The Efficiency of Governments` Policies to COVID-19: A Top-Down Approach Based on DEA Window Analysis

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Abstract

When all countries are battling Covid-19 by adopting different policies, it could help address the issue of government response policy efficiency. This study examines the efficiency of government intervention policies in 19 countries, the efficiency of preventing the spread, and also the mortality caused by the virus. The policies are categorized based on the Oxford COVID-19 Government Response Tracker, which combines various indicators, including Containment and closure, Economic response, and Health systems.

Given that the governments apply a top-down approach to design these policies, the current research evaluates the efficiency of policies based on the same approach. Here, two different models have been used to calculate the efficiency of policies. We designed a combined index in both models and applied Window DEA method to determine the output quantities in the efficiency ratio. The results of our study show that in both models, Japan, Finland and Thailand had the highest level of government response efficiency. The countries with the lowest government response efficiency were the United States, Spain, and Russia in the first model, and China, Italy, and Spain in the second.

Keywords: Coronavirus, COVID-19, DEA Window Analysis, Healthcare, Efficiency of Policy

JEL Classification: C61, I18, H11

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1. Introduction

Since the beginning of 2020, human societies worldwide have been facing a crisis; a communicable disease and its consequences. The novel coronavirus has been spreading in different countries and put the governments in the hard place of battling this virus alongside saving the economy. When it comes to battling this disease, the involved governments have shown different levels of capability. At the very first stage of facing the pandemic, countries like Canada, France, and Germany have indicated a lower than average inefficiency in preventing the spread of COVID-19, but after a while they faced an increase in their efficiency. While some other countries like Australia and South Korea have managed to improve their performance in preventing the spread of COVID-19 (Ghasemi et al, 2020).

To prevent the spread of coronavirus, various restrictions are applied to daily activities in different countries e.g., school closure, workings from home, and gatherings ban. However, some of these restrictions cause major economic costs (Bonacini et al, 2020; Deb, Furceri et al, 2020). Labor markets in many countries have been influenced, as an overall increase in the unemployment rate is being observed (Kapicka & Rupert, 2020). The lockdown and other restrictions have also led to a GDP decline (Barro et al, 2020; Bonadio, Huo et al, 2020), which affects all countries, but the developing countries suffer more than the others (McKibbin & Fernando, 2020). So, in addition to the massive biological threat that COVID-19 has caused, it has short term economic consequences and long term socio-economic impacts. The pandemic particularly makes the countries with lower level of economic development struggle more (Stojkoski et al, 2020). These countries are not as prepared as developed countries to face such an economic shock; hence they are less likely to afford restrictions such as social distancing (Robalino, 2020). Nevertheless all involved countries are dealing with heavy pressure on their economy, the high unemployment rate, GDP reduction, an increase in poverty, and a decrease in manufacturing exports that translate into a recession for many countries (Decerf et al, 2020; Lahmiri & Bekiros, 2020; Verikios, 2020).

What the world is dealing with is originally a health crisis, where the influences of it are very much related to the characteristics of each society. The virus is a communicable disease, so population characteristics are shown to play a role in the disease's mortality rate. The age structure is one of these characteristics since the elderly are at higher risk (Chen et al, 2020; Dowd et al, 2020; Remuzzi & Remuzzi, 2020; Shim et al, 2020; Verity et al, 2020). Also, where the population is dense, the risk of spreading the virus is higher (Gaeta, 2020).

Looking at the virus's biological and socio-economic consequences indicates the importance of government capability in eliminating the multidimensional damage caused by COVID-19, i.e., government performance. The governments of affected countries and particularly the developing countries need to find out the tradeoff between saving lives and saving the economy(Robalino, 2020). Therefore, a very crucial question to ask in this global crisis is whether the involved governments have found the best possible way out of this tradeoff between the health issue and the economic problems. In doing so, focusing on countries with a higher level of development would give the chance to find the appropriate performance in a crisis as such, thus a model for other countries can be found.

Considering the nature of the current crisis, it is not possible to evaluate the governments' performances to halt Covid-19 by directly comparing the number of infected people and the number of deaths. An evaluation, as such, would not be possible for two reasons. First, demographic characteristics such as population, population density, and aging rate are different.

