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A BOOTSTRAP EFFICIENCY ANALYSIS BASED ON ECONOMIC SENSITIVITY FOR THE FIRST TERM OF COVID-19

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ABSTRACT

No situation similar to the Covid-19 pandemic on a global scale has been encountered in the world lately. The uncertainty caused by the nature of the disease at the time of the emergence of Covid-19 also led to the fact that the methods of struggling with it were not fully known. Governments have started to implement strategies to combat the pandemic. However, it is debated whether the interventions of the countries are fast, serial, and effective enough. Although it is accepted that the Covid-19 crisis caused an unprecedented economic downsizing after the great depression of 1929, it is also known that countries responded seriously. In this study, the performance of countries in the pandemic was handled from an economic point of view, taking into account the Covid-19 parameters. Bootstrap Efficiency analyses conducted in 24 European countries during the period March 2020-March 2021 revealed that the countries did not exert full efficiency in terms of economic sensitivity which was used as output. The results indicated that countries should be more prepared for future risks related to the fight against the virus when assessed from an economic point of view.

Keywords: *covid-19, economic sensitivity, efficiency, European countries*

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INTRODUCTION

From the past to the present, pandemics have appeared on Earth many times. The global catastrophe of the 21st century is considered to be the Covid-19 pandemic. Covid-19 is known as a subtype of Coronavirus that is recognized well worldwide. This family of viruses first manifested itself in 2003 with the SARS pandemic. Like Covid-19, the SARS virus was first seen in China. Subsequently, the pandemics of MERS emerged in Saudi Arabia and Ebola in West Africa. The common feature of all three pandemics is that the known transmission ways originated from animals. In particular, coronaviruses transmitted via droplets can lead people to death with symptoms such as fever, cough, muscle pain, and shortness of breath. Although SARS, MERS, and the Ebola pandemic are known at the global level, Covid-19 has had a much more devastating impact in terms of indicators such as the area where it has spread, the number of cases, and death rates ([1], [2], [3]). Shortly after 31 December 2019, when China reported the disease to the World Health Organization (WHO), the first death due to Covid-19 was announced on 11 January 2020, and the WHO declared it a pandemic on 11 March 2020 [4]. The impact of Covid-19 on human health has been quite devastating. Millions of people lost their lives. For the pace of the pandemic to slow down, governments were forced to implement mandatory practices. The idea that the contagiousness of the disease would be broken depending on the distance and isolation pushed people to stay at home compulsorily. At this point, especially the places where people coexist, such as gyms, cafes, restaurants, and public-private sector workplaces were closed, face-to-face education in schools was stopped, and distance education was started. Curfews were even imposed. The global pandemic has significantly affected cultural, social, and economic activities along with these measures. Especially when judged from an economic perspective, there have been negativities in individuals, households, and firms at the micro-level and in the country's economies at the macro dimension, as well as in international economic relations.

Unlike past global crises, the crisis caused by the Covid-19 pandemic does not depend on a specific main source. The crisis caused by the global pandemic is a very comprehensive crisis in which demand, supply, and financial shocks are seen together. In the crisis that started due to Covid-19, the cessation of activities in some sectors, especially based on restriction policies, resulted in a shrinking in demand based on loss of income. On the other hand, in addition to the destruction experienced in production chains and supply structure, the decrease in employment has manifested itself as a supply shock in economies. With the collapse in asset values in both local and global financial markets, financial capital values have reached the point of evaporation [5]. Of course, the findings of the disease cannot be expected to decrease the economic growth rate, decrease the stock markets, increase inflation and increase unemployment alone. But it can be said that quarantine-based measures taken by governments have turned into a package of economic tightening while slowing the spread of the disease. For example, it seems unlikely that travel companies will gain value on the stock market in a circle where travel restrictions are increasing. Similarly, the revenues of sports clubs decreased during the period when matches were played without spectators. Conversely, the increase in demand for the food and retail sector has led to the transformation of the pandemic into an opportunity for these companies [6].

