Assessing Governmental Performance Amidst the COVID-19 Pandemic

Ian Cooper

University of San Diego, Shiley-Marcos School of Engineering

Applied Data Science

October 22, 2020

Abstract

Across 21 countries, three sets of criteria (fatality rate, number of tests, and stringency) were implemented to assess quality of response. One criterion (share of population over age 65) was used to assess risk factors. The resulting index encapsulated how well countries managed the pandemic, given their risk profiles. It was found that the model provided a statistically significant result for measuring government performance. The objective of this study was to provide a new benchmark which can be used both now and, in the future, to assess government performance. By implementing a new set of criteria to demonstrate a straight-forward way of perceiving how individual countries are responding to the most severe global recession since World War II (The Economist, 2020), it will help crystalize our understanding of this period in time and hopefully help incite newly proposed solutions to global crises like this moving forward.

Introduction

Study Objectives & Previous Research Uses

The COVID-19 pandemic has had sweeping implications on the trajectory of the world economy and the general well-being of nations across the globe. While government-imposed social distancing measures have helped preserve the lives of millions, great strides must still be made to return the world to the relative normalcy it once enjoyed. Becoming acutely aware of the relationship between government intervention and nationwide response during a global health crisis can help mitigate the length of time in which precautionary measures are needed to keep the virus at relative bay.

Countries have responded to the coronavirus in different ways in terms of action/inaction in the form of government-imposed social distancing measures (The Economist, 2020). Furthermore, through the assignment of certain criteria it is possible to quantify government effectiveness.

The Economist (2020) assessed the quality of OECD countries' responses to COVID-19. This EIU tracker ranked of the quality of response by the government while also considering risk factors such as obesity prevalence and the amount of international arrivals in the wake of the pandemic (The Economist *et al.*, 2020).

Similarly, Konig & Winkler (2020) implemented two separate performance metrics were used to rank countries based on COVID-19 policy response. In addition to the EIU index, the COVID-19 Misery (CM) index was introduced. The CM index also utilized descriptive statistics such as start stringency, sustained stringency, deaths per million, and delay to convey analogous findings pertaining to the importance of the government in handling the pandemic's impact (Konig, 2020). It is, however, important to note that the EIU and CM indices were not the same in terms of scope (or amount of countries included in the sample), and each country was graded on a scale unique to that particular index.

While the purpose of these previously reported studies places some emphasis on projections for economic growth, there have been various political as well as social events that have occurred since their publication in July 2020. Based on the notion that these projections will continue to fluctuate tremendously given the current circumstances, the implementation of the most precise criteria for determining government effectiveness was of the upmost importance.

Generalized Formula

As a generalized formula example to measure the variable of interest, Governmental Performance, as seen in (1).

$$\mathit{Governmental\_Performance}\begin{pmatrix} 1 = Poor \\ 2 = Fair \\ 3 = Good \\ 4 = Very\ Good \end{pmatrix}$$

$$= \beta_0 + \beta_1 Death\_Rate\begin{pmatrix} 1 = Poor \\ 2 = Fair \\ 3 = Good \\ 4 = Very\ Good \end{pmatrix} + \beta_2 Administration\_of\_Tests\begin{pmatrix} 1 = Poor \\ 2 = Fair \\ 3 = Good \\ 4 = Very\ Good \end{pmatrix}$$

$$+ B_3 \mathit{Stringency}(\mathrm{Y} \mid \mathrm{N}) + B_4 \mathit{Share\_of\_Population\_65+\_years}\begin{pmatrix} 1 = Poor \\ 2 = Fair \\ 3 = Good \\ 4 = Very\ Good \end{pmatrix} + \varepsilon \qquad (1)$$

Where Governmental_Performance is the variable of interest;

Independent variables are defined below;

β_0 is the intercept;

$\beta_{(1-i)}$ are the regression coefficients; and

ε is the standard error associated with regression coefficients (Vanderbilt, 2018).