Second, different policies with different stringencies have been adopted to control this epidemic. Based on these reasons, the question that arises is how efficient the intervention policies of governments in different countries have been to deal with this pandemic?

2. Research Methodology

Based on the CDC definition, “Policy” is “a law, regulation, procedure, administrative action, incentive or voluntary practice of governments and other institutions.” (Control & Prevention, 2013). Policies can operate at different levels (national, state, local, or organizational) that could influence complex systems to improve the health and safety of a population.

Policies are categorized into three different types; Legislative, regulatory, and organizational policies. The first type of policies, legislative policies, includes laws and ordinances that are created by elected representatives. The second type, regulatory policies, can be defined as rules and principles created by the government agencies with regulatory authority. Organizational policies, as the third type, are rules and practices established within agencies and organizations (Control & Prevention, 2013).

When evaluating a policy, we examine the content, implementation, or impact of that particular policy. Thus, policy evaluation help us understand the merit, worth, and utility of the studied policy (Control & Prevention, 2013). Policy evaluation as a dynamic and continuous activity is always considered by governments, private enterprises, and non-profit organizations. Although various methods have been proposed by various researchers to evaluate public policies (Association, 2012; Bauman et al, 2014; Smith et al, 2009), the authors of this article have presented an innovative method for evaluating the efficiency of the government's response to the COVID-19 pandemic.

In general, two different approaches can be used in policy design (Perrels, 2001):

Top-down approach: In this approach, the focus is on designing appropriate policies rather than targeting. Therefore, this approach is more efficiency-oriented than effectiveness-oriented.

Bottom-up approach: In this approach, effective targets are distinguished in great detail, and policy tools are considered according to the targets set. So this group of policies focuses more on effectiveness than efficiency.

The difference between these two approaches can be seen in the framework of the following diagram:

Figure 1: Policy design approaches

Approach	**Instruments**	**Measures**	**Effects**
Top-Down	Instruments →	? ⇢	Effects
Bottom-Up	? ⇢	Measures →	Effects

