A novel dataset of governments' responses to COVID-19 all around the world

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Abstract: Following the COVID-19 outbreak, governments all around the world have implemented public health and economic measures to contain the spread of the virus and to support the economy. Public health measures include domestic lockdown, school closures and bans on mass gatherings among others. Economic measures cover wage support, cash transfers, interest rates cuts, tax cuts and delays, and support to exporters or importers. This paper presents a unique living dataset of governments' responses to COVID-19. The dataset codes the various policy interventions with their dates at the country-level for more than 200 countries from January 1 to May 27, 2020. The generation of detailed data on the measures taken by governments can help generate robust evidence to support public health and economic decision making.

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BACKGROUND AND SUMMARY

In December 2019, a new coronavirus appeared in Wuhan, China and spread to nearly every country in the first quarter of 2020. In the end of April 2020, there were more than 3.36 million confirmed cases and over 239,000 deaths linked to the virus. The pandemic forced governments all around the world to adopt diverse public health policies and economic measures that are quite unique in history. Public policies data is needed in pandemics to best monitor the spread of infection, but also to understand the diversity in governments' responses. In order to provide accurate and openly available data, we collected data on twelve public health policies and seven economic measures, at the country-level and on a daily basis, and merged it with the data on daily cases and deaths from the European Center for Disease Prevention and Control (https://www.ecdc.europa.eu/en/geographical-distribution-2019-ncov-cases).

The dataset described in this paper is helpful to measure the impact of public health policies on the spread of the pandemic at the country-level. It is also helpful to measure the impact of economic measures on economic outcomes such as the gross domestic product or national financial market indices. We also make sense of our dataset by creating two novel indices of governments' interventions against COVID-19. The first index measures the rigidity of governments' responses to COVID-19 and is based on the implementation of twelve public health policies. The second index quantifies the economic responses to COVID-19 based on the coding of seven types of economic interventions to face the economic downturn following the various public health measures. The indices capture the rigidity of governments' responses to the pandemic between December 31, 2019, and May 27, 2020 on a country-daily basis. The final dataset is made of 34,121 country-day observations. 229 countries are included in the database.

The dataset is of interest for epidemiologists wishing to link governments' measures worldwide with the evolution of the number of cases (Xu et al. 2020). Several studies already assess the impact of travel restrictions (Chinazzi et al. 2020), human mobility restrictions (Kraemer et al. 2020) or various transmission control measures (Tian et al. 2020). The paper is also of interest for social scientist wishing to study the impact of other factors, e.g. health risk of the population, on the rigidity of the measures taken. We hope to contribute to this effort by allowing other researchers and practitioners to use our coding of governments' measures to respond to the pandemic. The index built in the paper can be related to the effort of other academics to map

governments' responses to the pandemic. Hale et al. (2020) built a dataset of governments' responses that includes different variables related to public health, economic interventions, public campaigns and research incentives for a vaccine (www.bsg.ox.ac.uk/covidtracker). The data collection is based on news articles and government press releases and briefings. Their great and concomitant work leads to the creation of a stringency index from 0 to 100 for each country. Our index differs in several manners from that of Hale et al. (2020). First, it largely covers economic measures and creates two different indices of government measures.[2] Second, our dataset considers elections as a key variable. Elections are an important moment in democracies, and postponing elections might be interpreted as the will of the governing power to influence the results of elections. Finally, it covers in a detailed manner the responses to COVID-19 in developing countries, particularly small Islands, thanks to the information provided by our sources.

Some other datasets tracking government interventions are more specific. Gentilini et al. (2020) track and update weekly the social protection and jobs responses to COVID-19 at the country-level. Elgin et al. (2020) created a static index of economic policies to respond to COVID-19, by collecting information on the nature and the range of governments' economic interventions in the end of March 2020. Noy et al. (2020) measure economic risk, at the sub-national level, relying on cross-country information and geo-localized indicators of economics, health and the spread of the pandemic.