While scrutinizing the effects of the pandemic in daily life, the most important issue on the agenda was the performance of countries in the fight against the disease. For this reason, the Covid-19 process management activities of countries have been investigated by researchers. For example, Ergülen et al. [7] handled the efficiency of the Ministry of Health of the Republic of Turkey in the Covid-19 Process of April, May, June, July, August, September, and October 2020 in Turkey through Data Envelopment Analysis (DEA). In the study consisting of two analyses, the number of patients and the number of tests were selected as input variables in the first case, and the number of patients and the number of tests were selected as input variables in the second case. The output variables were determined as the number of deaths in the first case and as the number of recovered patients in the second case. The results showed that April, May, July, and September achieved full efficiency, while June, August, and October did not achieve full efficiency. In addition, April, May, and September achieved full efficiency according to the number of deaths, while June, July, August, and October did not achieve full efficiency. In another study, Selamzade and Özdemir [8] investigated the efficiency of the Organization for Economic Co-operation and Development (OECD) countries in the fight against Covid-19. In the analysis based on DEA, the number of doctors, nurses, and hospital beds per ten thousand people, and the ratio of health expenditures to Gross Domestic Product (GDP) were used as input variables. The number of tests, the number of cases, and the number of deaths per million people constituted the outputs. Eight countries were found to exert efficiency as a result of the test conducted with the Charnes Cooper Rhodes (CCR), and 11 countries were found to exert efficiency as a result of the analysis of the Banker Charnes Cooper (BCC). Shirouyehzad et al. [9] calculated global efficiency with DEA for countries that have been at least one month since the first confirmed case of Covid-19 on March 25, 2020. The inputs are the country population density and average of 13 IHRCCS in the first stage and the variables of the confirmed case in the second stage. Confirmed cases were selected in the first stage, and the number of death cases and the number of recovered cases were selected in the second stage. The average efficiency was 0.879 for the first stage and 0.627 for the second stage. Aydın and Yurdakul [10] conducted a performance evaluation using clustering analysis, weighted stochastic improve data acquisition analysis (WSIDEA), and machine learning algorithms in 142 countries. The inputs were total deaths, stringency index, extreme poverty, CVD death rate, diabetes prevalence, female smokers, and male smokers, while the outputs were population, GDP, hospital beds, total recovered patients, and total tests. As a result of the analysis, it was found that the optimum number of clusters for 42 countries was three. In addition, 20 out of 142 countries were identified to achieve full efficiency. Finally, it was observed that data such as GDP, smoking rates, and diabetes patient rates did not affect the efficiency level of countries.

It is known that the most severe impact of the Covid-19 pandemic is on economies following health. It is seen that some economic indicators are also included in the literature studies investigating the efficiencies of countries in the field of health. Based on this, the main purpose of the study is to determine how Covid-19 changes economic efficiency. In the study, the efficiency of the impact of Covid-19 on the economy was calculated by taking into account the economic sentiment indicator (ECOSENTIMENT) published by the European Statistical System (Eurostat) [11]. The ECOSENTIMENT indicator is calculated monthly for European countries that are members and candidates of the European Union and thus used to monitor GDP growth. As is known, Covid-19 data (number of cases, number of recovered patients, number of deaths, etc.) is published daily. The data can be converted into monthly and annual forms. However, there are no indicators to represent economic growth daily. For this reason, the ECOSENTIMENT variable was used in the analyses. Thus, the performance levels of the countries were measured by combining economic parameters with the indicators of the Covid-19 crisis in the early period (number of confirmed cases, rate of transmission, number of tests, number of deaths, number of recoveries, etc.). The next part of the research continued with the methodology and findings sections where detailed information was presented. It was completed with the discussion section in which the results were discussed.

METHODOLOGY

Pandemics lead to significant changes in economic, social, political, and administrative aspects, as well as the occurrence of death cases in societies. The number of cases of infection and death in a society in the process of a pandemic in a country and their rate of spread largely depend on the readiness and strength of the health system of that country [8]. The number of confirmed cases, the rate of infection, the number of tests, the strictness of the measures, the number of deaths and the number of recoveries and the economic sensitivity indicators realized in the relevant period reveal the performance in the response to the pandemic. It is expected that these indicators, which provide a serious insight, will also reveal the efficiency of the country in combating the pandemic and reflecting it on the economy.

In the light of these evaluations, the present study aims to determine the first-term efficiency scores of the pandemic for 24 countries affected by the Covid-19 pandemic. In the evaluation of efficiency, DEA was preferred as a method that provides the ability to calculate the relative efficiency of each unit.

MEASURING EFFICIENCY SCORES: DATA ENVELOPMENT ANALYSIS (DEA)

The main approach used in the calculation of efficiency values in the study is DEA. DEA is a model that includes efficient and inefficient Decision-Making Units (DMU). The linear efficiency limit formed by the efficient ones forms an “envelope” surrounding all the observations, and the efficiency scores of all the observations are determined according to this envelope curve [12]. The approach that was first used only for measuring technical efficiency under the CCR assumption was later modified by Banker, Charnes, and Cooper [13] to make it possible to measure scale efficiency under the BCC assumption.

