THE INFLUENCE OF THE SELECTED MACROECONOMIC INDICATORS ON THE PERFORMANCE OF ECONOMIES IN 2020

Jiří Nožička

Abstract

In 2020, all developed economies experienced a decline in their performance. The main reason was undoubtedly the effects of the SARS-CoV-2 pandemic on the functioning of economic systems. Other significant factors were also Brexit and the political elements that disrupted the growth of the global economy. The economic impacts were significant, but their magnitude was not the same for all economies. Some economies suffered only a slight decline, while other economies suffered a very significant one. Theoretically, many factors might have significantly affected the intensity with which the economies were stricken. There is a clear influence of the individual government policies. However, the structure, orientation or indebtedness of the particular economy probably also had an important influence. The aim of this paper will be to analyse the GDP growth of the selected economies and their characteristics. The analysis will be based on the selected statistical methods. The output of the analysis will be formulated as an evaluation of which factors could have influenced the response of individual economies to a negative and unexpected shock, and in what ways.

Key words: structure of the economy; GDP; impacts of a pandemic

JEL Code: C10, E01, O11

Introduction

It has been more than a year since the beginning of the pandemic related to the occurrence of the Covid - 19 virus. This pandemic has brought about many negative factors on the health of the population, but also on economic development. The global economy must face one of the greatest challenges of recent decades. Lockdowns of economies are being introduced, some types of sales are being restricted. Supplier-customer chains have been disrupted, and therefore some components for complex products have become scarce goods. These supply disruptions have serious repercussions for the companies concerned, even though a relatively long time has passed since the onset of coronavirus complications.

Obviously, the companies have had relatively enough time to diversify the risk of shortages of feedstock and semi-finished products. This fact confirms that the global economy is not able to cover some major outages even in a medium-term perspective.

In the first half of 2020, almost all world economies suffered a decline in their performance. The Annual Growth Rates of GDP often fell by more than 10%. A clear reason was the outbreak of the coronavirus pandemic, for which economies were not prepared. These declines were mostly short-term, and in subsequent periods, the particular economies mostly returned to growth, although the pandemic did not subside. However, the declining of economies in the first two quarters of 2020 was not the same everywhere. Many countries were able to use a relatively lower decline of their economies in order to expand in world markets at the expense of the countries whose economies were struggling. However, a pre-condition for this expansion was a free capacity of expanding companies.

Nevertheless, it has not yet been clearly proven what factors caused the differences in the reaction of economies to the same negative externality. It might be assumed that these factors could have significantly affected the extent to which economies were damaged. At the same time, they might have also influenced the extent to which economies were able to expand and thus considerably affect the development of these economies in the near future. Therefore, the aim of this paper is to perform a basic statistical analysis of the development of the selected macroeconomic variables and determine whether it is possible to make statistically based recommendations for changes in the structure of economies, which should be more resilient to future external shocks and respond more flexibly to market changes.

1 Literature Review

The negative effects of the pandemic on individual economies are indisputable. It is clearly an unprecedented shock, unparalleled in recent years. From the studies on the course of this pandemic, many lessons can be learned for the future development of economies, which will subsequently be able to implement individual findings of multidisciplinary research.

The effects of a pandemic are either directly the economic ones or they are related to other areas. In the economic field, the impact of the pandemic on the fiscal policy of the five largest euro area states is addressed by Hurtgen 2021, who developed the DSGE model of the future development of these economies. Another DSGE model was compiled by Costa et al. 2021. Their model is intended to predict possible scenarios of economic development based

on the fiscal and monetary policies of individual states. Changes in Indonesia's tax system for a better economic recovery are addressed by Utami et al. 2021, who recommends that taxes be more flexible and cohesive. Naisbitt et al. 2020 prepared a detailed analysis of the effects of the pandemic on the economic development of world economies. Kumar et al. in 2021 have identified the sectors most affected by the pandemic in India and are working to make a list of recommendations to reduce the negative effects of such shocks.