METHODS

Public health measures taken by governments

The coding of public health measures is based on cross-country information reported by the Assessment Capacities Project (ACAPS; https://www.acaps.org/covid19-government-measures-dataset), the International Institute for Democracy and Electoral Assistance (IDEA; https://www.idea.int/publications/catalogue/elections-and-covid-19) for elections and the United Nations Educational Scientific and Cultural Organization (UNESCO; https://en.unesco.org/covid19/educationresponse) for schools closures. The main source of

[2]Oxford researchers also followed the same path (https://www.bsg.ox.ac.uk/sites/default/files/2020-06/Oxford-Covid-19-Government-response-tracker-expanded-PRESS-RELEASE.pdf).

information is the ACAPS. Their dataset is particularly useful in providing information on both the scale and the dates of the measures implemented. IDEA lists elections postponed or maintained all around the world since the spread of COVID-19. UNESCO provides a worldwide dataset of school closures all around the world.

Twelve public health measures were considered: bans on mass gatherings, bans on sporting and recreational events, restaurant and bar closures, domestic lockdowns, international travel restrictions, domestic travel restrictions, curfew, declarations of states of emergency, public testing, enhanced surveillance, school closures and the postponement of elections. Each measure is coded 1 or 0, depending on whether it was implemented or not, and as a missing variable if the country is not covered. Measures are coded on a daily basis: before the implementation, the measure is coded 0; from the day of the implementation, the measure is coded 1 until it is lifted.

The first ten measures were manually coded from the ACAPS dataset. The format of their dataset does not allow us to directly merge their dataset with another one, as they textually report the measures implemented or discussed. Their dataset requires some reading to qualify whether a given measure is implemented. Measures taken from the ACAPS were manually coded. School closures were directly taken from the UNESCO dataset which indicates on which scale schools are closed (local level, national-level or no school closures). The dataset was simply merged with our baseline dataset. Finally, the IDEA simply reports the postponed or maintained elections with their dates so the coding was done manually.

Additionally, for ten measures, extra variables which equal 1 if the implementation of a given measure is partial or localized, and 0 if it is strict or national, were added. This coding allows researchers to differentiate the degrees of implementation of the measures. The following differentiations were made:

- Bans on mass gatherings: if the ban was localized, the measure was considered partial;
- Cancellation of sporting and large events: if the cancellation was localized, targeted at some events or events could occur with a limited number of persons, the measure was considered partial;

- Travel restrictions: if international commercial flights are still allowed, except to or from some countries, with recommendations to avoid all non-essential travel, the measure was considered partial;
- Domestic travel restrictions: if domestic commercial travels are still allowed, except to or from some regions, with recommendations to avoid all non-essential travel, the measure was considered partial;
- Curfew: if curfews occurred only in a localized area of the country, the measure is considered partial;
- Restaurant and bar closures: when the closures were localized and/or the ban limited, e.g. a limited number of clients can still sit in the restaurants, the measure was considered partial;
- Public testing: when the public testing policy was targeted to certain categories of the population (e.g. health personnel), it was considered partial;
- Elections: we followed IDEA which reports whether all elections were postponed (strict) or only some elections were postponed and some others maintained (partial);
- Schools: we followed the UNESCO which reports whether the closures are localized or national.

The twelve public health measures can be used to create an index of the rigidity of governments' public health responses to COVID-19. Figure 1 is a static map of the rigidity index on April 15, 2020, all around the world. To build the index represented in Figure 1, we recoded, for each measure, strict and/or national measures as 1, partial and/or localized measures as 0.5 and no measures as 0. The index of rigidity is the mean of the coded indicators and ranges between 0 and 1. When the indicator is not fulfilled, because it is not retrievable, the index is the mean of the indicators which are fulfilled.

