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Variation in government responses to COVID-19

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www.bsg.ox.ac.uk/covidtracker

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Abstract: COVID-19 has prompted a wide range of responses from governments around the world. There is a pressing need for up-to-date policy information as these responses proliferate, and governments weigh decisions about the stringency of their policies against other concerns. We introduce the Oxford COVID-19 Government Response Tracker (OxCGRT), providing a systematic way to track the stringency of government responses to COVID-19 across countries and time. Using a novel index that combines various measures of government responses, we describe variation in government responses, explore whether rising stringency of response affects the rate of infection, and identify correlates of more or less stringent responses.

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1. Introduction

The rapid spread of COVID-19 globally has created a wide range of responses from governments. Common measures include school closings, travel restrictions, bans on public gatherings, and other interventions to create social distancing or to augment public health provision. However, governments have varied substantially in the measures that they have adopted and how quickly they have adopted them. This variation has created debate as policymakers and publics deliberate over the level of response that should be pursued, and as public health experts learn in real time the measures that are more or less effective.

The Oxford COVID-19 Government Response Tracker (OxCGRT) provides a systematic cross-national, cross-temporal measure to understand how government responses have evolved over the full period of the disease's spread. The project tracks governments' policies and interventions across a standardized series of indicators and creates a composite index to measure the stringency of these responses. Data is collected and updated in real time by a team of dozens of students and staff at Oxford University.

This working paper briefly describes the data OxCGRT collects and presents some basic measures of variation across governments. It will be updated regularly as the pandemic and governments' responses evolve.

2. Data and measurement

OxCGRT seeks publicly available information on 11 indicators (S1-11) of government response (see Table 1). S1-S7 are policy decisions relating to various kinds of public gatherings, and are recorded on an ordinal scale; S8-S11 are financial indicators, recorded as continuous variables. S1-S6 are further classified as either "targeted" (meaning they apply only in a geographically concentrated area) or "general" (meaning they apply throughout the entire jurisdiction).

Table 1: Indicators and coding instructions

ID	Name	Description	Measurement	Coding instructions
S1	School closing	Record closings of schools and universities	Ordinal scale + binary for geographic scope	0 - No measures 1 - Recommend closing 2 - Require closing 0 - Targeted

				1- General
S2	Workplace closing	Record closings of workplaces	Ordinal scale + binary for geographic scope	0 - No measures 1 - recommend closing 2 require closing 0 - Targeted 1- General
S3	Cancel public events	Record cancelling public events	Ordinal scale + binary for geographic scope	0- No measures 1 - Recommend cancelling 2 - Require cancelling 0 - Targeted 1- General
S4	Close public transport	Record closing of public transport	Ordinal scale + binary on geographic scope	0 - No measures 1 - Recommend closing 2 - Require closing 0 - Targeted 1- General
S5	Public info campaigns	Record presence of public info campaigns	Binary + binary on geographic scope	0 -No COVID-19 public information campaign 1 - COVID-19 public information campaign 0 - Targeted 1- General
S6	Restrictions on internal movement	Record restrictions on internal movement	Ordinal scale + binary on geographic scope	0 - No measures 1 - recommend movement restriction 2 - restrict movement 0 - Targeted 1- General
S7	International travel controls	Record restrictions on international travel	Ordinal scale	0 - No measures 1 - Screening 2 - Quarantine on high-risk regions 3 - Ban on high-risk regions
S8	Fiscal measures	What economic stimulus policies are adopted?	USD	Value of fiscal stimuli, including spending or tax cuts
S9	Monetary measures	What monetary policy interventions?	%	Value of interest rate

S10	Emergency investment in health care	Short-term spending on, e.g, hospitals, masks, etc	USD	Value of new short-term spending on health
S11	Investment in vaccines	Announced public spending on vaccine development	USD	Value of investment

Data is collected from publicly available sources such as news articles and government press releases and briefings. These are identified via internet searches by a team of several dozen Oxford University students and staff. OxCGRT records the original source material so that coding can be checked and substantiated.

While OxCGRT has begun with the 11 indicators listed in Table 1, future iterations may include further indicators or more nuanced versions of S1-S11.

Governments' responses to COVID-19 exhibit significant nuance and heterogeneity. Consider, for example, S1, school closing: in some places, all schools have been shut; in other places, universities closed on a different timescale than primary schools; in other places still, schools remain open only for the children of essential workers. Moreover, like any policy intervention, their effect is likely to be highly contingent on local political and social contexts. These issues create substantial measurement difficulties when seeking to compare national responses in a systematic way.