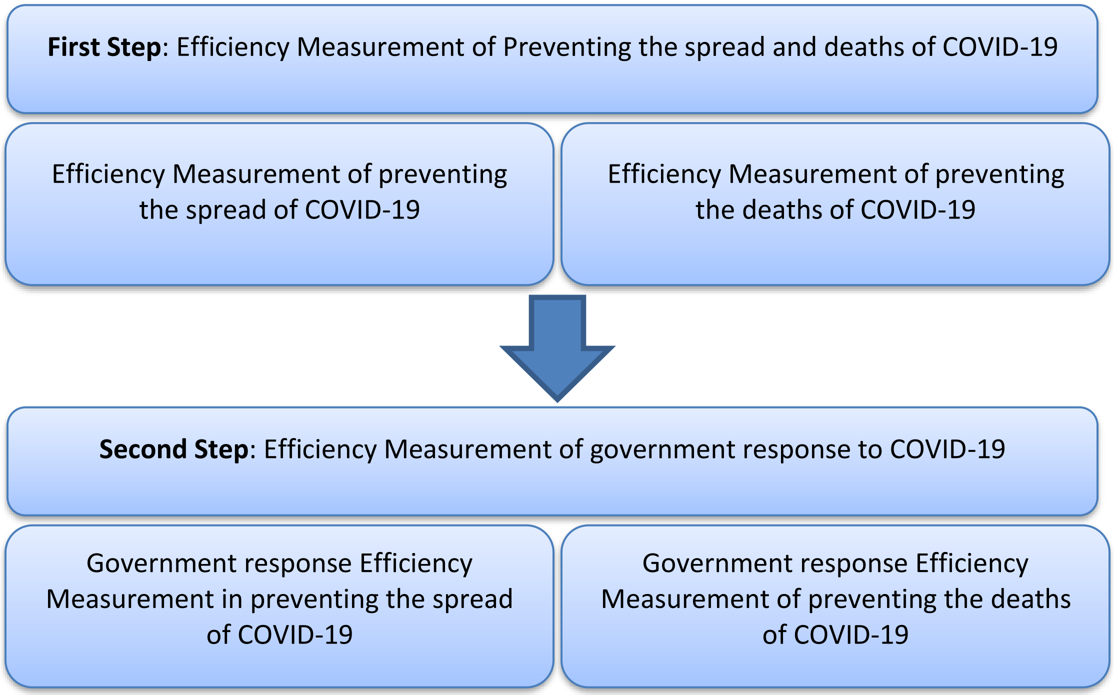
Source: Perrels, 2001

Depending on the type of approach towards policy design, the method of policy evaluation can also be different. Developing health policies in the two areas of coronavirus spread prevention and mortality reduction in different countries focuses on the Top-down approach. Therefore, to analyze the policies adopted by different countries, measuring the efficiency of policies is the preferred indicator compared to policies' effectiveness.

Due to the heterogeneity of different countries in terms of parameters such as population, population density, the age distribution of the population, etc., the variables of the number of coronavirus cases and the number of deaths cannot be used directly as an undesirable output. To solve this problem, the authors have used a combined index in two areas of preventing the spread of coronavirus and also preventing mortality. Also, due to the diversity and multiplicity of policies used in these two areas, a proxy indicator has been used for different governments' responses.

This paper follows a two-step measurement procedure to determine the government response efficiency with the efficiency of preventing the spread of COVID-19 as an intermediate output and the efficiency of preventing the deaths of COVID-19 as the final output of governments` responses. The stepwise methodological framework could be presented in figure 2.

Figure 2: Stepwise Framework for Government Response Efficiency



Source: Authors

2.1. Efficiency Measurement of Preventing- the Spread and Deaths of COVID-19

To measure and analyze the two types of efficiency, preventing the spread and preventing the deaths caused by COVID-19, this research takes two main steps, where the first step includes various sub-steps. To begin with, the population, population density, and confirmed cases of coronavirus are taken as the inputs. Hence, this part of the model is the first sub-step that gives us the inefficiency of halting the virus's spread.

Next, the second sub-step of the model takes the output of the previous one as an input. In other words, the inefficiency of halting the outbreak becomes an input to calculate the inefficiency of preventing the mortality of coronavirus patients. Other inputs in the second sub-step are population and the percentage of population at the age of 65 and above.

The DEA[1] window analysis is considered the developed basic DEA method to evaluate the dynamic effects through the time-invariant as well as time-varying data (Charnes & Cooper, 1984). Based on the concept of moving average, this approach can provide dynamic efficiency indicators through the separated DMUs at different periods. This methodology also exhibits the comparison results of efficiency performance across the countries of study throughout the consecutive windows of the suggested time periods. Hence, the input (X_n^t)- as well as output (Y_n^t) vectors of the DEA methodology are presented as follows:

$$X_n^t = \begin{bmatrix} x_n^{1t} \\ . \\ . \\ . \\ x_n^{rt} \end{bmatrix} , \; Y_n^t = \begin{bmatrix} y_n^{1t} \\ . \\ . \\ . \\ y_n^{rt} \end{bmatrix} \qquad (1)$$

1 - Data Envelopment Analysis

Where the k $(1 \leq k \leq T)$ is the time of the starting window, and w $(1 \leq w \leq T - k)$ is the window width of the model. Therefore, the input, as well as output matrices of each window (kw), are as following:

$$X_{kw} = \begin{bmatrix} x_1^k & \cdots & x_N^k \\ \vdots & \ddots & \vdots \\ x_1^{k+w} & \cdots & x_N^{k+w} \end{bmatrix} \quad , \quad Y_{kw} = \begin{bmatrix} y_1^k & \cdots & y_N^k \\ \vdots & \ddots & \vdots \\ y_1^{k+w} & \cdots & y_N^{k+w} \end{bmatrix} \tag{2}$$

