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How Well Do Authoritarian Systems Manage Emergencies?

A Case Study Comparing Regime Type and Effectiveness of COVID-19 Response.

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Quantitative Methods (POL63100)

Contents

1 Introduction

Right- and left-wing authoritarian political expression has reached a peak in middle of the 20th century, after which it lost traction by the end of the millenium (Coppedge et al., 2020). However temporary, authoritarian and populist parties are once more becoming engaged in politics more strongly (Timbro, 2020), posing the question of what makes the authoritarian model attractive - or at least, durable (Slater & Fenner, 2011) - in particularly liberal or illiberal settings. While studying this aspect would be a large endeavor, one set of variables may explain part of the attractiveness: the (image of) effectiveness in crisis management, most salient being the ongoing COVID-19 pandemic.

What is the effect of regime type on the deaths from COVID-19? The research question, "How well do authoritarian systems manage emergencies?," focuses on both sides of the political coin: the liberal systems, in political scores represented by Scandinavian countries, and the illiberal systems that are represented by the Democratic People's Republic of Korea, along with all the greyer country regimes between. Since countries have changed the definition of what constitutes a death from the COVID-19 disease in the midst of the pandemic (Tsang et al., 2020), sources of reported COVID-19 death (Dong, Du & Gardner, 2021) as well as excess deaths during the pandemic (Roser et al., 2021).

This paper answers the question by using ordinary least squares (further: OLS) linear regression models to estimate the effect of a variable such as level of democracy, on the variable related to COVID-19 deaths, estimated in crude death rate (further: CDR). The goals of such an attempt are the following: determine whether an effect exists, and if so, in which direction does it lean; and find out which control variables fit the model. The results reveal that even if threshold is lowered, the autocracy-positive effect is small, and likely present due to the currently unmeasurable error that is inherent in misreporting, level of mobilization, and similar. While underwhelming, results show a potential avenue for future research in transitorily authoritarian systems, based on the harshness and duration of their response to the impending "peak wave."

The limitations of this study include difficulties in accurately estimating COVID-19 metrics, and connecting different polity or democratic scores. Per country data is less precise than a smaller unit would allow, but given the availability of data, this study relies on sample size to provide indications as to whether and how much do regime types affect crisis (or more specifically, COVID-19 pandemic) response.

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2 Theory

2.1 Authoritarianism and Crises

The relationship between regime type and success in emergency management is a salient topic. Cases of nuclear disasters in Chernobyl and Fukushima (Steinhauser, Brandl & Johnson, 2014) have fueled discussions on which systems organize a proportionate reaction instead of maintaining their international image of doing so. Theoretically, according to Lijphart's (2012) thesis, systems which concentrate executive power may be more effective in decision-making, although less equal. Using Linz's (1964) definition relayed in Alon, Farrell & Li's (2020) study, a regime is authoritarian when it offers limited political pluralism, obtains legitimacy through populism, suppresses anti-regime sentiments, and has broadly-defined powers; the democracy, by extent, represents the logical opposite of the concepts. Autocracy and authoritarian are used interchangeably for the purpose of this study.

Several qualitative studies provide reasons for why authoritarian or autocratic systems falter where democracies succeed. Busygina (2012) provides the simplest explanation based on the evaluation of Russian 2010 forest fire management: more autocratic states manage risks less effectively because they are accountable to a limited number of people. Kim et al. (2018) find that democratic factors (except for political participation) contribute to better environmental management, with the caveat that management also improves as income rises. Lin (2015) also determines that democracy and state capacity together prevent losses, especially in more predictable disasters such as floods.

There are also studies which emphasize the potential advantage of more autocratic systems. Analyzing the potential of implementing solar radiation management geoengineering (SRMG) to address climate change, Szerszynski et al. (2013) conclude that factors of democratic systems - namely, uncertainty, unstable pluralities, and being conditioned by economic forces, among others - may contribute to poorer SRMG implementation across the globe. Ahlbom Persson & Povitkina (2017) find that natural disasters affect fewer people in democratic systems, only if they have high institutional quality, otherwise concluding an advantage in more autocratic systems. Others criticize the overemphasis of political risk of an epidemic for a system such as China in Western media, using the examples of both the 2003 SARS-Cov (Lin, 2012) and the current Sars-CoV2 (MacDonald, 2020) epidemic.