Economic measures taken by governments

Another index is based on the coding of economic measures taken to face the economic downturn following public health measures of containment. The information comes from the IMF (https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19) and the International Growth Centre (https://www.theigc.org/covid-19/). For each country we read the list of measures listed by the IMF and followed the IGC in the creation of seven categories of

economic intervention: wage support, cash transfer, credit schemes, tax cuts and delays, support to importers and exporters, and interest rate cuts. The coding is done on a binary basis, 0 or 1, depending on whether the measure is implemented or not. As for public health measures, the coding is done a country-daily basis. The day of the announcement is either reported in the country-profile of the IMF or in the list of economic measures of the ACAPS. The index of economic measures is the mean of the seven variables coded and ranges between 0 and 1. Figure 2 is a static map of the index of economic measures on April 15, 2020, all around the world.

DATA RECORDS

We have established a Github repository available at https://github.com/simonporcher/COVID-19-Governments-Responses where new data is uploaded twice a month. The updated versions of the database can be downloaded from GitHub in Excel and Stata formats and can be imported into a variety of software programs. The file "Sources.xls" in the repository reports, for each country, lists the sources used for the economic and public health measures.

As the situation regarding the COVID-19 outbreak is continuously evolving, the repository lists all the modifications of the database in the Stata do-files. Each row in the database represents the situation in a country at a given date between January 1, 2020 and April 28, 2020. A description of the fields in the database is shown below and is available through a data dictionary on Github (https://github.com/simonporcher/COVID-19-Governments-Responses):

- ***country*:** name of the country or the territory;

- ***iso***: three-letters country code;

- ***d***: date of the observation;

- ***cases***: number of cases reported on the given day by the European Centre for Disease Prevention and Control;

- ***deaths***: number of deaths reported on the given day by the European Centre for Disease Prevention and Control;

- ***school***: binary variable equal to1 if schools were closed and 0 otherwise;

- ***school_local**:* binary flag to distinguish localized school closures from other cases. 1 denotes that school closures were implemented at the local level and 0 denotes that school closures were not implemented at the local level (either at the national level or no school closures). The data on the scale of school closures is imported from the UNESCO. The interaction of *school* and *school_local* allows researchers to create three levels of measures: no school closures (*school*=0 and *school_local*=0), localized school closures (*school*=1 and *school_local*==1) or national school closures (*school*=1 and *school_local*=0);

- ***domestic**:* binary variable equal to 1 if there was a domestic lockdown and 0 otherwise;

- ***domestic_local***: binary variable to distinguish localized domestic lockdowns from other cases. 1 denotes that domestic lockdowns were implemented at the local level and 0 means that domestic lockdowns were not implemented at the local-level (either at the national level or not implemented). The nature of the domestic lockdown is based on our reading of the measures reported by the ACAPS. The interaction of *domestic* and *domestic_local* allows researchers to create three levels of measures: no domestic lockdown (*domestic*=0 and *domestic_local*=0), localized domestic lockdowns (*domestic*=1 and *domestic_local*=1) or national domestic lockdowns (*domestic*=1 and *domestic_local*=0);

- ***travel*:** binary variable equal to1 if travel restrictions were implemented and 0 otherwise;

- ***travel_partial***: binary flag to differentiate partial travel restrictions from other cases. 1 denotes that travel restrictions were partial and 0 denotes that travel restrictions were not partial (either strict or not implemented). The nature of the travel restrictions is based on our reading of the measures reported by the ACAPS. The interaction of *travel* and *travel_partial* allows researchers to create three levels of measures: no travel restrictions (*travel*=0 and *travel_partial*=0), partial travel restrictions (*travel*=1 and *travel_partial*=1) or strict travel restrictions (*travel*=1 and *travel_partial*=0);

- ***travel_dom*:** binary variable equal to1 if travel restrictions within the country (e.g. inter-region travels) were implemented and 0 otherwise;