Then, the results of DEA window analysis are generated as the inputs, and outputs of DMUs are substituted through the models. Also, the number of time periods under investigation should be considered to determine the window width of DEA. It is worthy noted that based on Zhang et al. (2011), the DEA window analysis implicitly suggests the existence of no technical changes during the time period under consideration through each window (Zhang et al, 2011) since in this research each specific country is evaluated across the others for a specific month within a given window. Specifically, this paper uses a narrow window width to follow the research question. According to Charnes et al. (1997), the time periods of window width should be selected to achieve the best possible balance through the explanatory power and also stability of the efficiency measure throughout the suggested models (Charnes et al, 1997). Therefore and per Halkos and Tzeremes (2009) and Zhang et al. (2011), the window width of two $(w = 2)$ is selected in this paper to have the statistically and practically justifiable efficiency results (Halkos & Tzeremes, 2009; Zhang et al, 2011). Given that the data used in this study are monthly, the first two months are taken as the first window. Then, the window of the model starts moving on a month period by dropping the basic month and adding a new month. Moreover, the process of the second window will be adjusted from the next two months of 2020 and then continued to the last window that is the last two months of 2020. Finally, the 2 windows are used in this paper for each country and then have 18 (n × w = 19 × 2) as the number of DMUs in each window. Consequently, the DEA window analysis method is applied in this study to investigate the time-invariant as well as time-varying data across the performance efficiency of 19 selected countries in two dimensions, i.e., inefficiency of preventing spread and also deaths caused by the coronavirus.

2.2 Government Response Efficiency

The second step of the measurement procedure is to calculate the government response efficiency (GRE) as a composite indicator to prevent the spread and death caused by COVID-19. The efficiency of government response was calculated once using the ratio of government efficiency in preventing the spread of coronavirus to the government response index and in the next step using the ratio of preventing death efficiency from coronavirus to the government response index as follows:

$$GRE_{i,t} = \frac{PE_{i,t}}{GRI_{i,t}} \tag{3}$$

Where, $GRE_{i,t}$ denotes government response efficiency measurement as the ratio of preventing the spread of coronavirus and preventing death from coronavirus efficiency ($PE_{i,t}$) to government response index ($GRI_{i,t}$) of the countries under consideration at time t. It's also worth noted that all countries' indicators are necessary to be normalized in order to make them comparable in a reasonable framework. In this way, normalizing the ratio of two efficiencies to the government response index with a linear max-min normalization method as equation (4) is the last step in calculating the government response efficiency. The normalized value r_{ij} for positive (benefit) criteria a_{ij} is acquired as:

$$r_{ij} = \frac{a_{ij}}{\max \quad a_{ij}} \qquad for \quad i = 1,2,\dots,m \qquad j = 1,2,\dots,n \tag{4}$$

3. Data and variables

Due to data limitation, only 19 countries were selected for which coronavirus cases information existed at least for a period of 8 months (January to August 2020) in internationally reputable databases. The selected countries are Australia, Canada, China, Finland, France, Germany, India, Malaysia, Russia, Singapore, Sweden, Thailand, The United States, Italy, Spain, Japan, Philippines, South Korea and The United Kingdom.

3.1 Input

With respect to this research' goal that investigates the efficiency of policies applied by governments to control the prevalence and mortality of Covid-19, the Oxford COVID-19 Government Response Tracker (OxCGRT) is used as input (Hale & Webster, 2020). This index is aggregated into four policy indices, and each index is composed of a series of individual policy response indicators. oxCGRT, include:

- Containment and closure
- Economic response
- Health systems
- Miscellaneous

The combination of policies used to determine the numerical values of this combined index in 4 different dimensions is as follows:

Table (1): Government Response Tracker (OxCGRT) Dimensions and Policies

Dimensions	Policies
Containment and closure	School closing
	Workplace closing
	Cancel public events
	Restrictions on gathering size
	Close public transport
	Stay at home requirements
	Restrictions on internal movement
	Restrictions on international travel
Economic response	income support
	debt/contract relief for households
	fiscal measures
	giving international support
Health systems	Public information campaign
	testing policy
	contact tracing
	emergency investment in healthcare
	investment in Covid-19 vaccines
Miscellaneous	Other responses

Source: The University of Oxford, 2020 (Hale et. Al., 2020)