Composite measures--which combine different indicators into a general index--inevitably abstract away from these nuances. This approach brings both strengths and limitations. Helpfully, cross-national measures allow for systematic comparisons across countries. By measuring a range of indicators, they mitigate the possibility that any one indicator may be over- or mis-interpreted. However, composite measures also leave out much important information, and make strong assumptions about what kinds of information "counts." If the information left out is systematically correlated with the outcomes of interest, or systematically under- or overvalued compared to other indicators, such composite indices may introduce measurement bias.

Broadly, there are three common ways to create a composite index: a simple additive or multiplicative index that aggregates the indicators, potentially weighting some; Principal Component Analysis (PCA), which weights individual indicators by how much additional variation they explain compared to the others; Principal Factor Analysis (PFA), which seeks to measure an underlying unobservable factor by how much it influences the observable indicators.

Each approach has advantages and disadvantages for different research questions. In this paper we rely on a simple, additive unweighted index as the baseline measure because this approach is most transparent and easiest to interpret. PCA and PFA approaches can be used as robustness checks.

All OxCGRT data is available under the Creative Commons Attribution CC BY standard.[1]

3. COVID-19 Government Response Stringency Index

Our baseline measure of variation in governments' responses is the COVID-19 Government Response Stringency Index (Stringency Index). For each ordinal policy response measure S1-S7, we create a score by taking the ordinal value and adding one if the policy is general rather than targeted, if applicable. This creates a score between 0 and 2 and for S5, and 0 and 3 for the other six responses. We then rescale each of these by their maximum value to create a score between 0 and 100, with a missing value contributing 0.[2] These seven scores are then averaged to get the composite Stringency Index (Figure 1).

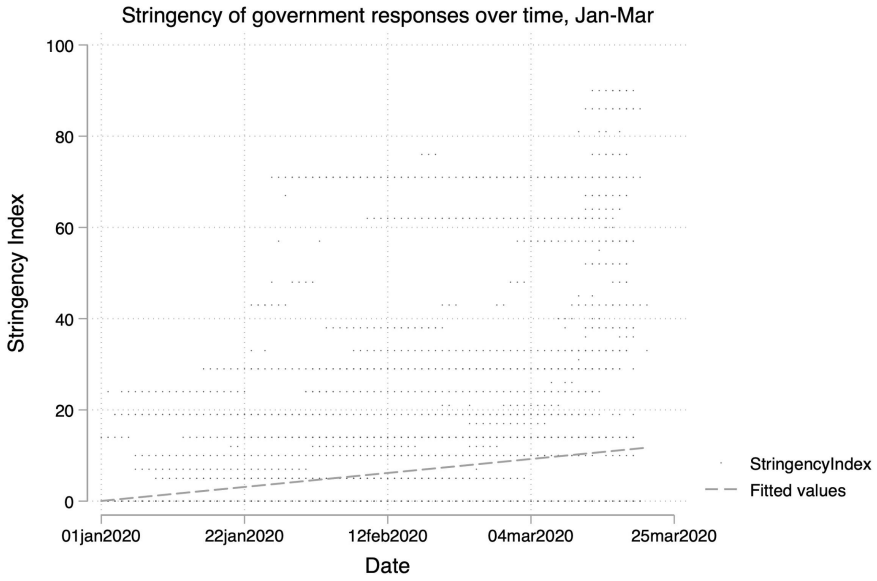
At the time of writing, OxCGRT has collected information on the stringency of government responses for 77 countries. More countries will be added in future iterations.

Importantly, the Stringency Index should not be interpreted as a measure of the appropriateness or effectiveness of a government's response. It does not provide information on how well policies are enforced, nor does it capture demographic or cultural characteristics that may affect the spread of COVID-10. Its value is instead to allow for efficient cross-national comparisons of government interventions.

Figure 1: Stringency of government responses over time

[1] www.bsg.ox.ac.uk/covidtracker

[2] We use a conservative assumption to calculate the Stringency Index. Where data for one of the seven indicators are missing, they contribute "0" to the Index. An alternative assumption would be to not count missing indicators in the score, essentially assuming they are equal to the mean of the indicators for which we have data for. Our conservative approach therefore "punishes" countries for which less information is available, but also avoids the risk of over-generalizing from limited information.

