What national factors contributed to the handling of Covid-19?

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Introduction

Since the outbreak of COVID-19, the virus that brought the world to a standstill, countries have handled the virus with differing policies and ideologies and against the backdrop of existing infrastructure.

A pertinent question, which we are sure will be subject to tremendous analysis and discussion by experts present and future, is what are the factors that contributed to the countries' handling of the virus? Given the data supplied to us, we attempted to answer this question through an exploratory approach.

How is the handling of Covid-19 measured?

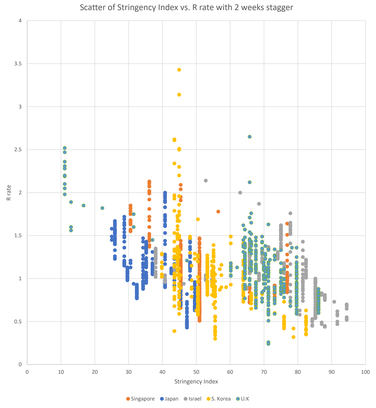
The first part of answering this question is deciding on a measure of how well each country handled the virus.

To do this, we decided on taking the R rate as the measure of impact of the virus for each country since it was the only variable that was self-normalised, that is, it wouldn't vary by different definitions of measurements between countries.

To additionally compare how well countries handled the pandemic, we looked at the Stringency Index of each country as it was the only variable each country could control. Therefore, our measure of virus handling is defined as the R rate relative to the Stringency Index.

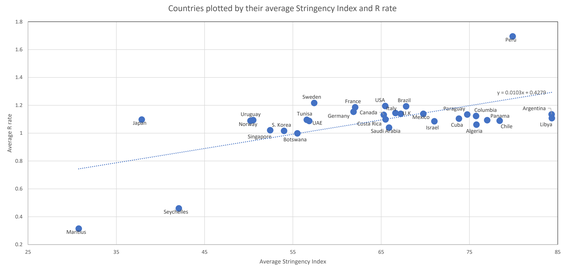
Evidence

Plotting the R rate vs. Stringency Index gives an idea of how the pandemic was handled



For each day of data available, the Stringency Index was plotted against the corresponding R rate 2 weeks ahead. In this example, comparing the four countries in Asia most similar to the U.K. in terms of Human Development Index, we can see different country behaviours. The positional cluster of the points tells us how the R rate varied relative to how stringent the country was. That means a country which handled the virus better, would be positioned at a lower R rate for the same Stringency Index

Global trends show that Stringency Index correlated with R rate



We compared the 6 most similar countries to the U.K across each continent and plotted the centres of mass (averages) of their R rate vs. Stringency Index clusters. Linear regression was carried out to see the trend of Stringency Index versus R rate.

- **The trend shows that countries with a higher Stringency Index have a higher R rate.**
- **Countries positioned below the line have done relatively better than the countries below.**

We next tested to see if any parameters were correlated to the positioning of a country and thus how relatively well they handled the pandemic. We investigated the following parameters individually as we believe they are they ones most likely to influence the R rate:

1 GDP per Capita

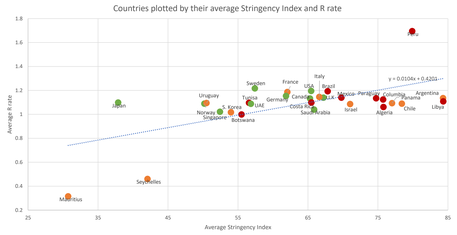
2 Life Expectancy

3 Population Density

4 Human Index Development

The countries were ranked according to those parameters and the best- , average-, and worst-performing countries were coloured in relative to their position (green to orange to red respectively). We expected to see the better ranked countries within each parameter to be more below the average trend line representing a better response to the pandemic.

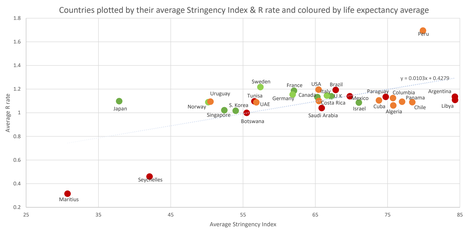
1. GDP per Capita



Countries with higher **GDP per Capita** are ranked green while the countries with lowest GDP per Capita are ranked red. GDP per Capita can be considered as a representation of the living standards within a country and how prosperous citizens feel.