The monthly values of this index for the selected countries from January to August 2020 are as follows:

Table (2): Government Response Tracker (OxCGRT) Monthly Values

Ountries	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Australia	4.05	23.72	39.18	68.12	69.70	61.51	75.26	81.07
Canada	5.05	8.33	42.40	73.53	72.53	71.73	70.00	71.97
China	24.71	64.80	67.96	58.35	70.38	76.77	77.88	77.88
Finland	0.62	9.64	38.79	54.75	50.87	42.86	46.13	46.79
France	2.11	11.86	62.18	82.69	79.53	65.51	53.46	56.19
Germany	3.89	17.28	45.26	69.57	65.35	65.66	60.47	61.26
India	2.94	17.31	57.31	93.85	83.74	79.05	77.46	78.84
Italy	1.38	33.12	74.12	84.62	66.60	60.26	63.11	60.42
Japan	5.06	21.51	38.88	47.69	46.96	37.27	38.61	41.88
Korea, South	1.34	38.04	60.82	69.21	53.36	62.50	58.16	58.72
Malaysia	7.65	23.72	42.27	75.72	76.37	68.95	60.53	66.05
Philippines	2.83	26.86	57.71	89.62	81.41	70.64	74.83	65.07
Russia	0.45	8.33	41.95	81.41	80.87	76.26	73.48	68.71
Singapore	16.62	29.33	35.15	71.66	82.42	75.47	65.01	64.10
Spain	1.16	17.15	46.82	79.36	75.41	59.51	63.04	65.92
Sweden	0.33	10.26	27.56	47.70	48.08	47.39	45.47	44.23

Thailand	0.00	0.00	30.94	76.78	80.13	71.81	58.33	55.98
United Kingdom	2.79	17.88	36.74	73.08	71.11	77.26	73.47	73.75
US	1.37	7.73	43.46	71.47	71.47	70.10	68.41	67.63

Reference: The University of Oxford, 2020 (Hale & Webster, 2020)

The trend for different countries shows changes both between countries and in one country over time. However, it shows an increase in government intervention and the adoption of stricter policies to control the disease.

3.2 Outputs

To calculate the efficiency of government control policies, two outputs in the form of two different models have been used:

3.2.1 Model (1): Inefficiency of preventing coronavirus spread as an intermediate output

To calculate this output, a dynamic data envelopment analysis model with one (undesirable) output and two inputs was designed to investigate the inefficiency of countries in preventing the spread of coronavirus.

Output: coronavirus confirmed cases from January to August in selected countries[2]

Inputs: Population[3] and Population density[4] are the most important factors that could affect each country's coronavirus cases (Gaeta, 2020). The number of COVID-19 cases is directly related to the population of countries. Population density can be measured by the number of human inhabitants per square kilometer. Given the emphasis on social distancing for reducing the spread of the virus, it is expected that the higher the population density in a country is, the higher the chances of spreading the virus are. Among the selected countries in our study, China and India

2 - Data are from Johns Hopkins University Center for Systems Science and Engineering (CSSE), (2020).
3- Data are from World Bank (2020).
4 - Data are from World Bank (2020).

have the largest populations, and Finland and Singapore have the lowest populations. In our sample, Singapore and India have the highest population density, and Australia and Canada have the lowest population density.

