m$ in the logical consequence, we quantified distances d^+, d^-, i—variant from ideal and basal variant, according to Equations (5) and (6):

$$d_i^+ = \sqrt{\sum_{i=1}^{n} (z_{ij} - h_j)^2} \tag{5}$$

$$d_i^- = \sqrt{\sum_{i=1}^{n} (z_{ij} - d_j)^2} \tag{6}$$

Furthermore, we determined a relative index of the variant distance from the basal variant according to Equation (7):

$$c_i = \frac{d_i^-}{d_i^+ + d_i^-} \tag{7}$$

In view of the above, we used the TOPSIS variant to rank the variants according to the values of these relative indicators, while the most suitable variant was the one that showed the maximum value, as we solved this method by maximizing.

In assessing the impact of the pandemic situation on the economic development of selected European countries, we also applied descriptive statistics, which we used to classify the collected quantitative data into statistical files according to predefined economic and social indicators of the analyzed issues and arranged by time factor, so we could present their tendencies' development through histograms. At the same time, we used the arithmetic mean, with which we quantified the average values according to the relationship below [15]:

$$\bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i \tag{8}$$

3. Results

Based on detailed quantitative analyses of selected indicators of economic development in selected EU countries, we found that these showed a fluctuating trend during the observed period, characterized by developmental disparities, and we came to the following partial conclusions:

- The most significant developmental disparities were recorded in the compared EU countries, especially in terms of GDP, unemployment rates, exports and imports of goods and services, population, mortality, and birth rates [16,17];
- The highest GDP during the analyzed period, with an average annual level of 492.8 billion €/year, was shown by PR; and, conversely, the lowest, with an average annual amount of 88.12 billion €/year, was reported by the SR, while the Czech Republic (CR) reported an average annual GDP of 204.06 billion €/year and MR reported one of 132.44 billion €/year [18–21];
- The highest unemployment rate during the analyzed period, with an average annual unemployment rate of 8.1%/year, was reported by the SR; and, conversely, the lowest, with an average annual level of 3.2% /year, was reported by the CR, with PR showing an average annual unemployment rate of 4.9%/year and MR showing one of 4.6%/year [18–21];
- The highest export during the analyzed period, with an average annual amount of 281,175.15 mil. €/year, was shown by PR; and, conversely, the lowest, with an average annual amount of 83,194.30 mil. €/year was in SR; and MR at the level of 112,828.83 mil. €/year [18–21],
- The highest import during the analyzed period, with an average annual amount of 258,867.92 mil. €/year, showed PR; and, conversely, the lowest, with an av-

erage annual amount of 82,106.75 mil. €/year was in SR; and MR at the level of 107,601.55 mil. €/year [18–21];

- The highest number of inhabitants during the analyzed period, with an average annual level of 38,045,079 per inhabitants, was shown by PR. Conversely, the lowest number, with an average annual level of 5,446,220 per inhabitants, was reported by the SR, while CR reported an average annual population of 10,622,739 per inhabitants and the MR reported one of 9,754,467 per inhabitants [22–24];
- The highest birth rate during the analyzed period, with an average annual height of 380,536 per inhabitants, was shown by PR. Conversely, the lowest, with an average annual height of 57,374 per inhabitant, was shown by SR, while CR reported an average annual natality value of 112,707 per inhabitants and MR reported one of 94,076 per inhabitants [22–24];
- The highest mortality during the analyzed period, with an average annual height of 418,425 per inhabitants, was shown by PR. Conversely, the lowest, with an average annual height of 54,576 per inhabitants, was shown by SR, while CR showed an average annual height mortality of 114,753 per inhabitants and MR showed one of 132,288 per inhabitants [22–24].

With regard to the above facts, we proceeded to assess the impact of the pandemic situation on economic development within the conditions of the analyzed countries [25], using the multi-criteria objective method TOPSIS [14]. In accordance with the principles of the clearly described TOPSIS methodological procedure, we defined the criteria based on available relevant data on individual indicators, including the lower criteria listed in Table 2 and then constructed an input table (Table 3) by analyzed country, based on the average values of indicators during pandemic years.

Table 2. Identification of economic development criteria.

K1	GDP
K2	Measure of unemployment
K3	Export of goods and services
K4	Import of goods and services
K5	Mortality
K6	Natality

Source: own processing according to [14].

Table 3. Input values of economic development criteria.