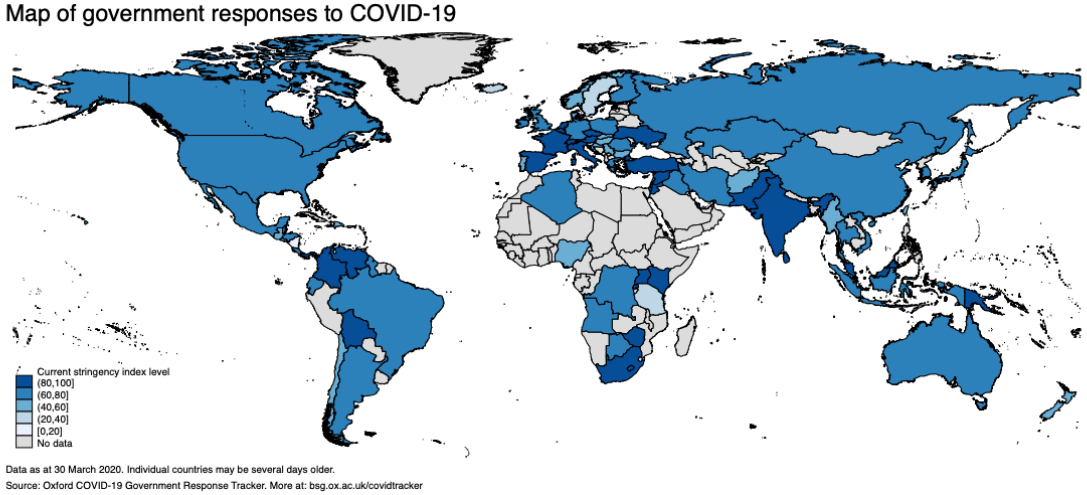


OxCGRT also tracks countries' financial responses to COVID-19 via S8-S11. These indicators will be discussed in future iterations of the working paper.

4. Variation in government responses

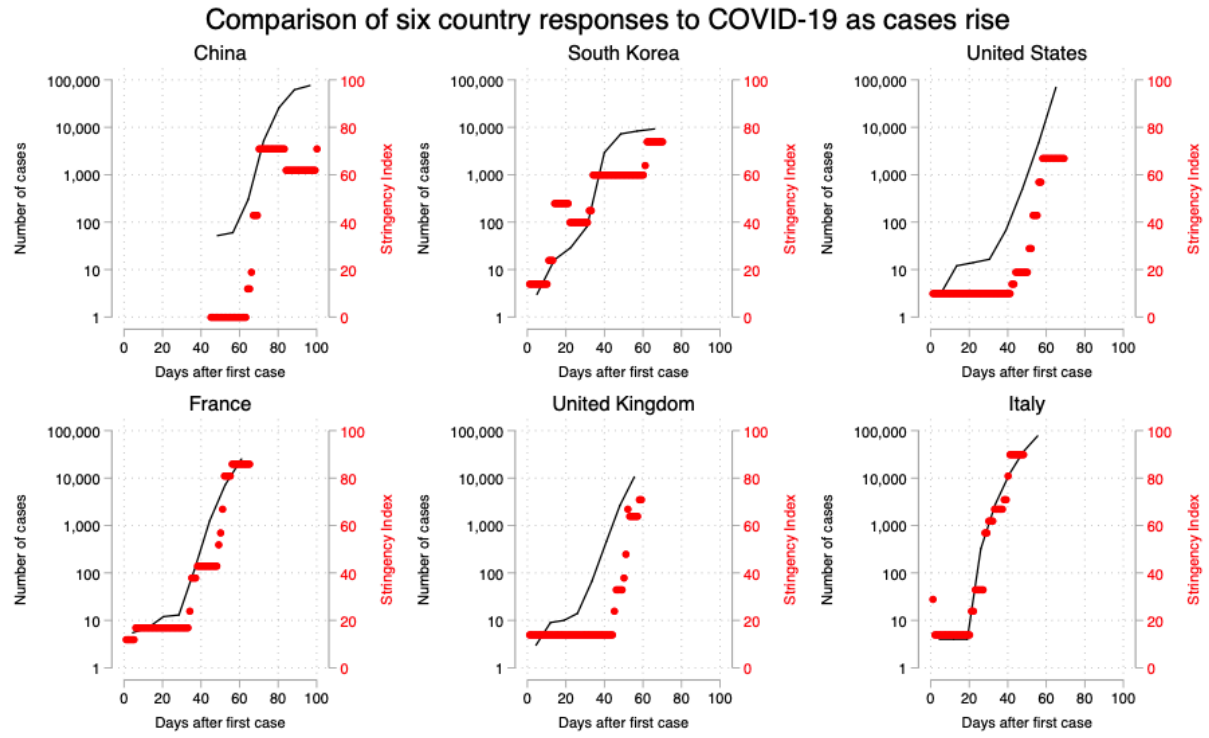
How have governments' responses varied? In general, government responses have become more stringent over the course of the outbreak. However, variation can be seen across countries (Figure 2). This variation is becoming less pronounced over time as more countries implement comprehensive suites of measures.