Table (3): Inefficiency of preventing coronavirus spread

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Average
Australia	0.98%	0.66%	17.95%	2.81%	0.66%	0.85%	6.70%	6.34%	4.62%
Canada	0.22%	0.59%	24.36%	46.27%	36.99%	9.56%	5.59%	6.87%	16.30%
China	17.48%	53.78%	0.17%	0.04%	0.01%	0.02%	0.04%	0.03%	8.95%
Finland	0.32%	0.83%	10.64%	23.94%	11.87%	1.65%	0.63%	2.50%	6.55%
France	0.17%	1.80%	35.95%	59.51%	10.87%	3.53%	4.56%	27.65%	18.00%
Germany	0.17%	1.37%	38.23%	38.10%	8.40%	3.83%	3.08%	8.33%	12.69%
India	0.00%	0.00%	0.10%	0.63%	2.93%	5.42%	9.50%	19.50%	4.76%
Italy	0.06%	25.45%	73.48%	58.73%	15.22%	3.24%	1.98%	7.30%	23.18%
Japan	0.17%	1.04%	0.52%	1.81%	0.34%	0.23%	1.32%	2.53%	1.00%
Korea, South	0.32%	51.62%	4.86%	0.63%	0.53%	0.69%	0.48%	2.32%	7.68%
Malaysia	0.46%	0.62%	3.73%	3.68%	2.03%	0.64%	0.19%	0.23%	1.45%
Philippines	0.01%	0.01%	0.60%	1.15%	1.77%	2.62%	4.89%	12.04%	2.89%
Russia	0.04%	0.00%	2.54%	38.38%	100.00%	59.42%	31.12%	29.17%	32.58%
Singapore	3.93%	11.43%	6.34%	94.26%	100.00%	37.52%	25.18%	15.18%	36.73%
Spain	0.04%	1.71%	90.80%	87.14%	18.79%	5.60%	14.08%	77.00%	36.89%
Sweden	0.18%	1.21%	21.25%	60.51%	60.21%	74.35%	14.58%	13.83%	30.76%
Thailand	0.52%	0.32%	1.03%	0.63%	0.06%	0.04%	0.03%	0.04%	0.33%
United Kingdom	0.05%	1.22%	26.56%	76.53%	40.43%	10.18%	5.13%	9.86%	21.24%
US	0.05%	0.08%	62.00%	100.00%	80.47%	72.52%	100.00%	87.59%	62.84%

Reference: Authors' Calculations

Given that the numbers in this table indicate inefficiency, efficiency values were used to calculate the government responses efficiency using the following equation:

$$Efficiency_{jt} = 1 - Inefficiency_{jt} \quad (5)$$

3.2.2 Model (2): inefficiency of preventing deaths caused by coronavirus as a final output

The second model focuses on the number of deaths due to Covid-19 instead of focusing on the number of cases of Covid-19. In this stage, a dynamic DEA model with an (undesirable) output and three inputs is designed as follows:

Output: Coronavirus confirmed deaths in each month[5]

With respect to the zero mortality cases in some selected countries, our data is starting March and continuing until August.

Inputs: Undoubtedly, one of the factors influencing the number of coronavirus deaths is who countries operate in preventing the coronavirus spread. Therefore, the countries' inefficiency in preventing the coronavirus spread, which is the result of the first model, was used as an input in the second model.

The number of population and the population aged 65 and above (% of the total population)[6] in each country, are other inputs used in the second model.

The results of using this model to calculate the inefficiency of countries in controlling mortality from coronavirus are as follows:

Table (4): inefficiency of preventing deaths caused by coronavirus

	Mar	Apr	May	Jun	Jul	Aug	Average
Australia	0.38%	3.54%	6.99%	5.00%	1.68%	4.93%	3.75%
Canada	1.42%	37.46%	55.62%	57.20%	81.35%	62.68%	49.29%
China	70.30%	99.27%	100.00%	99.54%	94.16%	100.00%	93.88%
Finland	0.59%	7.16%	9.70%	9.72%	9.76%	9.84%	7.79%
France	22.11%	84.42%	88.94%	100.00%	98.48%	76.23%	78.36%

5 - Data are from Johns Hopkins University Center for Systems Science and Engineering (CSSE), (2020).
6 - Data are from World Bank (2020)