Country/Criteria	K1	K2	K3	K4	K5	K6
CR	225.47	2.35	164,249.3	152,417.9	127,084	111,216
PR	542.2667	3.25	312,368.6	284,072.1	443,532	365,132
SR	94.00667	6.3	85,533.6	85,331.53	61,928	56,852
MR	153.5	3.9	117,810	115,339.3	135,609	93,454

According to the supplementary matrix, (see Table 4) we constructed matrix R (Table 5) and matrix Z (Table 6) for identically evaluated weights of economic development criteria at the level of 1/6 in terms of their interaction links for a multicriteria assessment of the solved problem.

For the individual criteria, we quantified the distances $d_i^+; d_i^-$ of the i-variant from the ideal and basal variant (Table 7) and the entropy of weight for higher mentioned criteria (Table 8).

According to the entropy calculation in the logical connection, we quantified the values of the weights of the higher defined criteria of the economic development in chosen EU countries (see Table 9).

Table 4. Supplementary matrix of the economic development in the analyzed countries.

Country/Criteria	K1	K2	K3	K4	K5	K6
CR	50,836.72	5.5225	2.7×10^{10}	2.32×10^{10}	1.62×10^{10}	1.24×10^{10}
PR	294,053.1	10.5625	9.76×10^{10}	8.07×10^{10}	1.97×10^{11}	1.33×10^{11}
SR	8837.253	39.69	7.32×10^{9}	7.28×10^{9}	3.84×10^{9}	3.23×10^{9}
MR	23,562.25	15.21	1.39×10^{10}	1.33×10^{10}	1.84×10^{10}	8.73×10^{9}
Sum (square root)	614.2388	8.42526	381,768.5	352,863.7	484,866.8	397,058.7

Table 5. Matrix R of the economic development in the analyzed countries.

Country/Criteria	K1	K2	K3	K4	K5	K6
CR	82.76377	0.655469	70,665.46	65,836.21	33,308.65	31,151.28
PR	478.7277	1.253671	255,584.6	228,691.6	405,721	335,771.5
SR	14.38732	4.710834	19,163.44	20,635.37	7909.549	8140.232
MR	38.36008	1.805286	36,355.01	37,700.53	37,927.54	21,995.63

Table 6. Matrix Z for the same weights of the economic development criteria in the analyzed countries.

Country/Criteria	K1	K2	K3	K4	K5	K6
CR	13.79396	0.109245	11,777.58	10,972.7	5551.442	5191.88
PR	79.78795	0.208945	42,597.43	38,115.26	67,620.17	55,961.92
SR	2.397887	0.785139	3193.907	3439.228	1318.258	1356.705
MR	6.393346	0.300881	6059.168	6283.421	6321.256	3665.939
h_j	79.78795	0.785139	42,597.43	38,115.26	67,620.17	55,961.92
d_j	2.397887	0.109245	3193.907	3439.228	1318.258	1356.705

Table 7. Calculation of the distances.

Country/Criteria	d_i^+	d_i^-	c_i	Rank
CR	90,092.79	12,769.54	0.124142	2
PR	0.576194	100,661.5	0.999994	1
SR	100,661.5	0.675894	6.71×10^{-6}	4
MR	94,025.22	6830.939	0.06773	3

Table 8. Entropy of weight of the economic development criteria.

Country/Criteria	K1	K2	K3	K4	K5	K6
CR	1407	1509.3	359.3	141.15	107.48	33.67
PR	6511.6	9762.21	2450.3	257.13	489.96	67.17
SR	142.5	581.2	238.7	106.56	44.46	62.1
MR	3414.8	4021.7	606.88	345.17	339.12	62.11
(Sum)	11,475.9	15,874.41	3655.18	850.01	681.02	225.05
Country/Criteria	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**
CR	0.122605	0.131519	0.031309	0.0123	0.009366	0.002934
PR	0.567415	0.850671	0.213517	0.022406	0.016553	0.005853
SR	0.012417	0.050645	0.0208	0.009286	0.003874	0.005411
MR	0.297563	0.305447	0.052883	0.030078	0.029551	0.005412

Table 9. Quantification of the criteria weights of economic development.

Country/Criteria	K1	K2	K3	K4	K5	K6
CR	−0.25732	−0.2668	−0.10845	−0.0541	−0.04374	−0.01711
PR	−0.32153	−0.13758	−0.32968	−0.08511	−0.06789	−0.03009
SR	−0.0545	−0.15107	−0.08055	−0.04345	−0.02152	−0.02824
MR	−0.36068	−0.36746	−0.15546	−0.10539	−0.10407	−0.02825
(Sum)	−0.99404	−0.92291	−0.67414	−0.28805	−0.23721	−0.010369
	0.717045	0.665738	0.486291	0.207781	0.171113	0.074796
	0.282955	0.334262	0.513709	0.792219	0.828887	0.925204
Weights	0.076948	0.0909	0.1397	0.215439	0.22541	0.251603

Following the above quantification of weights, we constructed the final matrix Z (Table 10) according to the clearly quantified entropy, on the basis of which we could state that during the pandemic years, PR showed the best economic development and Slovakia (SR) showed the worst. From the results of the final matrix Z constructed and quantified in accordance with the principles of the TOPSIS objective multicriteria method, we constructed a descending order of economic development of the analyzed countries, which was influenced by the pandemic situation resulting from the coronavirus spread (see Table 10):

- Poland (PR),
- Czech Republic (CR),
- Hungary (HR),
- Slovakia (SR).