To measure how well individual countries responded to the coronavirus pandemic, it was necessary to introduce a variety of independent variables. These variables pertain to the administration of COVID-19 tests, the death rate, the stringency of government-imposed social distancing measures, and the share of populations aged 65+ across the various countries in the sample population. Since certain countries face inherently greater risk due to the age and health of its citizens, it was necessary to include the proportion of elderly people in (1).

An indicator of strong government performance would be a "Very Good" ranking amongst the variables measuring quality of response. Variables β_1, β_2, β_3, and β_4 measured the initiative as well as the effectiveness by which governments acted in response to the pandemic while considering potential biases including the age and general health of population.

To explain the variation of the data from one data point to another, Table I provides a clear idea about the distribution of the data.

Exploratory Data Analysis

Table I

Variable	Measure of Location & Dispersion
Death Rate (per million)	
Mean	257.69
Median	150.45
Minimum	4.14
Maximum	846.7
Range	842.56
Tests (per million)	
Mean	3.38
Median	4
Mode	4
Standard Deviation	0.84
Range	3
Stringency	
Mean	0.0453
Median	0.034
Mode	0.0215
Standard Deviation	0.0401
Range	0.1501
Share of Population Age 65+	
Mean	0.1233
Median	0.12
Mode	0.09
Standard Deviation	0.0259
Range	0.08

The measure of location/dispersion shows the scattering of the data. According to Table I, Tests, Stringency, and Share of Population Age 65+ each conveyed standard deviations within three of the mean. The Death Rate served as the only independent variable in the study with a notable amount of variability amongst the data. This can be conveyed by the range, which measures the difference between the minimum and the maximum values in the data set. According to the data set, while Australia was able to mitigate the amount of deaths in its country to 4.14 deaths per million people, Belgium faced significantly greater challenges in its pursuit to do the same. It is important to note, however, that no outliers existed in the data set despite the disparity between the minimum and maximum values in the data set, which totaled 846.7. Countries such as Australia, Japan, New Zealand, and South Korea were each able to keep the death rate in their respective countries to under 10 deaths per million people. Countries such as Sweden, Spain, UK, Italy and Belgium experienced at least 500 deaths per million people in their respective countries.

The mean was greater than the median for both Death Rate and Stringency, therefore the distribution was positively skewed. While the Share of Population Age 65+ showed negligible differences amongst measures of location, the Tests variable was negatively skewed due to the value of the median exceeding that of the mean.

The characteristics of geographic location for the population were displayed in Table II.

Table II
Characteristics of 21 Countries

Variable	Population N (%) (N = 21 Countries)	EMEA n (%) (n=16)	APAC n (%) (n=3)	Americas n (%) (n=2)	*p*-value*
Death Rate (per million)					<0.0001
> 600 (1)	4 (19.0%)	4 (25%)	0 (0%)	0 (0%)	
400 - 600 (2)	2 (9.5%)	2 (12.5%)	0 (0%)	0 (0%)	
200 - 400 (3)	4 (19.0%)	3 (18.8%)	0 (0%)	1 (50%)	
< 200 (4)	11 (52.4%)	7 (43.8%)	3 (100%)	1 (50%)	
Administration of Tests (per million)					<0.0001
< 15,000 (1)	1 (4.7%)	0 (0%)	1 (33.3%)	0 (0%)	
10,000 - 20,000 (2)	2 (9.5%)	2 (12.5%)	0 (0%)	0 (0%)	
20,000 - 50,000 (3)	6 (28.6%)	5 (31.3%)	0 (0%)	1 (50%)	
> 50,000 (4)	12 (57.1%)	9 (56.3%)	2 (66.7%)	1 (50%)	
Stringency					<0.0001
> 5% daily rate of positive cases (0)	6 (28.6%)	5 (31.3%)	0 (0%)	1 (50%)	
< 5% daily rate of positive cases (1)	15 (71.4%)	11 (68.8%)	3 (100%)	1 (50%)	
Share of Population 65+ Years Old					<0.0001
> 20% (1)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
15-20% (2)	4 (19.0%)	3 (18.8%)	0 (0%)	1 (50%)	
10-15% (3)	11 (52.4%)	8 (50%)	2 (66.7%)	1 (50%)	
< 10% (4)	6 (28.6%)	5 (31.3%)	1 (33.3%)	0 (0%)	