Germany	4.14%	23.10%	29.51%	24.68%	24.38%	21.89%	21.28%
India	1.72%	27.99%	29.47%	51.82%	74.48%	77.87%	43.89%
Italy	45.68%	90.55%	95.53%	98.50%	100.00%	98.07%	88.05%
Japan	8.65%	13.79%	31.83%	16.51%	2.85%	4.32%	12.99%
Korea, South	4.84%	28.00%	11.12%	3.03%	3.49%	2.06%	8.76%
Malaysia	1.74%	2.55%	1.54%	1.45%	3.62%	6.80%	2.95%
Philippines	12.13%	24.31%	8.54%	6.35%	7.77%	8.97%	11.34%
Russia	0.74%	4.43%	13.04%	21.41%	26.30%	29.51%	15.90%
Singapore	0.11%	0.52%	0.72%	0.75%	0.77%	0.77%	0.61%
Spain	38.25%	95.24%	97.82%	100.00%	100.00%	100.00%	88.55%
Sweden	8.51%	53.90%	77.91%	89.13%	91.72%	91.48%	68.77%
Thailand	1.31%	5.59%	10.64%	8.30%	7.81%	10.80%	7.41%
United Kingdom	19.29%	86.48%	96.35%	99.14%	100.00%	100.00%	83.54%
US	12.39%	81.27%	92.16%	98.58%	92.01%	100.00%	79.40%

Reference: Authors' Calculations

Given that the numbers in this table indicate inefficiency, efficiency values were used to calculate the government responses efficiency using the following equation:

$$Efficiency_{jt} = 1 - Inefficiency_{jt} \tag{6}$$

4. Results

The ranked average normalized Government Response Efficiency of preventing the spread of COVID-19 (as the intermediate output) and ranked normalized Government Response Efficiency of preventing the deaths caused by the virus (as the final output) are shown in table 5. The country on the top has achieved the highest level of GRE among the countries of study.

Table (5): Average Normalized Government Response Efficiency

Ranking of Countries	GRE (Intermediate Output Approach)	GRE (Final Output Approach)	Ranking of Countries
Japan	100.00%	100.00%	Japan
Finland	83.62%	95.04%	Finland
Thailand	74.35%	78.94%	Thailand
South Korea	68.72%	77.65%	Singapore
Malaysia	65.96%	73.78%	Malaysia
Australia	62.60%	73.64%	Australia
Sweden	62.10%	72.32%	South Korea
China	59.24%	63.04%	Germany
Germany	57.48%	60.66%	Russia
Philippines	56.17%	58.87%	Philippines
India	51.38%	42.29%	Sweden
Canada	50.96%	40.86%	Canada
France	50.25%	35.92%	India
United Kingdom	47.79%	19.96%	US
Italy	47.63%	19.32%	United Kingdom
Singapore	42.28%	16.06%	France
Russia	39.02%	11.13%	Spain
Spain	33.10%	7.66%	Italy
US	12.05%	4.19%	China
Average	**56.04%**	**50.07%**	**Average**

Reference: Authors' Calculations

The final analysis of the results requires careful attention to the concept of focus in this research. We have estimated the efficiency of involved governments' response to the current crisis; hence the policies they have been applying are evaluated here. It is true that some governments at some point have saved more lives than the others. However, once in a dynamic approach, we consider the policies, the compatibility of applied policies to the current situation and the characteristics of each country become important. In other words, the applied rules to halt the virus can be very strict, but the level of enforcement and the perceived stringency also play a role in achieving a better outcome. In a country where mildly less strict rules are applied but a higher level of acceptance and cooperation towards the rules have taken place, better results are achieved. To have the big picture of the analysis, this compatibility is necessary, as the stringency and enforcement of new rules and policies go hand in hand. At the end, the more successful responses are performed by the governments that have been taking the compatibility into account.

5. Conclusion

This research applies a dynamic DEA to evaluate the Government Response Efficiency of 19 countries struggling with the COVID-19 pandemic. Our model shows that Japan has performed the most efficient response to the pandemic in preventing the spread and preventing the mortality caused by COVID-19. However, United States of America indicates the lowest response efficiency of preventing the spread of coronavirus and China shows the lowest response efficiency of saving coronavirus's patients and controlling the deaths caused by the virus. Previous studies have directly examined the performance of governments in preventing the spread of the coronavirus and reducing its mortality rate. This research uses a systematic methodology and presents a two-step hybrid innovative approach to calculating government response efficiency. Thus, not only the governments' ability to save their citizens from the virus is measured here, but the compatibility of these governments' relevant policies to the current situation of each county is evaluated. The more compatible the policies are, the better the final outcome is. Further research suggested by the authors can be about why some countries have managed to respond more efficiently than the others based on the context and fundamental factors in each country.

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