

## Relating Government Policies to Covid-19 Pandemic

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### Abstract

The Covid-19 Pandemic has threatening the human being as a whole starting from the January of 2020. In response to the crisis, government authorities across the globe have come up with varied range of reactions and precautions in controlling the spread of the virus, as what we have taken from the Government Reactions Dataset. In the Report, we examine the level of reactions of governments by constructing a Government Reaction Index (GRI) by nations, following a timeline from January to August; combining GRI and with growth rates, confirmed cases and other numerical indications of the virus spread to explore whether these reactions are effective. We draw a solid overall conclusion of how governments take actions in response to the crisis, and particularly few representative countries for a more detailed observation. The research gives clear indications of the and helps to construct the idea of governments' future actions.

### Keywords

Covid-19 Confirmed Cases; Covid-19 Growth Trend; Government Reaction Index (GRI).

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## 1. Introduction

Covid-19 has putting a great threat on human beings, to control the spread of the disease, government authorities around the world have come up with a large range of reactions. In the work, by combining GRI with rate of growth, number of confirmed cases and other indexes, we analyze government authorities' reactions to the Covid-19 disease numerically and graphically. The research uses graphics and analysis to reveal and relate government policies and government reactions.

## 2. Dataset Information

### 2.1 Data cleaning

#### 2.1.1 Covid-19 dataset (Daily Data)

From the code `unique(lapply(all, names))`, we can know that the names of data sets are different, and there are four kinds of them. While differences like "Province.States" and "Province\_States" can be fixed with `gsub`, it is need to add columns in order to combine all data sets. We subset all data sets into 4 types according to the numbers of columns and combine each kind of data sets together. Then, we add needed columns to each type and make them in the same order for the purpose of combining all data sets. After merging all data sets together using `rbind`, we discovered that the country names are not unified. For example, in column "Country\_Region", there are "China" and "Mainland China". We decide to use a new data set which includes many possible wrong names for countries and provides right names and iso for them. Since looping over the original data set will be very slow because of the length of it, we decide to loop over the new data set and correct the country names in

the original data set. However, that new data set doesn't include every wrong country name in the original data set, thus we need to add rows to keep it working. After doing all cleaning, we add population, iso, and code to the data set for further analysis.

### 2.1.2 Oxc dataset [1]

The only cleaning process in the Oxc dataset is to replace all the NA (missing values) in the dataset into figure 0 since NA represents the state that government took no reactions; being numerically uniform helps us with our analysis and graphics construction. command: `(x[is.na(x)] <- 0)`

## 2.2 Understanding of datasets

### 2.2.1 Variables

The Oxc dataset provides us with a variety range of information related to the growth and spread of the pandemic along with a series of reactions by the government. We will be utilizing several variables from the dataset directly. From Oxc dataset, we have government reactions including school closing, workplace closing, cancel public events, restrictions on gatherings, close public transport, stay at home requirements, restrictions on international movement, international travel controls and other restrictions that can be used to calculate GRI, a indicator of the level of the countries' overall restrictions of controlling the spread of the virus.

### 2.2.2 GRI Calculation

GRI is calculated from a known study. *Oxford COVID-19 Government Response Tracker*. Blavatnik School of Government. Available: [www.bsg.ox.ac.uk/covidtracker](http://www.bsg.ox.ac.uk/covidtracker)