- ***travel_dom_partial***: binary flag to differentiate partial domestic travel restrictions from other cases. 1 denotes that travel restrictions were partial and 0 denotes that travel restrictions were not

partial (either strict or not implemented). The nature of the travel restrictions is based on our reading of the measures reported by the ACAPS. The interaction of *travel* and *travel_partial* allows researchers to create three levels of measures: no domestic travel restrictions (*travel_dom*=0 and *travel_dom_partial*=0), partial domestic travel restrictions (*travel_dom*=1 and *travel_dom_partial*=1) or strict domestic travel restrictions (*travel_dom*=1 and *travel_dom_partial*=0);

- ***curf*:** binary variable equal to1 if a curfew was implemented and 0 otherwise;

- ***curf_partial***: binary flag to differentiate partial curfews from other cases. 1 denotes that the curfew was partial and 0 denotes that the curfew was not partial (either strict or not implemented). The nature of the curfew is based on our reading of the measures reported by the ACAPS. The interaction of *curf* and *curf_partial* allows researchers to create three levels of measures: no curfew (*curf*=0 and *curf_partial*=0), partial curfew (*curf*=1 and *curf_partial*=1) or strict curfew (*curf*=1 and *curf_partial*=0);

- ***mass***: binary variable equal to1 if bans on mass gatherings were implemented and 0 otherwise;

- ***mass_partial***: binary flag to distinguish localized bans on mass gatherings from other cases. 1 denotes that bans on mass gatherings were partial and 0 denotes that bans on mass gatherings were not partial (either strict or not implemented). The nature of the bans on mass gatherings is based on our reading of the measures reported by the ACAPS. The interaction of *mass* and *mass_partial* allows researchers to create three levels of measures: no bans on mass gatherings (*mass*=0 and *mass_partial*=0), localized or partial bans (*mass*=1 and *mass_partial*=1) or national or strict bans (*mass*=1 and *mass_partial*=0);

- ***elect***: binary variable equal to1 if some elections were postponed and 0 otherwise;

- ***elect_partial***: binary flag to differentiate countries which postponed only some of the elections from the others. 1 denotes that countries both maintained and postponed elections and 0 denotes that elections were either postponed, maintained or were not scheduled. IDEA lists all maintained and postponed elections since the beginning of 2020. The interaction of *elect* and *elect_partial* allows researchers to differentiate three settings: all elections were maintained despite COVID-19

(*elect*=0 and *elect_partial*=0), some elections were maintained and others were postponed (*elect*=1 and *elect_partial*=1) or all elections were postponed (*elect*=1 and *elect_partial*=0);

- ***sport****:* binary variable equal to1 if bans on sporting and large events were implemented and 0 otherwise;

- ***sport_partial****:* binary flag to distinguish partial bans and cancellations of sporting and large events. 1 denotes that bans on sporting and large events were localized, strict or with no spectators, 0 that bans on sporting and large events are not localized or partial (either national or no measures implemented). The nature of the bans on sporting and large events is based on our reading of the measures reported by the ACAPS. The interaction of *sport* and *sport_partial* allows researchers to create three levels of measures: no bans (*sport*=0 and *sport_partial*=0), partial bans (*sport*=1 and *sport_partial*=1) or national bans on mass gatherings (*sport*=1 and *sport_partial*=0);

- ***rest****:* binary variable equal to1 if restaurants were closed and 0 otherwise;

- ***rest_local***: binary flag to distinguish localized and/or partial restaurant and bar closures from other cases. The variable is coded 1 in the three following situations: localized closures, limitations on the number of customers in bars and restaurants, and closures of either bars or restaurants. 0 indicates national closures or no closures at all. The coding is based on our reading of the measures reported by the ACAPS. The interaction of *rest* and *rest_local* allows researchers to create three levels of measures: no closures (*rest*=0 and *rest_local*=0), localized closures (*rest*=1 and *rest_local*=1) or national closures (*rest*=1 and *rest_local*=0);

- ***testing***: binary variable equal to1 if there was a public testing policy and 0 otherwise;