DEA is a model that allows multi-input and multi-output efficiency analyses to be performed. In the model based on calculating the efficiency score of each DMU, the efficiency of the DMU is measured in the form of the ratio of weighted total outputs to total inputs:

$$\text{Max } e_j = \frac{\sum_{r=1}^{s} u_{rj} Y_{rj}}{\sum_{i=1}^{m} v_{ij} X_{ij}} \quad (1)$$

Where j represents DMU, and Y_{rj}, r = 1,…,s represents the number of output factors produced by the DMU, and X_{ij}, i= 1,…,m indicates the number of input factors. The weights loaded by j into the input and output factors are represented by v_{ij} and u_{rj} [14].

The weights given by the method to the inputs and outputs cannot have a negative value, and the efficiency of any DMU can exceed 1,000. Thus, many weight sets can be selected for DMUs, and there is usually a tendency to give the highest weight to the least used inputs and the most produced outputs for DMUs. In the DEA, which aims to measure how effectively the DMU uses resources to create an output set, the fact that the value of $(\sum_{r=1}^{s} u_r y_r)$ function is equal to 1,000 means that the DMU is efficient, in other cases, it is not efficient [15].

BOOTSTRAP IN EFFICIENCY

If it is difficult or impossible to obtain the sample distribution of an estimator using an asymptotic approach, and if the information about the data generation process of observations is not enough, the Bootstrap method, which is a statistical resampling method, is used. This method, proposed by Efron [16], is often used in complex problems. The main idea of this method is to create an artificial sampling distribution of the estimator of interest by making a certain number of repeated samples from the available mass sample. The Bootstrap method, which is used to make some inferences about the sample distribution, was later developed by Efron and Tibshirani [17] for some statistical inferences such as confidence interval. The data generation process takes place by resampling the original dataset to produce a set of samples taken each time the Bootstrap is repeated. The model can be estimated experimentally by applying the obtained Bootstrap samples to the original estimators. Thus, the samples created by the Bootstrap method reflect the statistical characteristics of the main sample [18].

The Bootstrap DEA method was developed by Ferrier and Hirschberg [19], as well as Simar and Wilson [20], to overcome the main deficiency of basic DEA analysis, namely the precision of sampling results, by determining confidence intervals of DEA efficiency scores. The Bootstrap DEA method was later developed by Simar and Wilson ([21], [22], [23]). In these studies, they aimed to remove the dependency between the efficiency scores and to evaluate the statistical characteristics of nonparametric efficiency scores resulting from the process of producing some unobservable data. Thus, a method has been developed with different studies to obtain the bias of DEA efficiency scores. Due to the statistical limitations of the DEA method, the Bootstrap DEA method is often used. Based on repeating the original data B times, DEA efficiency scores are recalculated with each repetition.

Based on the original DEA estimator θ DEA (x, y), the Bootstrap deviation estimation values are calculated as follows:

$$\widehat{BIAS}_B\left(\hat{\theta}_{DEA}(x,y)\right) = B^{-1}\sum_{b=1}^{B}\hat{\theta}^*_{DEA,b}\ (x,y) - \hat{\theta}_{DEA}(x,y) \quad (2)$$

In the formula, $\hat{\theta}^*_{DEA,b}\ (x,y)$ indicates the Bootstrap value, and B indicates the Bootstrap repetition count. The deviation-corrected estimator (x, y) can be calculated from the formula as follows:

$$\hat{\theta}_{DEA}(x,y) = \hat{\theta}_{DEA}(x,y) - \widehat{BIAS}_B\left(\hat{\theta}_{DEA}(x,y)\right) = 2\hat{\theta}_{DEA}(x,y) - B^{-1}\sum_{b=1}^{B}\hat{\theta}^*_{DEA,b}\ (x,y) \quad (3)$$

This deviation correction process performed according to Simar and Wilson [24], may cause an additional error. Therefore, the sample variance of the estimated Bootstrap values $\hat{\theta}^*_{DEA,b}(x,y)$ is calculated as:

$$\hat{\sigma}^2 = B^{-1}\sum_{b=1}^{B}\left[\hat{\theta}^*_{DEA,b}(x,y) - B^{-1}\sum_{b=1}^{B}\hat{\theta}^*_{DEA,b}\ (x,y)\right]^2 \quad (4)$$