Figure 2: COVID-19 Government Response Stringency Index by country, March 31, 2020



We expect the stringency of response measures to broadly track the spread of the disease. However, the rate at which such measures are adopted plays a critical role in stemming the infection. Relying on WHO data, Figure 3 compares the rate of the growth of confirmed cases (the black line) since the first reported case to changes in a country's Stringency Index (the red dots).Some governments immediately ratchet up measures as an outbreak spreads, while in other countries the increase in the stringency of responses lags the growth in new cases.

Figure 3: Rate of change in confirmed cases and Stringency Index, selected countries



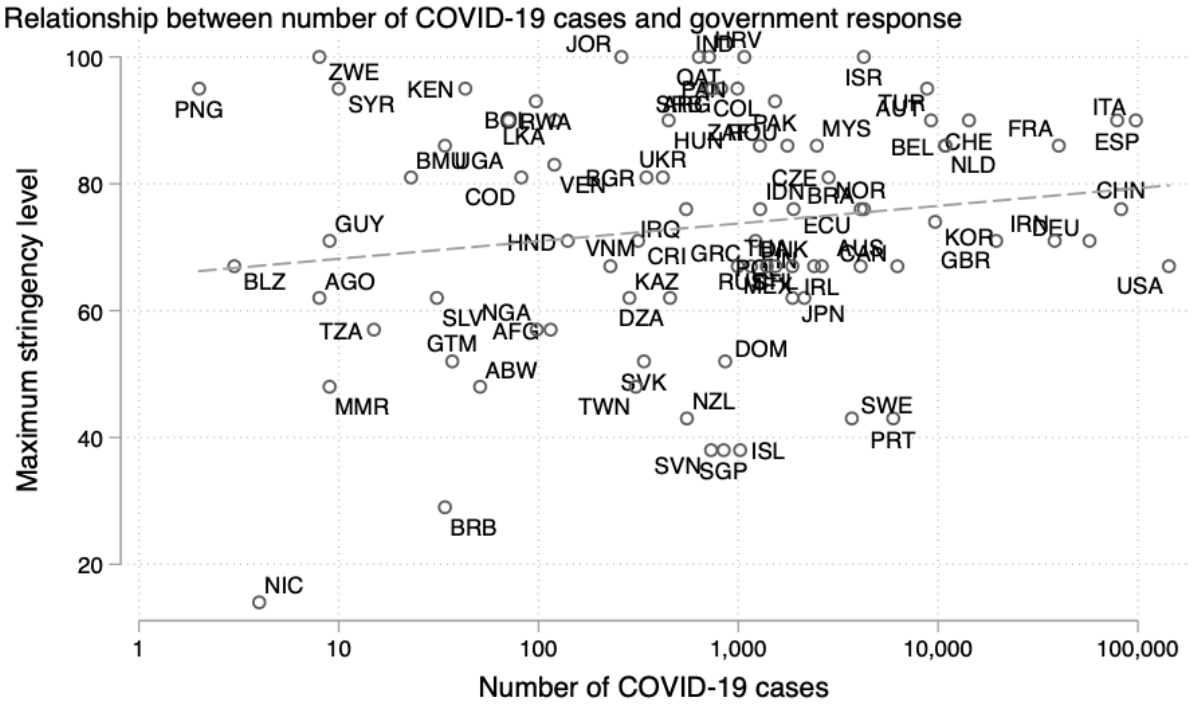
Data as at 30 March 2020. Individual countries may be several days older.
Source: Oxford COVID-19 Government Response Tracker. More at: bsg.ox.ac.uk/covidtracker

Differential responses can also be seen across the entire period. One measure of interest is the Stringency-Risk Ratio, which compares a government's response to the risk it faces. Risk is difficult to measure, since the number of cases recorded is in part a function of how much testing is carried out, which is likely to co-vary with the stringency of the government's response. The number of deaths is not correlated with testing (unless deaths are misattributed) but also correlated with the stringency or the response.

Figure 4 presents the Stringency-Risk Ratio operationalized as the maximum level of stringency a government has reached compared to the total number of cases in that country. Countries above the line can be interpreted as having more stringent measures than the average country, given their number of confirmed cases.