- ***testing_narrow*****:** binary flag to distinguish narrow testing policies from large testing policies. 1 denotes that testing policies were targeted to some individuals, 0 that testing policies were not targeted (either large or not implemented). The nature of the testing policy is based on the information reported in the measures "mass population testing" and "testing policy" in the ACAPS. When the measure was targeted, *testing_narrow* was coded 1. On the contrary, when the measure was not targeted, *testing_narrow* was coded 0. The interaction of *testing* and *testing_narrow* allows researchers to create three levels of measures: no testing policy (*testing*=0

and *testing_narrow* =0), narrow testing policy (*testing*=1 and *testing_narrow* =1) or large testing policy (*testing*=1 and *testing_narrow* =0);

- ***surveillance*:** binary variable equal to1 if mobile app or bracelet surveillance was implemented and 0 otherwise;

- ***state***: binary variable equal to1 if the state of emergency is declared and 0 otherwise;

- ***state_partial*:** binary variable equal to1 if the state of emergency is declared on a local basis and 0 otherwise, based on information in the ACAPS. When the measure was local, *state_partial* was coded 1. On the contrary, when the measure was not localized, *state_partial* was coded 0. The interaction of *state* and *state_partial* allows researchers to create three levels of measures: no state of emergency (*state*=0 and *state_partial* =0), partial state of emergency (*state*=1 and *state_partial*=1) or national state of emergency (*state*=1 and *state_partial* =0);

- ***cash*:** binary variable equal to1 if cash transfers are implemented and 0 otherwise;

- ***wage*:** binary variable equal to1 if wage support is implemented and 0 otherwise;

- ***credit*:** binary variable equal to1 if credit schemes are implemented and 0 otherwise;

- ***taxc*:** binary variable equal to1 if tax credits are implemented and 0 otherwise;

- ***taxd*:** binary variable equal to1 if tax delays are implemented and 0 otherwise;

- ***export*:** binary variable equal to1 if supports to importers or exporters are implemented and 0 otherwise;

- ***rate*:** binary variable equal to1 if the Central Bank lowered the interest rates and 0 otherwise;

- ***Rigidity_Public_Health***: average of the twelve coded public health measures. Public health measures are valued 0.5 if they are localized or partial and 1 if they are national or strict. 0 indicates no measures;

- ***Economic_Measures***: average of the coded economic measures.

TECHNICAL VALIDATION

The database was checked on a rolling basis using two complementary methodologies. One was manual and the other was machine enabled. We first exchanged with a research assistant and manually checked the accuracy of the coding of the data for each country on a rolling basis. The dataset was sent via email to the research assistant who checked that the coding was accurate. Two overall checks were done on March 30 and April 17, 2020. Discussions occurred via the phone. For economic measures, the research assistant went through the two sources (IGC if the country was coded in their dataset, IMF if the country was not coded in the IGC) and orally listed for each country the economic measures implemented. We controlled in the dataset, using the "summarize" function in Stata 14 (https://www.stata.com/), that the coded measures were the same as the ones reported by the sources. When the coding was not accurate, we checked that the policy was not implemented after the last verification in the ACAPS dataset, and updated the dataset with a measure change or modified the mistake. The list of corrected mistakes is available in a Stata do file posted on the repository (verif.do).

The same manual methodology was used for public health measures: the research assistant filtered the ACAPS dataset on four categories of interventions (lockdown, movement restrictions, public health measures and social distancing) and orally listed the measures taken at the country-level with their dates. We checked that the coding was accurate using the "tabulate" function in Stata for all coded measures. The tabulate function allows us to summarize information for a given country at a given date. As the ACAPS dataset records the dates of policy measures, modifications were directly made – if necessary – for measures implemented between the two rounds of data verification. All the modifications are listed in the abovementioned Stata do file (verif.do). For the list of democratic elections covered by IDEA, the principal investigator did the secondary check directly on April 28, 2020.

The latest check was divided in two rounds. The principal investigator checked that the potential policy updates in the 10th version of the ACAPS dataset between May 25 and May 29, 2020. Two extra research assistants were hired and updated the economic measures reported by the IMF between May 25 and May 29, 2020. The principal investigator manually checked that their coding was accurate, based on his reading of the IMF measures.