EMPIRICAL RESULTS

In the study, 4 input and 2 output variables were used for 24 countries influenced by the pandemic. As input variables, the number of confirmed cases (NEWCASE), transmission rate of the disease (REPRODUCTION), the number of tests (NEWTEST), and stringency index (STRINGENCY) were determined. Also, as the output variables, the number of deaths (NEWDEAD), the number of recovered patients (RECOVERED), and the economic sentiment indicator (ECOSENTIMENT) variables were determined. The data were obtained from the Eurostat [11] and the Humanitarian Data Exchange databases [25]. The results were reported separately with the original and Bootstrap calculations as CCR and BCC. Table 1 demonstrates the original one-year CCR values of the countries in the analyses (March 2020-March 2021).

According to Table 1, the average efficiency value for March 2021 was 0.651. The efficiency value of the relevant period was well below the full efficiency value (1,000), and only France was able to reach the full efficiency level during this period. In April, this number increased to 5 (Albania, Croatia, France, Italy, and Slovenia), and the average number of efficiency increased by 15% compared to the previous month. A full efficiency was observed in 6 countries (Albania, Croatia, Cyprus, Ireland, Italy, and Latvia) in the May period, though it was one of the periods when the average efficiency level was high. Also, in the June period, 6 countries consisting of Albania, Estonia, Ireland, Lithuania, Luxembourg, and Malta reached the full efficiency level. In July, only Luxembourg was seen to have full efficiency, while in August, September, October, and November, no country achieved full efficiency in terms of original CCR values, and the average efficiency value of these 4 periods decreased by 7.32% compared to the previous period, decreasing to 0.696.

Table 1. *Original CCR Efficiency Scores*

Country	ORIGINAL CCR												
	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH
Albania	0,841	**1,000**	**1,000**	**1,000**	0,896	0,936	0,859	0,677	0,708	0,664	0,711	0,741	**1,000**
Austria	0,657	0,625	0,664	0,733	0,767	0,739	0,571	0,527	0,722	0,632	0,644	0,682	0,938
Bulgaria	0,572	0,673	0,708	0,706	0,783	0,792	0,656	0,693	0,818	0,819	0,690	0,681	0,965
Croatia	0,786	**1,000**	**1,000**	0,805	0,944	0,989	0,850	0,820	0,816	0,946	**1,000**	0,994	0,895
Cyprus	0,638	0,867	**1,000**	0,738	0,702	0,649	0,558	0,524	0,529	0,565	0,500	0,513	0,635
Denmark	0,454	0,532	0,617	0,617	0,615	0,598	0,704	0,663	0,689	0,772	0,702	0,688	0,805
Estonia	0,626	0,704	0,899	**1,000**	0,985	0,829	0,893	0,736	0,720	0,785	0,812	0,688	0,871
Finland	0,511	0,659	0,887	0,949	0,803	0,772	0,776	0,731	0,720	0,739	0,683	0,727	0,949
France	**1,000**	**1,000**	0,616	0,620	0,591	0,683	0,689	0,881	0,852	0,810	0,859	0,771	0,890
Germany	0,650	0,755	0,667	0,691	0,645	0,706	0,601	0,722	0,864	**1,000**	**1,000**	0,897	**1,000**
Greece	0,776	0,787	0,703	0,671	0,631	0,647	0,610	0,567	0,717	0,596	0,527	0,557	0,748
Hungary	0,636	0,803	0,999	0,660	0,616	0,606	0,686	0,578	0,745	0,726	0,635	0,623	0,982
Ireland	0,418	0,731	**1,000**	**1,000**	0,578	0,588	0,546	0,670	0,519	0,509	0,697	0,616	0,802
Italy	0,955	**1,000**	**1,000**	0,777	0,622	0,658	0,539	0,774	0,934	0,845	0,826	0,828	**1,000**
Latvia	0,716	0,722	**1,000**	0,756	0,831	0,818	0,776	0,664	0,624	0,638	0,671	0,686	0,745
Lithuania	0,585	0,743	0,955	**1,000**	0,966	0,974	0,727	0,613	0,647	0,756	0,750	0,747	**1,000**
Luxembourg	0,879	0,985	0,827	**1,000**	**1,000**	0,763	0,716	0,680	0,700	0,764	0,739	0,759	0,990
Malta	0,664	0,596	0,918	**1,000**	0,739	0,816	0,677	0,618	0,710	0,668	0,697	0,686	**1,000**
Portugal	0,446	0,462	0,497	0,586	0,602	0,589	0,542	0,589	0,665	0,594	**1,000**	**1,000**	**1,000**
Romania	0,409	0,514	0,638	0,658	0,751	0,740	0,645	0,636	0,720	0,734	0,883	0,830	**1,000**
Slovakia	0,465	0,944	0,744	0,851	0,891	0,884	0,570	0,577	0,603	0,657	0,675	0,740	0,976
Slovenia	0,636	**1,000**	0,772	0,831	0,857	0,679	0,572	0,549	0,577	0,692	0,804	0,787	**1,000**
Spain	0,957	0,795	0,856	0,518	0,515	0,626	0,630	0,766	0,674	0,626	0,954	0,813	0,805
Turkey	0,361	0,494	0,530	0,664	0,696	0,672	0,659	0,531	0,940	**1,000**	**1,000**	**1,000**	**1,000**
Mean	*0,651*	*0,766*	*0,812*	*0,785*	*0,751*	*0,740*	*0,669*	*0,658*	*0,717*	*0,731*	*0,769*	*0,752*	*0,917*