## 3. Explore Covid-19

### 3.1 Displaying the current information

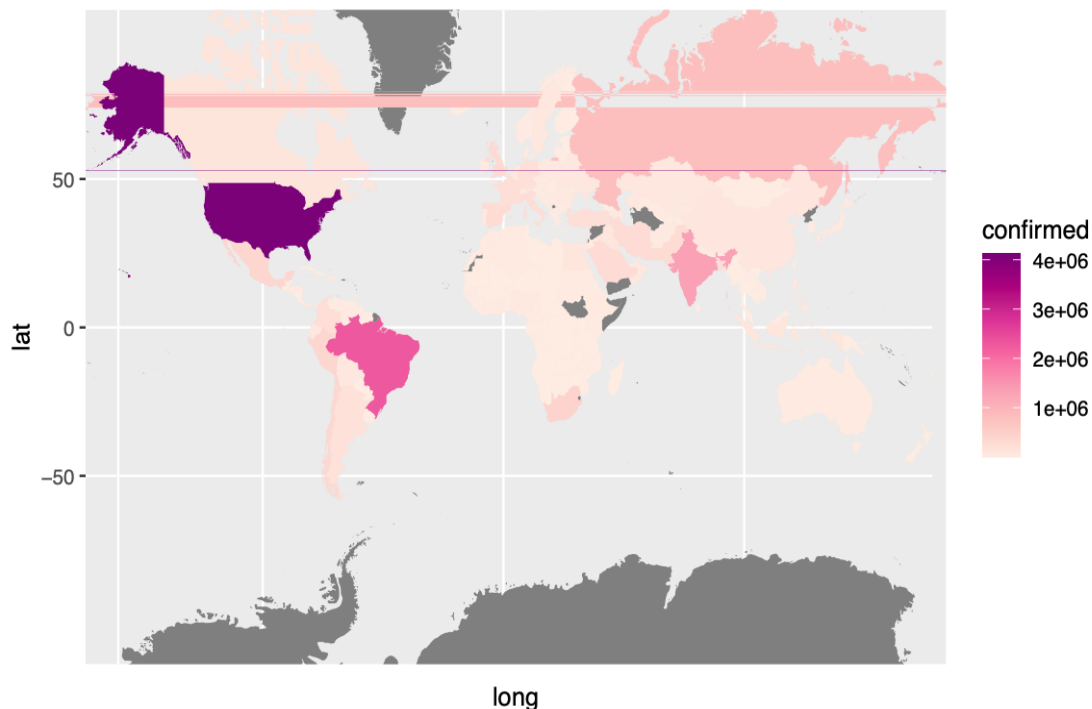


Figure 1. COVID-19 Confirmed Cases World Map, July 24, 2020

As shown in Figure.1, over 200 days have passed since the first appearance of the Covid-19 virus. The situation in the majority of the countries across the globe is getting stable after implementing means of restrictions with few exceptions. As what can be clearly observed from Figure 1, the America continent is still greatly threatened by the crisis, with the largest amount of confirmed cases

across the globe. Meanwhile, some part of Asia and western European countries own large amount of confirmed cases as well.

### 3.2 Customized Graphs

Based on the Covid Dataset (Daily Data), we created several customized graphs at first to observe those representative countries with distinctive features and particular cases in this pandemic for future investigations on country scale, following a timeline from January to July.