The other verification was made in Stata to check that the coding was consistent before and after the implementation of a given policy, and after the end of the lockdown. To do so, the principal

investigator used the “tsline” function in Stata to graph the time series of the indices to check that there was no break in the tendencies. This graphical check was run for the 37 OECD countries. If the trend was unexpected – e.g. with a decreasing trend at some date or values higher than 0 before any COVID-19 cases was reported – the principal investigator checked that the coding of the measures was accurate and particularly that, at date t-1 before the implementation of a given measure, the coding was 0, and that, at date t+1, the coding was 1. The check for all other countries was run in Stata by tabulating all countries with values of the indices in *t* lower than their values in *t-1*. Mistakes were corrected by refereeing to the sources.

USAGE NOTES

The dataset is based on manual recording of policy measures implemented all around the world. Even though we made the best attempt to report data as accurately as possible, there might be some remaining errors and we apologize in advance for that. Please email the corresponding author if you wish to point some errors or leave a message on the GitHub repository.

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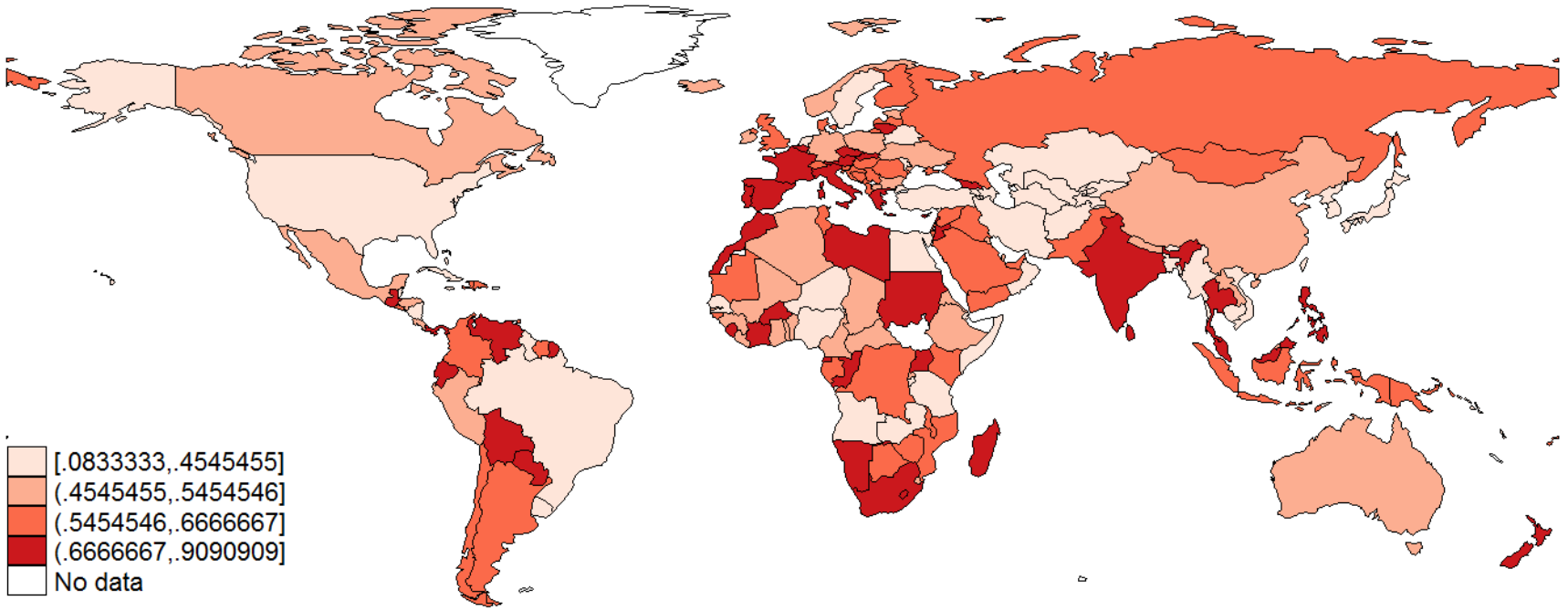
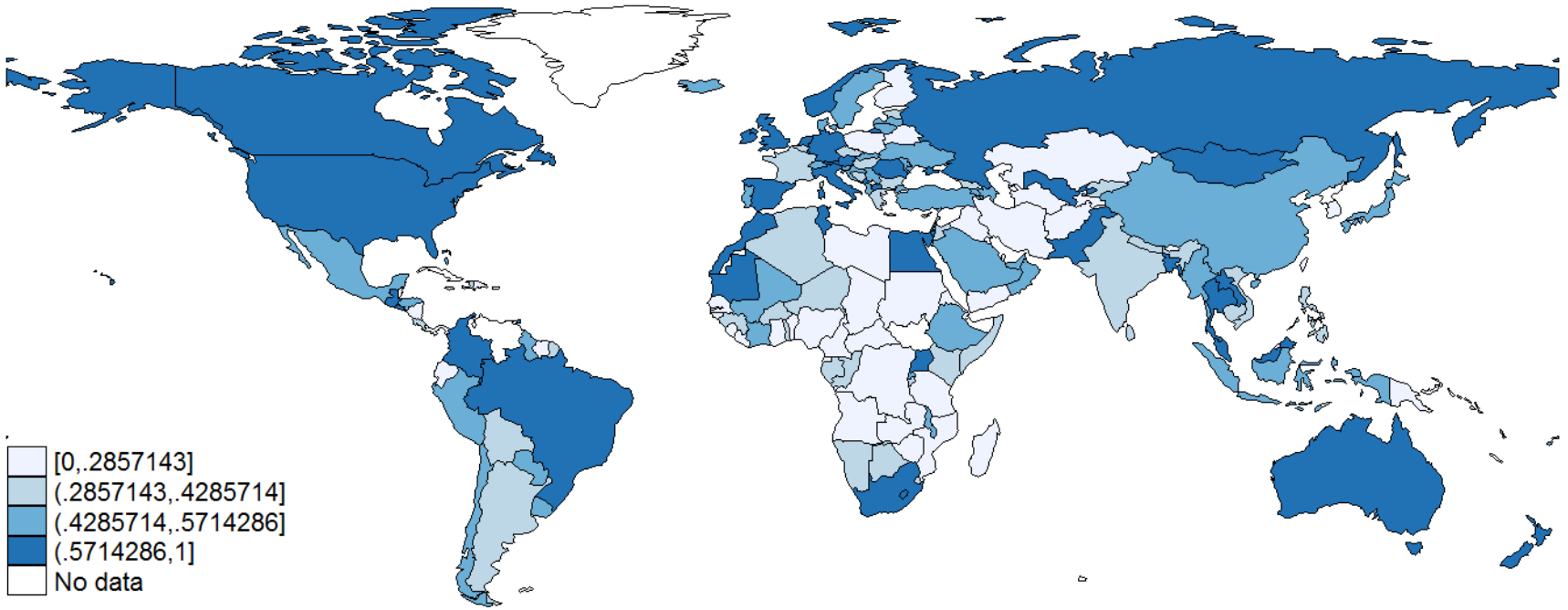
Figure 1: Static map of public health responses to COVID-19 as of April 15, 2020



Note: The index ranges between 0 and 1, with 0 being the lowest possible value (no public health response to COVID-19) and 1 being the highest value (all potential listed policies are implemented at the national-level).

Figure 2: Static map of the index of economic responses to Covid-19 as of April 15, 2020



Note: The index ranges between 0 and 1, with 0 being the lowest possible value (none of the considered economic responses to COVID-19 is implemented) and 1 being the highest value (all potential listed economic measures are implemented at the national level).