Table 10. Final matrix Z for the weights according to the entropy.

Country/Criteria	K1	K2	K3	K4	K5	K6
CR	6.368483	0.059582	9871.957	14,183.67	7508.112	7837.761
PR	36.837	0.113959	35,705.13	49,269.02	91,453.68	84,481.19
SR	1.107072	0.428216	2677.13	4445.657	1782.893	2048.108
MR	2.95172	0.164101	5078.791	8122.154	5849.256	5534.171
h_j	36.837	0.428216	35,705.13	49,269.02	91,453.68	84,491.19
d_j	1.107072	0.059582	2677.13	4445.657	1782.893	2048.108
Country/Criteria	d_i^+		d_i^-		c_i	**Rank**
CR	121,735		14,590.84		0.107029	2
PR	0.314257		133,925.5		0.999998	1
SR	133,925.5		0.368634		2.75×10^{-6}	4
MR	125,446.5		8787.542		0.065464	3

4. Discussion and Conclusions

In this paper, we focused on the impact of the pandemic situation on the economic development of selected countries of the European Union. Based on detailed quantitative analyses of selected indicators of economic development in selected EU countries, we found that these showed a fluctuating trend over the period, characterized by developmental disparities, and we concluded that the most significant developmental disparities were recorded in the compared EU countries, especially in terms of GDP, unemployment rates, exports and imports of goods and services, population, mortality and natality. We also showed that the highest GDP during the analyzed period was reported by the Republic of

Poland and the lowest by the Slovak Republic. Next, we analyzed the unemployment rate, where the highest unemployment rate during the analyzed period was reported by the Slovak Republic and, conversely, the lowest was reported by the Czech Republic. Based on the analysis of demographic data, we can say that these data also have an impact on the economic development of the selected countries. A large part of the population has decided to move or live abroad thanks to the measures of the state. On the basis of the performed analysis, one can demonstrate that the highest number of inhabitants during the analyzed period was reported by PR, and, conversely, the lowest was reported by SR. The size of these countries must also be taken into account in this figure. PR showed the highest natality during the analyzed period, and, conversely, SR showed the lowest. This was not the case with mortality either. We also assessed the impact of the pandemic situation on economic development under the conditions of the Slovak Republic, the Czech Republic, the Slovak Republic and the Czech Republic using the multicriteria objective method TOPSIS. From the results of the final matrix Z, constructed and quantified in accordance with the principles of the TOPSIS objective multicriteria method, we constructed a descending order of economic development of the analyzed countries, which was influenced by the pandemic situation. Such results are in accordance with the research of Vasiljeva et al. (2020) [26], showing a predicted decline in the eastern European GDP due to the COVID-19 pandemic, as well as with the research of Hyman et al. (2021) [27] and Majumdar et al. (2020) [28], revealing the severe impact of COVID-19 on employment.

The used causality in the contribution demands that one further consider the time sequence of the reaction (consequence) to the reason (impulse). In this sense of causality, the reaction to the COVID-19 situation has a time sequence, which means that the next reactions to the COVID-19 situation could be researched. This means that the fact that COVID-19 affected the economic situation of the studied countries may not be directly related to the overall development of the COVID-19 crisis. Thus, the direct causality here is not only COVID-19, but also other factors. Causality, interpreted in a simplified way in the article, thus represents the basis for other investigated factors that could have been either negatively or positively affected by the pandemic. This mainly means that the present results can be used in future research within the framework of GDP determination per capita in individual countries, which could provide other points of view on the state´s situation [29].

The results of this paper can be used within the framework of monetary and fiscal policy, as well as financing and tax paying [30]. However, the present contribution can be extended to future research, orientated (due to the uncertain development of the pandemic according to the Pan et al. (2020)) toward the evaluation of possible scenarios of future pandemics so as to analyze the impacts to countries' economies [31]. The analyzed criteria are influenced by many factors, not only COVID-19, so the analysis can be extended within the framework of future research.

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