The trend highlights that countries with a higher GDP per Capita appear to be positioned above the trend line indicating a higher R rate.

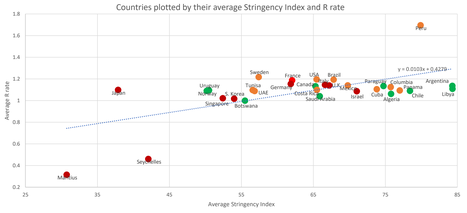
2. Life Expectancy



Countries with higher **Life Expectancy** are ranked green while the countries with lower Life Expectancy are ranked red. Life Expectancy can be considered as a representation of the overall health within a country.

The trend highlights that countries with a higher Life Expectancy appear to be positioned above the trend line indicating a higher R rate.

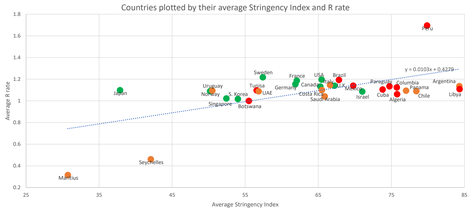
3. Population Density



Countries with lower **Population Density** are ranked green while the countries with higher Population Density are ranked red. We expect that countries with lower population density would have lower spread of the virus.

The trend highlights that countries with a lower Population Density appear to be positioned below the trend line indicating a lower R rate.

4. Human Development Index



Countries with higher **Human Development Index** are ranked green while the countries with lower Human Development Index are ranked red. Human Development Index is a composite measure of quality of life and includes education.

The trend highlights that countries with a higher Human Development Index appear to be positioned above the trend line indicating a higher R rate.

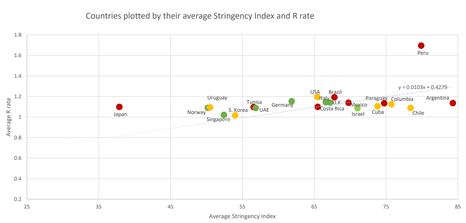
Results & Conclusion

The surprising results showed the more developed countries tended to fare relatively worse

We would expect that countries with higher GDP per Capita, Life Expectancy, and Human Development Index would be able to have lower R rates relative to the Stringency Index. This is because those parameters are associated with better education, healthcare, and infrastructure which would assist in stopping the spread of the virus. However, we saw the opposite trend and only the Population Density correlated with a country's R rate. Therefore, it seems like Population Density is a key factor influencing the R rate within a country.

To investigate why the more developed nations had worse R rates relative to the Stringency Rate, we considered the hypothesis that more developed nations had better infrastructure for testing and identifying cases, resulting in higher R-rates. Therefore, we next looked at the average Testing per Thousand over the time period of data collection in each of the countries to see if testing affected R rate.

Average testing per thousand



Countries with higher average Testing per Thousand are ranked green while the countries with lower average Testing per Thousand are ranked yellow to red.

We expect that countries with higher average Testing per Thousand would have higher measured R rates.

The graph shows that there isn't a clear trend in average Testing per Thousand and R rates.

Our findings show that it is difficult to predict how well a country will handle a virus

We have shown that many parameters, which we expected to correlate to better handling of the virus, as measured by R rate, during the pandemic was not in fact true, and actually showed the opposite. Interestingly, out of all our parameters tested, only a lower population density seemed to have some correlation with lower R rates. Therefore, a possible explanation of the observed trends is that the more developed countries would be more urbanised and industrialised, leading to more concentrated populations, resulting in higher R rates.

Of course, this work has also highlighted that there is no clear parameter or even set of parameters that can predict or correlate to how well a country has handled the pandemic. Even so, many parameters that can potentially affect the spread of the virus were not included in the data set such as the percentage of urban population. Additionally, some parameters such as cultural attitudes towards the virus would be difficult to quantify. Further studies should seek to address those parameters of interest.

We recommend that as low population density appeared to slow the spread of the virus, social distancing is a key strategy in limiting the spread of the virus.