*p-values based on Pearson chi-square test of association

The population, which consisted of 21 countries, was divided into three regions: Europe, Middle East and Africa (EMEA), Asia Pacific (APAC), and the Americas. The majority of the countries included as part of the sample population were located in the EMEA region, whereas a low proportion of the sample population was located in the Americas and APAC regions. Proportionately more 10,000 – 50,000 administered tests per million were in EMEA than the overall population (p < .0001). While 0% of the sample population for both APAC and the Americas had a death rate over 400,000 million people, the same cannot be said about EMEA; six countries in the EMEA sample had a death rate of over 400,000 million people (37.5%).

As it relates to COVID tests, at least 50% of the sample population in each of the three regions similarly administered more than 50,000 tests per million people. While it should be noted that the amount of countries included in the sample population for the Americas was the fewest, the daily rate of positive cases eclipsed 5% for half of the subjects. This is proportionately higher than EMEA and APAC, however 31.3% of subjects in EMEA revealed the same. Nonetheless, in each of the three regions at least 50% of subjects boasted a sub-5% daily rate of positive cases. An area of consideration, which could be directly correlated to the amount of deaths in a given region was the share of the population 65 years of age and above. Similarly, EMEA, APAC and the Americas displayed 10-15% of their respective populations were 65+ years old. A statistically-significant association was found between these variables and region at an α level of 0.05 (p <0.0001).

Regression Analysis

Table III

Sample Population	**Death Rate**	**Gov't Perform.**	X^2	$x * y$	$x - \bar{x}$	$(x - \bar{x})^2$	$y - \bar{y}$	$(y - \bar{y})^2$	$\hat{y} = 0.8372X + 0.2105$	$(y - \hat{y})^2$	$(\hat{y} - \bar{y})^2$
Australia	4	4	16	16	0.95	0.91	1.24	1.53	3.56	0.19	0.64
Austria	4	4	16	16	0.95	0.91	1.24	1.53	3.56	0.19	0.64
Belgium	1	1	1	1	-2.05	4.19	-1.76	3.10	1.05	0.00	2.94
Chile	4	3	16	12	0.95	0.91	0.24	0.06	3.56	0.31	0.64
Denmark	4	4	16	16	0.95	0.91	1.24	1.53	3.56	0.19	0.64
France	3	3	9	9	-0.05	0.00	0.24	0.06	2.72	0.08	0.00
Germany	4	4	16	16	0.95	0.91	1.24	1.53	3.56	0.19	0.64
Iceland	4	4	16	16	0.95	0.91	1.24	1.53	3.56	0.19	0.64
Italy	1	1	1	1	-2.05	4.19	-1.76	3.10	1.05	0.00	2.94
Israel	4	4	16	16	0.95	0.91	1.24	1.53	3.56	0.19	0.64
Japan	4	2	16	8	0.95	0.91	-0.76	0.58	3.56	2.43	0.64
Netherlands	2	2	4	4	-1.05	1.10	-0.76	0.58	1.88	0.01	0.77
New Zealand	4	4	16	16	0.95	0.91	1.24	1.53	3.56	0.19	0.64
Norway	4	4	16	16	0.95	0.91	1.24	1.53	3.56	0.19	0.64
Portugal	3	3	9	9	-0.05	0.00	0.24	0.06	2.72	0.08	0.00
South Korea	4	2	16	8	0.95	0.91	-0.76	0.58	3.56	2.43	0.64
Spain	1	1	1	1	-2.05	4.19	-1.76	3.10	1.05	0.00	2.94
Sweden	2	2	4	4	-1.05	1.10	-0.76	0.58	1.88	0.01	0.77
Switzerland	3	2	9	6	-0.05	0.00	-0.76	0.58	2.72	0.52	0.00
UK	1	1	1	1	-2.05	4.19	-1.76	3.10	1.05	0.00	2.94
US	3	3	9	9	-0.05	0.00	0.24	0.06	2.72	0.08	0.00
SUM:	64	58	224	201	0.00	28.95	0	**27.81**			**20.29**
MEAN:	3.05	2.76									