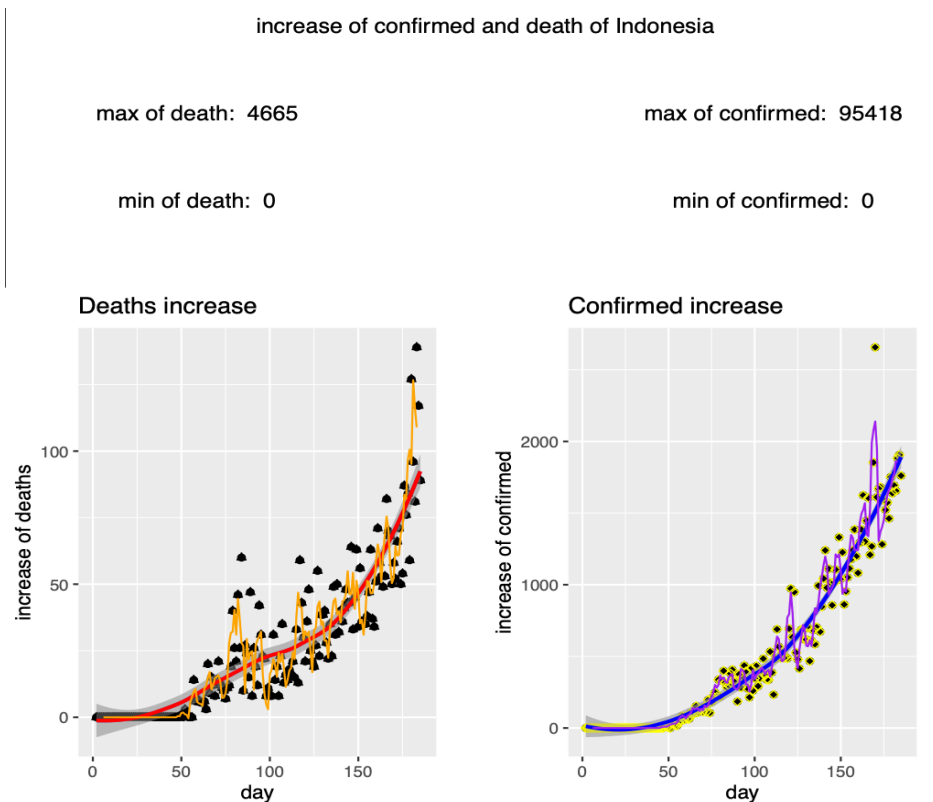


Figure 2: Customized Graph for Indonesia as an example

### 3.3 Shiny APP

For future investigations and justifications, we created a Shiny APP for displaying. This dashboard allows us to examine whether future inspections from graphics we produced are reasonable.

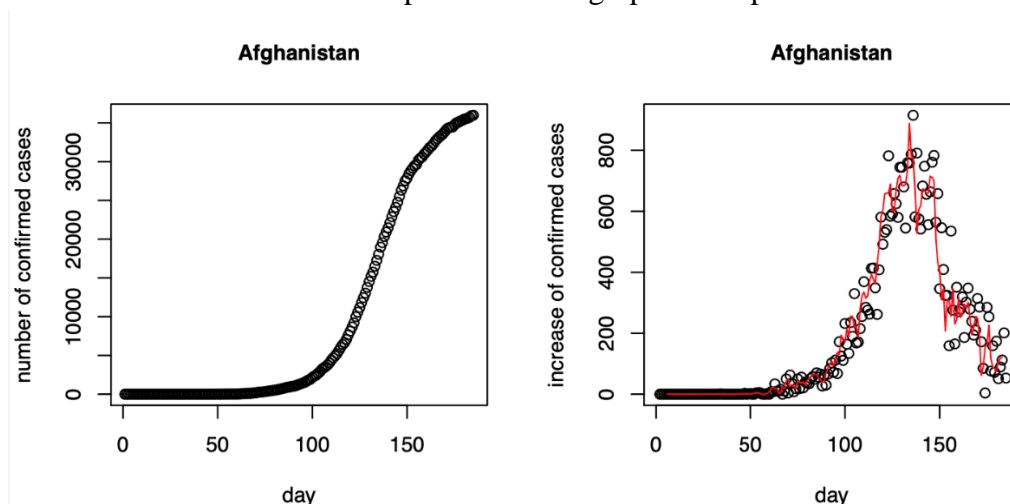


Figure 3: Number of confirmed cases, increase of confirmed cases in Afghanistan as an example