Conversely, countries below the line show less stringency than the average country given their number of confirmed cases. Thus, the closer a country is to the top-left corner of Figure 4, the more stringent its response in light of the risk it faces, and conversely, the closer a country is to the bottom-right corner, the less stringent its response given its risk.

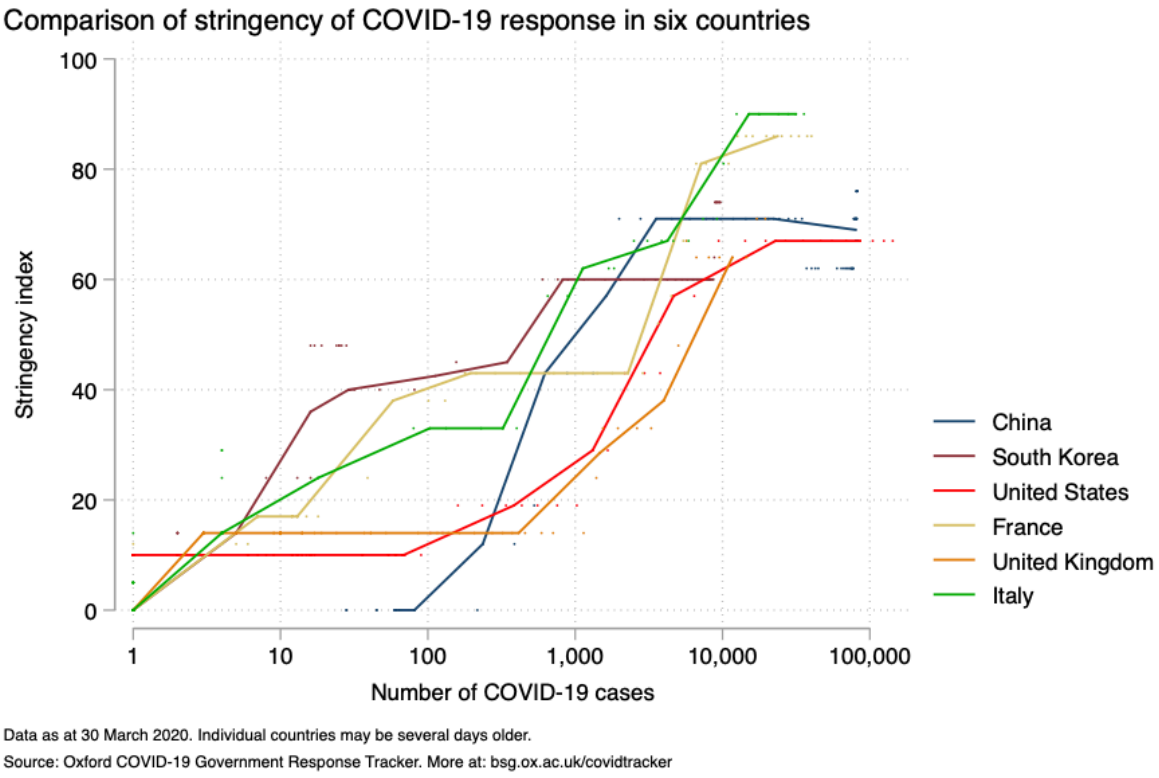
Figure 4: Stringency-Risk Ratio



Data as at 30 March 2020. Individual countries may be several days older.
Source: Oxford COVID-19 Government Response Tracker. More at: bsg.ox.ac.uk/covidtracker

Another way of thinking about this is to consider at which point in a country's infection trajectory they choose to implement more stringent policies. We generally see that countries increase their level of stringency as their number of confirmed COVID-19 cases rise, however there is significant variation in the rate and timing of this relationship. Figure 5 compares this relationship for the same six countries considered in Figure 3 above.

Figure 5. Stringency-Risk change over time



5. 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. OxCGRT seeks to contribute to this knowledge gap by providing a comparable measure of the stringency of government responses over time. We find significant variation in both the measures that governments adopt and when they adopt them. Going forward, governments will benefit from adopting an evidence-based approach to the measures they deploy.

OxCGRT will continue to evolve over the coming weeks as the pandemic progresses. We envision not only updating the data on a regular basis, but also refining and improving the indicators we record for each country.

It is our hope that scholars, medical professionals, policymakers, and concerned citizens will make use of the OxCGRT data to enhance all countries' responses to the COVID-19 pandemic. We welcome constructive feedback and collaboration on this project as it evolves.

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