r^2 = 20.29/27.81 = **0.7297**

r = $\sqrt{(r^2)}$ = $\sqrt{0.7297}$ = 0.8542

H_0: *p* = 0

H_a: *p* ≠ 0

$\alpha = .01$

$$t = \frac{0.8542\ (\sqrt{21-2})}{\sqrt{1-(0.8542)^2}}$$

t = 7.1603

p-value = 0.0001

The proportion of variance in the dependent variable that can be attributed to the independent variable can be identified as r^2; the square of the correlation was approximately 0.73. In a given regression model, if the observed values and estimated values are far apart, r^2 will be closer to 0, and if there is a perfect fit between said values, r^2 will be equal to 1. Therefore, $r^2 = 0.73$ proved that the compared values between Death Rate and Government Performance were closely correlated. According to the regression equation, $\hat{y} = 0.8372X + 0.2105$, based on the value of the unbiased coefficient estimate that had low variance, the model suggested that as the independent variable increases, the dependent variable tended to increase as well.

Based on the utility test of the simple linear regression model using $\alpha = .01$, there were important takeaways pertaining to the relationship between the variables. If the *p*-value were equal to 0, we would fail to reject the null hypothesis, and if the *p*-value was not equal to 0 we would reject the null hypothesis. Since the *p*-value was less than the significance level 0.01, the null hypothesis was rejected. Thus, there was sufficient evidence to conclude that there was a useful linear relationship.

Limitations of Existing Research

While the results of the analysis were clear, the lack of reliable data represented the most significant limitation of this study. Not only were there reports on countries falsifying daily positivity rates, hospitalizations, and deaths, the amount of available data in general was somewhat limited in certain parts of the world. Other possible limitations in the study included cross-country differences in healthcare quality and availability. Furthermore, the nature in which deaths were reported lack context; health-related issues amongst people which contributed to their deaths were not acknowledged in reporting efforts. For a large percentage of the reported fatalities, their symptoms likely became exacerbated due to poor auto-immune function. This was a factor that was only partially accounted for through the criterion which attempted to assess risk. Still, the model provided a statistically significant result for measuring government performance.

Conclusion

The significance of this study cannot be overstated. Without analyzing the available data during critical points in human history, we are doomed to repeat our mistakes as a society. Early in the lockdown, most people were taken aback by the unfathomable situation that still seemingly has an unforeseen end. Many were claiming that their basic rights were being violated and that governments on the federal and state level were overstepping. Still, we have largely managed to follow the lead of our government officials to create a blueprint for navigating around a global health scare. This was made possible through studies which helped create a fair and just narrative surrounding a situation with a lot of uncertainty.

References

The Economist. (2020). *How well have OECD countries responded to the coronavirus crisis?* https://pages.eiu.com/rs/753RIQ438/images/Coronavirus%20whitepaper%20V3.pdf?mkt_tok=eyJpIjoiTWpRMk5HTTFaVGhpWVRGaSIsInQiOiJua0tsZVZxOEMwc1BmYVRVYlY0SDFpb3BRbkdvSHhXT2tCYnpLV1B1ZmxHd0JoZHpOeUQ2XC9jS0tUZzl0MndiOHJsNDc2eHVrZXoycGhMclFKS0Z1Zm9welNrV1lSOU9DemhxS0I1dTRNY0lDa25rZGZXelFNWXBsMDNpbXREOWEifQ%3D%3D

Konig, M., & Winkler, A. (2020). COVID-19 and Economic Growth: Does Good Government Performance Pay Off? *Intereconomics, 55*(4), 224-231. https://doi.org/10.1007/s10272-020-0906-0