## 4. Explore Varied Government Restrictions

### 4.1 Displaying the current information

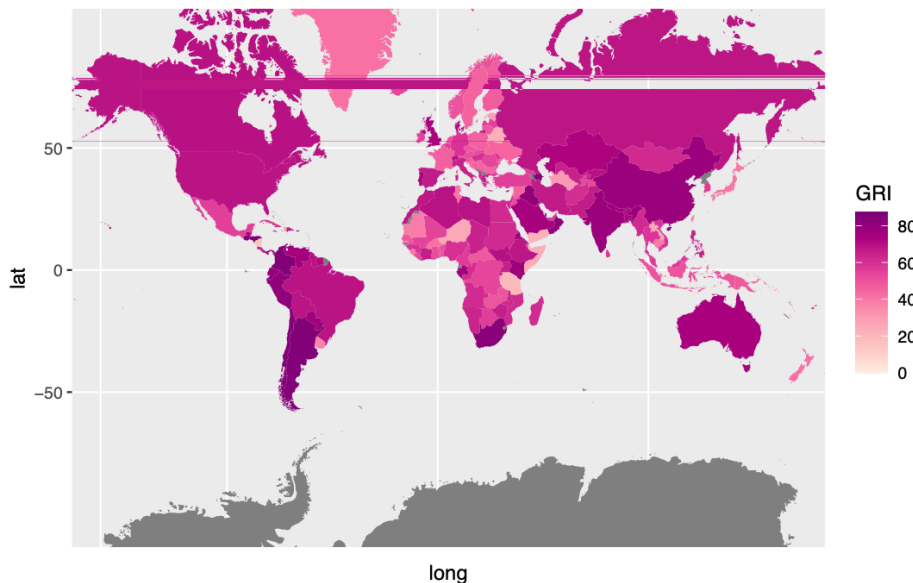


Figure 4: Government Response Index World Map, June 10, 2020

As seen in the graph, almost every country around the world have taken measurements in countering the pandemic. The levels of measurements (numerically indicated by GRI) varies among different countries: on continents of America and Asia where the virus has been widely spread, strong levels of measurements are taken, led by Argentina and China with highest GRI. It is evident that the world reaches an agreement on fighting against the pandemic as a whole by staying alert.

### 4.2 Varied Government Restrictions

There are eight specific means of restriction in the Oxc dataset; they are used to calculate Government Response Index.

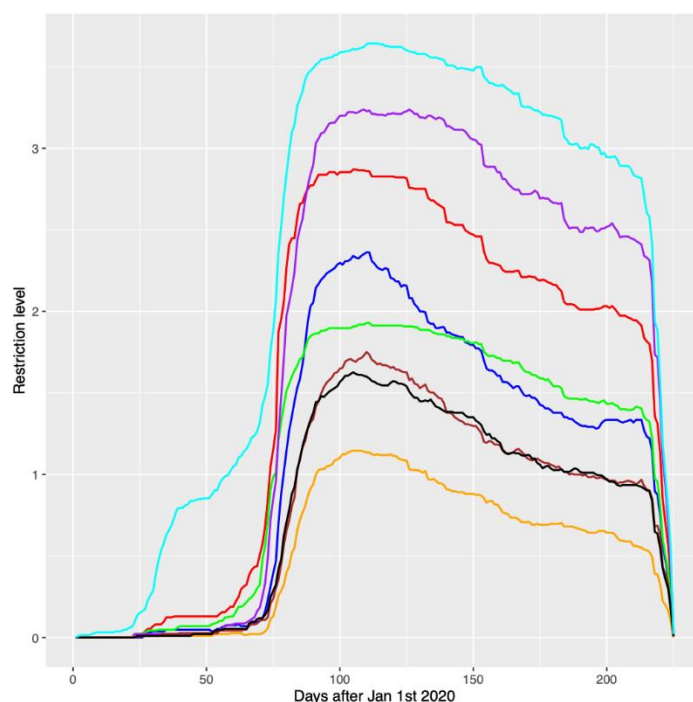


Figure 5: Mean Eight Restriction levels of all countries by time

Table 1: Each color in Figure 5 corresponds to a certain government reaction

Restriction:	School Closing	Cancel public events	Restrictions on gatherings	Close public transport
Color:	Red	Blue	Green	Purple
Restriction:	Close public transport	Stay at home requirements	Restrictions on internal movement	International travel controls
Color:	Orange	Brown	Black	Cyan

Measurements are taken globally starting from approximately 75 days after January 1st, 2020, when the virus is spread internationally from China; the very first response prior to any other restrictions is the cancellation of public events. In comparison to other restriction levels, cancelling public events is treated as a more precautional method, which is not a hard decision for government authorities than others.