Table 2. *Bootstrap CCR Efficiency Scores*

Country	BOOTSTRAP CCR												
	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH
Albania	0,716	0,805	0,862	0,844	0,801	0,859	0,791	0,626	0,649	0,620	0,664	0,654	0,830
Austria	0,606	0,569	0,620	0,698	0,733	0,690	0,534	0,508	0,664	0,578	0,594	0,647	0,890
Bulgaria	0,521	0,629	0,657	0,677	0,754	0,756	0,603	0,644	0,719	0,707	0,620	0,613	0,888
Croatia	0,719	0,807	0,832	0,747	0,876	0,947	0,776	0,755	0,759	0,830	0,815	**0,893**	0,806
Cyprus	0,578	0,777	0,870	0,636	0,658	0,594	0,534	0,500	0,509	0,521	0,464	0,497	0,613
Denmark	0,425	0,484	0,574	0,580	0,587	0,575	0,673	0,634	0,665	0,721	0,645	0,640	0,757
Estonia	0,580	0,624	0,799	0,797	0,894	0,758	**0,847**	0,702	0,694	0,753	0,775	0,647	0,799
Finland	0,474	0,608	0,822	0,853	0,722	0,719	0,746	0,702	0,699	0,716	0,661	0,700	0,911
France	0,792	0,803	0,577	0,587	0,548	0,656	0,642	**0,803**	0,795	0,741	0,795	0,741	0,861
Germany	0,601	0,683	0,617	0,641	0,608	0,666	0,563	0,693	0,781	0,823	0,815	0,788	0,848
Greece	0,706	0,714	0,657	0,635	0,607	0,628	0,588	0,547	0,663	0,551	0,509	0,537	0,726
Hungary	0,550	0,694	**0,874**	0,598	0,576	0,568	0,639	0,551	0,695	0,651	0,570	0,568	0,889
Ireland	0,364	0,661	0,812	0,847	0,547	0,567	0,525	0,623	0,500	0,492	0,657	0,577	0,772
Italy	0,815	0,852	0,832	0,667	0,563	0,621	0,499	0,691	0,817	0,745	0,722	0,726	0,814
Latvia	0,667	0,651	0,826	0,669	0,746	0,735	0,716	0,640	0,593	0,611	0,641	0,651	0,701
Lithuania	0,532	0,677	0,869	0,829	0,866	**0,890**	0,698	0,581	0,623	0,694	0,665	0,667	0,823
Luxembourg	0,806	**0,878**	0,746	**0,865**	**0,935**	0,720	0,690	0,649	0,653	0,705	0,698	0,719	**0,941**
Malta	0,592	0,532	0,802	0,842	0,698	0,777	0,648	0,592	0,675	0,640	0,665	0,629	0,829
Portugal	0,416	0,430	0,476	0,549	0,573	0,567	0,522	0,572	0,634	0,550	0,859	0,807	0,811
Romania	0,368	0,462	0,607	0,619	0,709	0,698	0,597	0,600	0,637	0,629	0,768	0,715	0,809
Slovakia	0,419	0,840	0,669	0,786	0,820	0,803	0,540	0,560	0,588	0,632	0,642	0,701	0,904
Slovenia	0,561	0,793	0,660	0,746	0,771	0,645	0,551	0,507	0,514	0,617	0,704	0,686	0,858
Spain	**0,819**	0,705	0,772	0,471	0,493	0,611	0,613	0,730	0,648	0,596	**0,878**	0,760	0,782
Turkey	0,337	0,462	0,504	0,626	0,644	0,634	0,615	0,485	**0,860**	**0,857**	0,820	0,877	0,813
Mean	*0,582*	*0,672*	*0,722*	*0,700*	*0,697*	*0,695*	*0,631*	*0,620*	*0,668*	*0,666*	*0,694*	*0,685*	*0,820*