Even in the areas that are only indirectly related to the economic impacts of the pandemic, several interesting studies have been published. King et al. 2021 calls for the need to implement changes in health care and presents the expected effects on health and on GDP if these changes do not occur. Mansour 2021 is researching whether the pandemic has led the governments of developing countries to support the development of cashless payments and further digitization of society. Amdaoud et al. 2021 are researching what factors have caused differences in the response to a pandemic in selected European regions. They have identified the impact of the age of the population, the unemployment rate, or the number of medical staff. The correlation between the capacity of transportation and the spread of Covid-19 in selected economies has been demonstrated by Ma et al. 2021. Beckham et al. 2021 deal with the impact of the pandemic on agriculture, especially on the food-away-from-home sector (FAFH). Pedauga et al. 2021 focus on the impact of lock-down on SME in Spain. The negative effects on the development of expenditures on the cultural sector in Russia were analysed by Abankina et al. 2021.

The effects of a pandemic are not just negative. Khurshid et al. 2021 address the decline in energy consumption with other positive impacts on the global climate in 2020.

2 Research Methods

The research dealt with a basic statistical analysis of available macroeconomic data of the selected economies. For this purpose, large European economies were selected, namely France, Italy, Spain. Portugal was also monitored because of its size comparable to the Czech Republic and also due to the fact that both countries had a similar problem with managing the pandemic in some periods. Furthermore, the Scandinavian states of Sweden and Denmark were chosen because these countries opted for a different strategy in the fight against the pandemic than most of the states assessed. For the same reasons, Serbia was added to the selection. The group of selected countries also included Central European countries, i.e. the Czech Republic, Germany, Slovakia, Austria, Poland and Hungary. From the non-European

countries, the economies of the USA and Israel were chosen, as they can be considered important for their approach to the fight against the coronavirus pandemic.

The main indicator was the development of GDP, which represented the performance of the economy. Subsequently, it was determined whether there is a correlation between the development of GDP and selected indicators. Pearson's correlation coefficient was calculated by MS Excel software. Whenever a data correlation was found, moving averages were subsequently used to determine the residues. Residue independence was subsequently verified using the Durbin Watson test. Subsequently, a correlation analysis of the residues was performed.

The development of GDP was compared with the development of central bank interest rates. A comparison with monetary policy developments was carried out in order to assess a potential role of expansionary measures of central banks in early 2020. Apparently, the main objective of central banks is to maintain price level stability, but central banks loosened their monetary policies in order to help, as far as possible, in the economic recovery following the negative shock. When comparing GDP developments and interest rates, various time shifts were tested to take account of the monetary policy horizon. ECB interest rates were used for all the members of the euro area selected for monitoring. For the other countries, the interest rates of their central banks were used.

The decline in economies was compared with the ratio of household consumption and the ratio of net exports in the given economies. It was further compared with GDP per capita. A comparison with the significance of the population's consumption was intended to determine whether the extent to which the GDP of a given economy is dependent on domestic consumption did not affect the decline. Comparison with net exports was then aimed at finding out whether there is an effect of the dependence on foreign trade, which has suffered greatly owing to the particular pandemic measures taken by individual states. A comparison with GDP per capita was used to find out whether richer countries did not have a lower-impact decline due to their stronger economic base.

3 Study Results

All the data used for calculations in this article were obtained from tradingeconomics 2021, which publishes the data from the official authorities of the given economies.

The data were then processed using MS Excel software and the result of selected analyses will be presented below.

For the purposes of the article, the null hypothesis H_0 is established, which means that there is no statistically significant correlation between the monitored variables. A 95% level of significance was considered in the assessment.

3.1 The relationship between the development of GDP and the development of interest rates of central banks

In the first half of 2020, most central banks cut their interest rates to help economies within their remit and to make credit more affordable. An exception was represented by central banks, such as the ECB, which at that time already had very low interest rates and therefore, they no longer had room for reduction. Quarterly data from the beginning of 2011 to the end of 2020 were used. The calculation of the Pearson correlation coefficient r was also performed for time shifts (0-6 quarters), which were used in order to consider a possible monetary policy horizon. The results of these correlations are shown in the following tables.