From day 100- 150 after January 1st, 2020. Every restriction level increases dramatically, the world was being highly alert during that period; after day 120 the overall restriction level started to decline gradually as in some regions the spread of disease is under control. Note that the sudden decrease of restriction levels is due to the fact that the dataset gives the restriction level zero for dates researchers have not gathered the data.

### 5. Relating Government Policies to Covid-19 Pandemic

After a series graphical analysis, we will combine the past two part of the project together: the Covid-19 pandemic and government restrictions. We contracted Combined Graphics by Countries to inspect whether the restrictions in a specific country is effective. We will discuss and list several representative countries in the following.

a) China

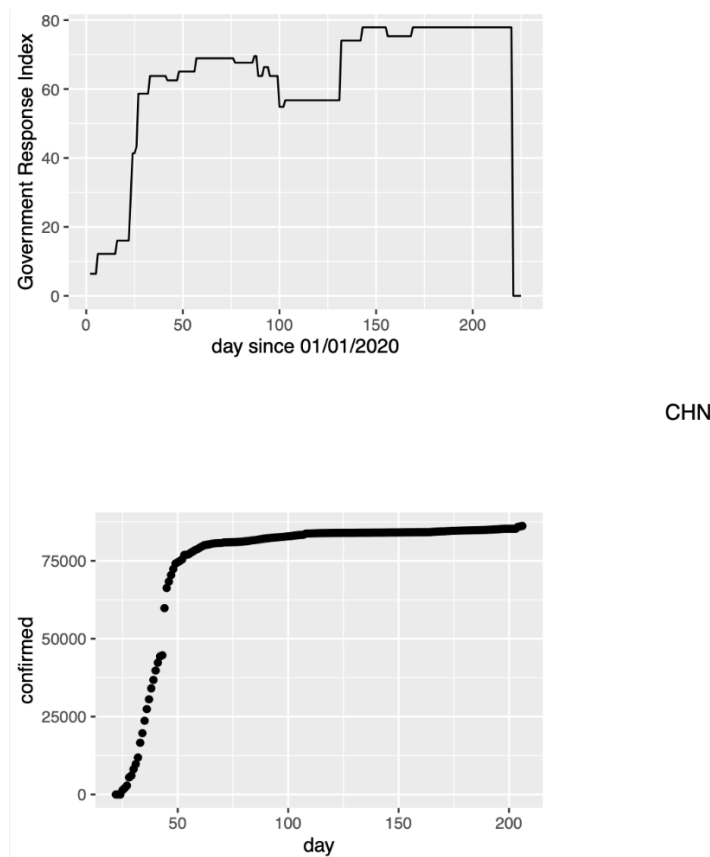


Figure 6: Government Response Index and Confirmed Cases of China

b) United States

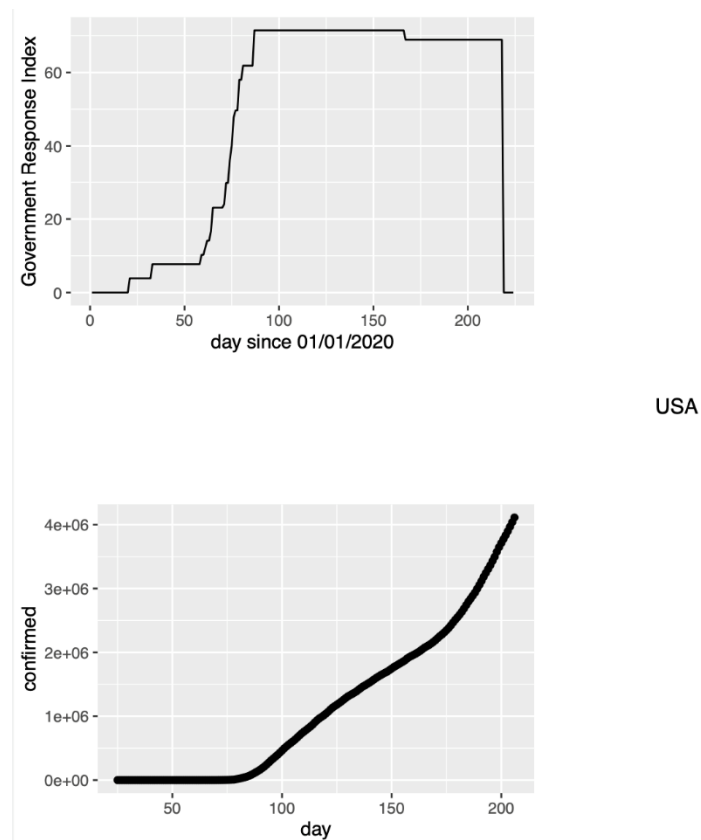


Figure 7: Government Response Index and Confirmed Cases of United States

c) United Kingdom

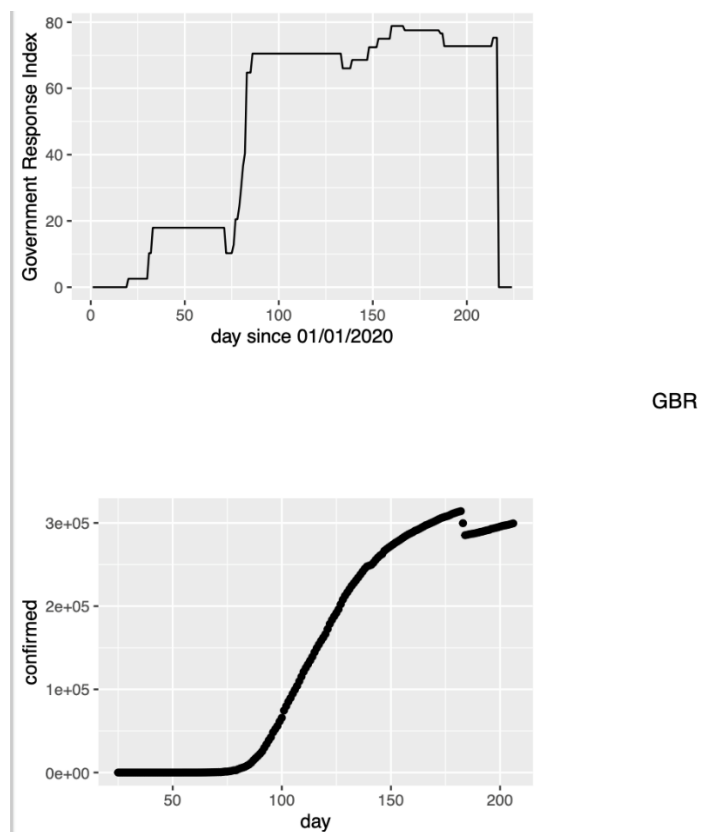


Figure 8: Government Response Index and Confirmed Cases of Great Britain

d) France

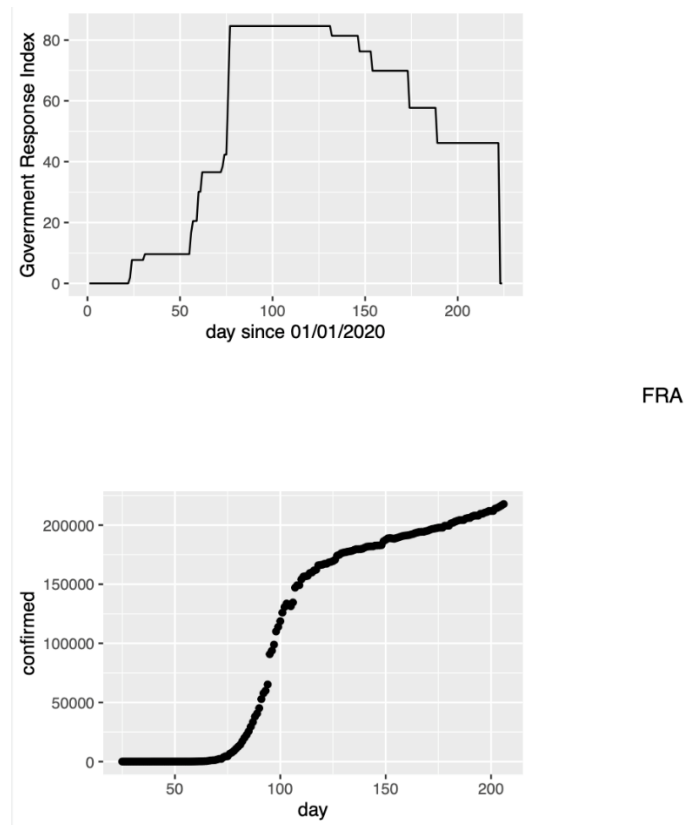


Figure 9: Government Response Index and Confirmed Cases of France

e) Russia

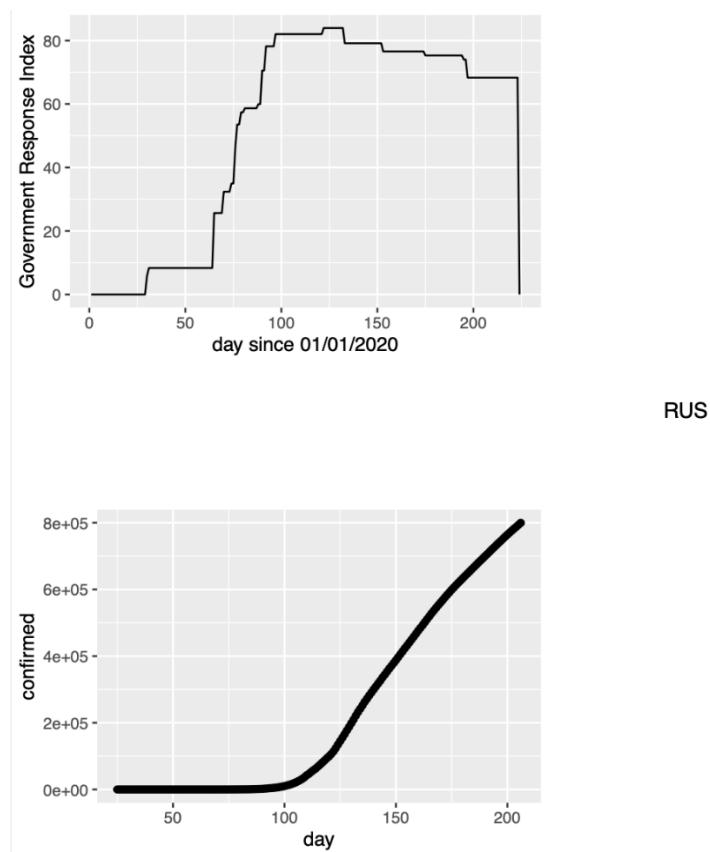


Figure 10: Government Response Index and Confirmed Cases of Russia

## 6. Conclusion

As governments continue to respond to COVID-19, it is imperative to study what measures are effective and which are not. While the data presented here do, of course, not measure effectiveness directly, they can be useful input to studies that analyse factors affecting disease progression. [2]

The restriction level is not a direct indicator of how well or strict that government authorities devoted into the prevention of the spread of the disease, but from the graphics and analysis we provided we are able to construct a clear picture of how are government reactions and the growth of the pandemic correlated. Due to the limit of time, we are not able to finish further parts of the project: for example, calculate a GRI on our own and study the time lagging between the change in Covid-19 situation and government responses, which requires further studies deep into R as well as the datasets. Covid-19 group will keep working after the end of the program and seek for improvements over the existing work.

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