This situation started to improve partially since 2 countries (Germany and Turkey) reached the full efficiency level in December. Full efficiency was ensured in 4 countries including Croatia and Portugal in January, and Germany and Turkey continued their level of efficiency in December. In February, there was a decrease again, and this count of countries decreased to 2 (Portugal and Turkey). In March 2021, the last month of the research period, the count of countries that ensured full efficiency reached the highest, and full efficiency was ensured in 9 countries consisting of Albania, Germany, Italy, Lithuania, Malta, Portugal, Romania, Slovenia, and Turkey. In addition, this period is the period when the highest average level of efficiency (0.917) was achieved during the relevant period when decreases and increases were encountered.

In Table 2, Bootstrap CCR scores are given. Because Bootstrap efficiency measurement contains a more accurate calculation, lower efficiency values were encountered compared to the original CCR measurement. According to this measurement, it is observed that no country that is the subject of the research for the relevant period reached the full level of efficiency. The highest level of efficiency during the corresponding period was in March 2021, and the lowest level of efficiency was in March 2020. Decreases and increases in Bootstrap CCR values throughout the process were detected. The highest efficiency value during the period was in March 2021 in Luxembourg. The highest efficiency values were recorded in Spain in March 2020 and January 2021; Luxembourg in April, June, July, and March 2021; Hungary in May; Lithuania in August; Estonia in September; France in October; Turkey in November and December; and Croatia in February.

Table 3 shows the original BCC values of the 24 countries in the analyses for March 2020-March 2021. According to the analysis results, the average efficiency value was 0.727 in the March 2021 period. According to BCC values, Albania and France achieved full efficiency during this period. In April, the number of countries which were able to reach the full level of efficiency increased to 6 "(Albania, Croatia, France, Italy, Luxembourg, and Slovenia). The increase continued during the May period, and there was full efficiency in 9 countries (Albania, Croatia, Cyprus, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, and Malta). In June, there was a small decrease in the average efficiency level, and 8 countries including Albania, Estonia, Finland, Ireland, Latvia, Lithuania, Luxembourg, and Malta reached the full level of efficiency. Only Croatia, Latvia, and Luxembourg were found to achieve full efficiency during the July period, while the count of countries achieving efficiency decreased to 2 in August, and the efficiency in Latvia and Lithuania reached the level of 1,000. No country appears to have achieved full efficiency in terms of original BCC values in September and October. This situation has started to improve partially since Turkey reached full efficiency in November. In December, Turkey and Germany achieved full efficiency, and in January, Turkey and Germany, which continued the level of efficiency they reached, as well as Croatia, Portugal, and Spain, a total of 5 countries, achieved full efficiency. In February, there was a decrease again, and this number decreased to 2 (Portugal and Turkey). In March 2021, the last month of the research period, there was a significant efficiency increase of 16.5% compared to the previous month, the number of countries ensuring full efficiency reached the highest, and full efficiency was achieved in 10 countries including Albania, Germany, Italy, Lithuania, Luxembourg, Malta, Portugal, Romania, Slovenia, and Turkey. In addition, this period is the period when the average efficiency level (0.924) closest to the full efficiency level was reached during the research period in which the declines and rises were seen.

The Bootstrap BCC values are presented in Table 4. According to the Bootstrap BCC measurement, it seems that no country that is the subject of the research reached the full level of efficiency during the research period. The highest level of efficiency during the corresponding period was in March 2021, and the lowest level of efficiency was in March 2020. During the process, Bootstrap BCC values were detected to initially rise and then decline again. The highest efficiency value during the period was in August in Croatia, and the lowest level of efficiency was in March 2020 for Ireland.