Tab. 1: Correlation coefficients for the relationship between the development of GDP and interest rates with a lag

	Czech Republic		Slovakia		Germany		Poland		Serbia	
d	R	t	r	t	r	t	r	t	r	t
0	-0.032	-0.20	0.057	0.3610	0.274	1.8053	0.156	1.0034	-0.209	-1.356
1	-0.373	-2.51	0.045	0.2813	0.19	1.20856	0.025	0.1567	-0.244	-1.571
2	-0.545	-4.00	0.0298	0.1837	0.135	0.84305	-0.08	-0.525	-0.268	-1.720
3	-0.715	-6.22	0.0163	0.0991	0.086	0.53047	-0.170	-1.0544	-0.291	-1.852
4	-0.781	-7.51	0.0001	0.0010	0.068	0.40894	-0.213	-1.313	-0.328	-2.085
5	-0.822	-8.53	-0.0164	-0.097	0.078	0.46644	-0.198	-1.200	-0.309	-1.928
6	-0.869	-10.2	-0.0079	-0.046	0.0816	0.477398	-0.171	-1.015	-0.298	-1.821

Source: author

Tab. 2: Correlation coefficients for the relationship between the development of GDP and interest rates with a lag

	Austria		Italy		France		Spain		Portugal	
d	R	t	r	t	r	t	r	t	r	t
0	0.1719	1.1038	-0.019	-0.123	0.1626	1.04270	-0.190	-1.224	-0.348	-2.352
1	0.0841	0.5272	-0.086	-0.541	0.1351	0.85163	-0.20	-1.327	-0.371	-2.500
2	0.043	0.2653	-0.141	-0.879	0.1088	0.67485	-0.216	-1.368	-0.376	-2.503
3	0.0185	0.1129	-0.174	-1.080	0.0881	0.53798	-0.214	-1.337	-0.364	-2.380
4	0.0036	0.0219	-0.174	-1.060	0.0818	0.49269	-0.191	-1.170	-0.335	-2.139

5	-0.007	-0.042	-0.145	-0.872	0.0843	0.50063	-0.152	-0.9138	-0.298	-1.848
6	-0.014	-0.085	-0.09	-0.585	0.09492	0.555984	-0.095	-0.559	-0.232	-1.391

Source: author

Tab. 3: Correlation coefficients for the relationship between the development of GDP and interest rates with a lag

	Hungary		Denmark		Sweden		USA		Israel	
d	r	t	r	t	r	t	r	t	r	t
0	-0.237	-1.469	-0.158	-1.014	-0.123	-0.787	0.2729	1.794	0.284	1.876
1	-0.266	-1.634	-0.198	-1.267	-0.175	-1.112	0.2147	1.372	0.234	1.504
2	-0.255	-1.540	-0.222	-1.405	-0.153	-0.960	-0.070	-0.436	0.205	1.296
3	-0.223	-1.318	-0.209	-1.300	-0.143	-0.879	-0.259	-1.631	0.151	0.929
4	-0.180	-1.038	-0.175	-1.067	-0.053	-0.322	-0.454	-3.057	0.116	0.705
5	-0.107	-0.602	-0.156	-0.94	0.0333	0.197	-0.557	-3.967	0.112	0.669
6	-0.028	-0.149	-0.102	-0.599	0.147	0.867	-0.622	-4.635	0.157	0.931

Source: author

The critical value of the test statistic t for the given time series at the selected 95% significance level is 2.042. According to the tables Tab. 1 - Tab.3, we do not reject the null hypothesis H_0 for most economies. The results of the test criterion t for the time-shifted economies of the Czech Republic and the USA allow us to reject the null hypothesis. Therefore, a residue correlation was subsequently performed.