Table 3. *Original BCC Efficiency Scores*

Country	**ORIGINAL BCC**												
	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH
Albania	**1,000**	**1,000**	**1,000**	**1,000**	0,925	0,937	0,883	0,678	0,713	0,666	0,714	0,811	**1,000**
Austria	0,849	0,696	0,665	0,753	0,782	0,758	0,599	0,576	0,781	0,690	0,668	0,683	0,969
Bulgaria	0,679	0,721	0,781	0,779	0,805	0,807	0,739	0,728	0,856	0,838	0,720	0,689	0,975
Croatia	0,830	**1,000**	**1,000**	0,822	**1,000**	0,993	0,905	0,878	0,846	0,979	**1,000**	0,997	0,913
Cyprus	0,647	0,911	**1,000**	0,754	0,707	0,691	0,559	0,546	0,554	0,672	0,568	0,541	0,659
Denmark	0,584	0,740	0,658	0,622	0,635	0,615	0,716	0,697	0,709	0,851	0,738	0,702	0,822
Estonia	0,663	0,732	0,901	**1,000**	0,986	0,830	0,894	0,739	0,724	0,789	0,814	0,710	0,900
Finland	0,548	0,742	0,892	**1,000**	0,837	0,838	0,796	0,749	0,740	0,747	0,692	0,747	0,950
France	**1,000**	**1,000**	0,661	0,639	0,615	0,702	0,727	0,908	0,865	0,856	0,897	0,781	0,894
Germany	0,761	0,851	0,691	0,708	0,668	0,729	0,618	0,737	0,869	**1,000**	**1,000**	0,943	**1,000**
Greece	0,806	0,876	0,712	0,671	0,642	0,658	0,618	0,591	0,763	0,645	0,553	0,581	0,764
Hungary	0,644	0,805	**1,000**	0,730	0,622	0,636	0,734	0,608	0,805	0,767	0,643	0,635	0,984
Ireland	0,487	0,822	**1,000**	**1,000**	0,584	0,597	0,576	0,732	0,531	0,561	0,736	0,665	0,805
Italy	0,960	**1,000**	**1,000**	0,780	0,686	0,691	0,573	0,833	0,958	0,873	0,850	0,843	**1,000**
Latvia	0,717	0,738	**1,000**	**1,000**	**1,000**	**1,000**	0,777	0,667	0,644	0,673	0,705	0,718	0,755
Lithuania	0,620	0,771	**1,000**	**1,000**	0,968	**1,000**	0,729	0,628	0,664	0,807	0,768	0,749	**1,000**
Luxembourg	0,922	**1,000**	0,997	**1,000**	**1,000**	0,763	0,759	0,690	0,723	0,766	0,741	0,762	**1,000**
Malta	0,807	0,642	**1,000**	**1,000**	0,739	0,818	0,679	0,628	0,710	0,672	0,699	0,723	**1,000**
Portugal	0,578	0,615	0,563	0,661	0,617	0,606	0,568	0,621	0,702	0,615	**1,000**	**1,000**	**1,000**
Romania	0,493	0,640	0,664	0,708	0,783	0,768	0,682	0,661	0,766	0,757	0,892	0,831	**1,000**
Slovakia	0,555	0,953	0,760	0,858	0,917	0,941	0,578	0,636	0,633	0,689	0,691	0,763	0,978
Slovenia	0,802	**1,000**	0,857	0,847	0,867	0,693	0,576	0,604	0,624	0,749	0,885	0,817	**1,000**
Spain	0,969	0,842	0,862	0,536	0,542	0,651	0,653	0,788	0,694	0,639	**1,000**	0,817	0,807
Turkey	0,522	0,726	0,596	0,710	0,730	0,693	0,675	0,559	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
Mean	*0,727*	*0,826*	*0,844*	*0,816*	*0,777*	*0,767*	*0,692*	*0,687*	*0,745*	*0,762*	*0,791*	*0,771*	*0,924*