The centered moving averages method was used to balance the time series. The obtained residues were tested for independence using the Durbin Watson test.

The results of the residue correlation are presented in the following table.

Tab. 4: Correlation coefficients for residue correlation

	Czech Republic		USA	
d	r	t	r	t
3	0.005	0.028723		
4	-0.0915	-0.51978		
5	0.141899	0.798136	-0.25798	-1.4867
6	-0.472	-2.93246	-0.40064	-2.39501

Source: author

The results of the correlation of residues show that for the economies of the Czech Republic and the USA, with a delay of 6 quarters, we reject the null hypothesis H_0 and confirm the correlation between the examined time series.

3.2 Relationship between the value of GDP in Q1 2020 and the values of selected macroeconomic characteristics

Furthermore, the values of GDP development in the first quarter of 2020 were compared with the values of the percentage of domestic consumption and net exports per GDP, and subsequently with GDP per capita. The results are shown in the following table.

Tab. 5: Correlation coefficients for dependence with the development of GDP in Q1 2020

	the correlation coefficient	test statistics
C	0.20245	0.74538
NX	-0.2935	-1.1068
GDP per capita	-0.2984	-1.1281

Source: author

The critical value of test statistics for a given sample of 15 states at the selected 95% level of statistical significance is 2.160. The results show that in none of these cases, we reject the null hypothesis $H_{0.}$ In conclusion, in none of the cases we can confirm the correlation between how the selected economies reacted to the arrival of the pandemic.

Discussion

The results of the individual selected analyses were presented in the previous chapter. The results will now be commented on and evaluated.

The first analysis assessed the relationship between the development of GDP and the development of monetary policy of the economies, represented by the development of interest rates of central banks. As expected, no correlation was found for the euro area economies. Their monetary policy is ensured by the ECB, which implements a single monetary policy for all Member States, although their development varies. No correlation was found in most countries that have their own central bank. Only the results of the correlations and the subsequent correlations of residues in the Czech Republic and the USA confirmed the correlation between the development of GDP and the development of interest rates of the

central bank with a delay of 6 quarters. However, this correlation still does not mean causality. These results support the theory of the monetary policy horizon.

The second analysis assessed the relationship between GDP in the first quarter of 2020 and the selected macroeconomic characteristics of the monitored countries. The first characteristic was the percentage of household consumption in this GDP, the second was the percentage of the difference between the values of exports and imports in the given GDP, and the last characteristic was the GDP per capita indicator. The characteristics were chosen to represent different structures of economies based on the consumption of the population, the dependence on foreign trade and the economic maturity of the country. It is not possible to prove a correlation in any of these investigated relationships. Thus, the results did not confirm that the representation of individual sectors in GDP would have a statistically significant effect on the economy's response to an unexpected negative shock.

Conclusion

The results of the analyses presented in this article showed that there were other reasons for differences in the response of economies to an unpredictable external shock than the macroeconomic factors selected by the author. The only exceptions were the economies of the Czech Republic and the USA. In these economies, a correlation of monetary policy with a lag of 6 quarters was demonstrated, followed by the correlation of residues. This correlation supports the theory that monetary policy can partially influence the development of GDP, and it also supports the theory of the monetary policy horizon.

It is therefore clear from the results that the main influence on the reaction of the economy to an unexpected external shock, i.e. on the flexibility of the given economy, is represented by other factors. Identifying and demonstrating other factors would be a suitable goal for further research. The results of further research could lead to recommendations, the implementation of which would create more resilient economies.

There are other factors that might have had some influence, but they were not addressed in this paper. These are for example, government actions, such as e.g. quick steps to ensure the liquidity of companies, various forms of guarantees or the scope of the established lock-down. Another important factor could be the representation of the most damaged sectors of the economy in the GDP of a given state. These were mainly the tourism sectors or the sectors that are dependent on semi-finished products, which have become scarce due to the pandemic, such as electronics for the automotive industry. Another factor could be the degree of implementation of robotics and automation.

References

Abankina, TV., Matskevich, AV., Nikolayenko, EA. & Romanova, VV. (2021). Economic consequences of the coronavirus pandemic for the cultural organizations in Russia. *Voprosy Ekonomiki*, 3, 110-116. doi: 10.32609/0042-8736-2021-3-100-116 WOS: 000628596000005

Beckman, J. & Countryman, AM. (2021). The Importance of Agriculture in the Economy: Impacts from COVID-19 JEL codes. *American Journal of Agricultural Economics*. doi: 10.1111/ajae.12212, WOS: 000626505600001

Costa. CJ., Garcia-Cintado, AC. & Marques, K. (2021). Macroeconomic policies and the pandemic-driven recession. *Interantional Review of Economics & Finance*, 72, 438-465. doi: 10.1016/j.iref.2020.12.010 WOS: 000620678100028

Hurtgen, P. (2021). Fiscal space in the COVID-19 pandemic. *Applied Economics*. doi: 10.1080/00036846.2021.1904121, WOS: 000634643400001

Khurshid, A. & Khan, K. (2021). How COVID-19 shock will drive the economy and climate? A data-driven approach to model and forecast. *Environmental Science and Pollution Research International*, 28, 3, 2948-2958. Doi: 10.1007/s11356-020-09734-9

King, EM., Randolph, HL., Floro, MS. & Suh, J. (2021). Demographic, health, and economic transitions and the future care burden. *World Development*, 140, 105371. doi: 10.1016/j.worlddev.2020.105371, WOS: 000620650300002

Kumar, S., Viral, R., Deep, R., Sharma, P., Kumar, M., Mahmud, M. & Stephan, T. (2021). Forecasting major impacts of COVID-19 pandemic on country-driven sectors: challenges, lessons, and future roadmap. *Personal and Ubiquitous Computing*. doi: 10.1007/s00779-021-01530-7, WOS: 000633267300001

Ma, L., Yu.Z., Jiao, Y., Lin, L., Zhong, W., Day, SW., Poslethwaite, A., Chen, H., Li, Q., Yin, HL. & Wang, G. (2021). Capacity of transport and spread of COVID-19 an ironical fact for developed countries. *Environmental Science and Pollution Research*. doi: 10.1007/s11356-021-12765-5 WOS: 000628491600019

Mansour, H. (2021). How successful countries are in promoting digital transactions during COVID-19. *Journal of Economic Studies.*doi: 10.1108/JES-10-2020-0489 WOS: 000634169100001

Naisbitt, B., Boshoff, J., Holland, D., Hurst, I., Kara, A., Liadze, I. & Whyte, K. (2020). THE WORLD ECONOMY: Global outlook overview. *National Institute Economic Review*, 253, F35-F88. doi: 10.1017/nie.2020.33

Pedauga, L., Saez, F. &Delgado-Marquez, BL. (2021). Macroeconomic lockdown and SMEs: the impact of the COVID-19 pandemic in Spain, *Small Business Economics*. doi: 10.1007/s11187-021-00476-7 WOS: 000625598600001

Tradingeconomics (2021). Indicators data [Datafile]. Retrieved from https://tradingeconomic.com/countries

Utami, D., & Ilyas, WB. (2021). The role of tax in COVID-19 response in Indonesia: The principles of flexibility, solidarity, and transparency. *Asian Politics & Policy*. doi: 10.1111/aspp.12573 WOS: 000632701000001

Amdaoud, M., Arcuri, G. & Levratto, N. (2021). Are regions equal in adversity? A spatial analysis of spread and dynamics of COVID-19 in Europe. *European Journal of Health Economics*. doi: 10.1007/s10198-021-01280-6 WOS: 000631323700001

Contact

Jiří Nožička

University of Pardubice, Faculty of Transport Engineering, Department of Transport Management, Marketing and Logistics

Studentská 95, 532 10 Pardubice 2, Czech Republic

Jiri.nozicka@upce.cz