Table 4. *Bootstrap BCC Efficiency Scores*

Country	**BOOTSTRAP BCC**												
	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH
Albania	**0,851**	0,818	0,861	0,813	0,838	0,854	0,772	0,621	0,646	0,613	0,651	0,739	0,828
Austria	0,789	0,646	0,609	0,713	0,749	0,712	0,566	0,557	0,737	0,649	0,621	0,638	0,844
Bulgaria	0,622	0,668	0,731	0,741	0,756	0,761	0,688	0,678	0,766	0,737	0,656	0,624	**0,894**
Croatia	0,763	0,817	0,816	0,762	**0,911**	**0,945**	**0,837**	0,821	0,797	**0,878**	0,827	**0,889**	0,803
Cyprus	0,585	0,812	**0,875**	0,653	0,649	0,627	0,527	0,518	0,531	0,634	0,542	0,521	0,641
Denmark	0,558	0,708	0,612	0,579	0,609	0,592	0,682	0,672	0,682	0,812	0,688	0,654	0,728
Estonia	0,606	0,655	0,793	0,810	0,880	0,756	0,832	0,702	0,692	0,749	0,768	0,676	0,826
Finland	0,502	0,698	0,811	0,880	0,756	0,783	0,761	0,722	0,718	0,719	0,667	0,722	0,873
France	0,813	0,819	0,628	0,599	0,574	0,670	0,686	**0,836**	0,808	0,800	0,836	0,740	0,799
Germany	0,721	0,795	0,641	0,659	0,636	0,690	0,577	0,708	0,775	0,816	0,815	0,816	0,819
Greece	0,700	0,779	0,648	0,621	0,619	0,636	0,594	0,570	0,712	0,608	0,534	0,559	0,737
Hungary	0,563	0,704	0,858	0,661	0,577	0,602	0,696	0,578	0,766	0,706	0,582	0,587	0,863
Ireland	0,446	0,738	0,826	0,858	0,553	0,575	0,559	0,685	0,512	0,545	0,685	0,629	0,736
Italy	0,840	**0,857**	0,849	0,682	0,633	0,661	0,538	0,766	0,849	0,786	0,755	0,747	0,817
Latvia	0,657	0,661	0,816	**0,859**	0,822	0,857	0,714	0,640	0,618	0,650	0,680	0,688	0,709
Lithuania	0,569	0,693	0,848	0,817	0,855	0,888	0,677	0,596	0,637	0,753	0,689	0,666	0,816
Luxembourg	**0,851**	0,843	0,870	0,839	0,874	0,694	0,680	0,657	0,665	0,687	0,680	0,701	0,822
Malta	0,737	0,576	0,863	0,829	0,680	0,760	0,644	0,583	0,661	0,638	0,660	0,668	0,813
Portugal	0,558	0,595	0,539	0,633	0,583	0,583	0,551	0,603	0,672	0,574	0,853	0,819	0,815
Romania	0,465	0,609	0,629	0,676	0,744	0,729	0,639	0,626	0,697	0,666	0,785	0,725	0,816
Slovakia	0,517	0,847	0,674	0,777	0,814	0,866	0,547	0,619	0,619	0,663	0,658	0,723	0,867
Slovenia	0,736	0,816	0,747	0,758	0,751	0,655	0,553	0,572	0,570	0,688	0,800	0,725	0,821
Spain	0,849	0,765	0,788	0,494	0,522	0,637	0,637	0,750	0,668	0,605	**0,937**	0,753	0,738
Turkey	0,487	0,699	0,563	0,675	0,684	0,659	0,633	0,519	**0,933**	0,866	0,817	0,875	0,817
Mean	*0,658*	*0,734*	*0,746*	*0,724*	*0,711*	*0,716*	*0,650*	*0,650*	*0,697*	*0,702*	*0,716*	*0,704*	*0,802*

CONCLUSION

Nowadays, it is discussed that the Covid-19 pandemic has come to an end. Considering two years ago, the main goal in all countries was to prevent and control the spread of the pandemic. On the other hand, the treatment of people infected with the disease and the supply and production of drugs and a vaccine or other methods that will provide this treatment have been intensively studied. On the other hand, the pandemic has been the main source of many problems, from economic downsizing to unemployment, from financial difficulties to trade contractions, to businesses stopping their activities. With the pandemic, the whole world has faced a crisis environment that is not limited to the health sector. Of course, states have resorted to the necessary struggle policies with the onset of the crisis. How effectively countries were able to perform against this shock they faced in the early period of Covid-19 Bootstrap efficiency analysis was carried out in 24 countries by focusing on the period of March 2020-March 2021, which is considered to be the first period of the pandemic. Average efficiency data showed that the full efficiency value was not reached in any country. The analysis revealed that the economic efficiency of the policies of countries against Covid-19 was not realized at the desired level. When today's technology and sophistication are taken into account, it is impossible to imagine that production will stop all over the world for even one day, but the world has experienced this situation. Thus, the result has now brought up concepts such as new economic models, different structural reforms, and system renewal. Now it is wondered how the years will be shaped after the pandemic. It is because the digitalization, social networks, distance education, homeworking, individual life, the future of globalization, and capitalism should be reassessed by examining the role of the government in the education and health sectors.

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