There is, however, little evidence of a clear relationship. In their analysis of nuclear energy policy, Richter & Wurster (2016) found less of an effect of regime type on the diffusion of policies. By studying the COVID-19 pandemic, Piscopo (2020) emphasizes institutional trust, bureaucratic capacity and corruption as main determinants of deaths (although these factors are more present in democracies).

2.2 Previous (Quantitative) Studies

Several studies have made earlier attempts to estimate the connection between regime type and various COVID-19 case metrics. Alon, Farrell & Li (2020) published a qualitative study in May of 2020, analyzing the response of China vis-a-vis Taiwan, most notably in terms of reporting cases of people who show symptoms, as opposed to reporting all positive tests. Another study by Kavanagh & Singh (2020) in December of 2020 draws conclusions on the mechanisms used by democracies and autocracies, where the latter may have an advantage in initiating "coercive public health measures."

From quantitative data, Petersen (2020) looked at COVID-19 testing (source: OWID) per regime type (source: VDEM) in July 2020, concluding a "low correlation between democratic regimes and non-testing" (p. 18, Petersen, 2020), also subsequently finding strong correlation of testing with government effectiveness and GDP per capita. Bosancianu et al (2020) studied political and social correlates extensively, but found no statistically significant correlation between decentralized democracies and less (reported) cumulative deaths per capita. Still, the study found a connection between trust in institutions and state capacity in together reducing deaths, which is corroborated by Piscopo (2020) who had similar results using OECD 2017 survey on trust in government. Lastly, Frey, Chen & Presidente (2020) similarly find little evidence of effectiveness in either authoritarian or democratic systems. After an analysis of the correlates to the Oxford COVID-19 Government Response Tracker (OxCGRT), they, at the very least, show a trend of more stringent lockdowns and contact tracing in autocratic systems, as well as 20% more success for democracies in reducing geographic mobility (Frey, Chen & Presidente, 2020).

2.3 Recording COVID-19 Deaths

Many academic, governmental and intergovernmental agencies record the number of COVID-19 cases, deaths and recoveries, but few aggregate them as thoroughly as the researchers of John Hopkins University (Dong, Du & Gardner, 2020). The John Hopkins University dataset is widely used in many studies, from political science (Babiker et al., 2020; Binder, 2020; Ricard & Medeiros, 2020) to medicine (see, for example: Abramovitz et al., 2020; Wadhera et al., 2020; Bamidele & Daniel, 2020; Larochelambert et al., 2020).

The JHU and OWID data are used to illustrate the differences in how COVID-19 deaths are recorded, although their results cannot be directly compared. Researchers recording COVID-19 deaths source the data from many different databases, most of which are maintained by government agencies and medical communities which have different definitions for what is a death from COVID-19 (Dong, Du & Gardner, 2020). Because of the sensitivity of the topic for many political regimes, as well as the methodological challenge in recording cases accurately and regularly[*], there is legitimate concern that deaths will remain underreported (Angelopoulos et al., 2020). This is especially visible in Turkmenistan, which has reported no cases nor deaths from the COVID-19 pandemic, despite an increase in hospitalization due to respiratory diseases (Yaylymova, 2020). Instead of relying on potentially biased official data during the pandemic, the measure of excess deaths by the researchers at Global Change Data Lab provides a substitute variable for estimation (Roser et al., 2021).

Excess deaths are measured according to all recorded deaths in a given time period, subtracted by average deaths for that same period (in this case, mean deaths in 2015 - 2019). While this data still does not address missing data in countries such as Turkmenistan where reporting is a general problem, it provides an estimate that also includes unrecorded deaths at home, insufficient testing, and inaccurate measures of mortality (Roser et al. 2021). Excess deaths, however, include all proximate pandemic-related increases (e.g. surge in preventable deaths due to overburdened hospitals) and decreases (e.g. drops in traffic-related deaths during lockdown), so they cannot be directly compared to recorded COVID-19 cases. Nonetheless, both variables provide the necessary information to estimate the effect of a political regime as objectively as possible.

[*] See Appendix 4 for an overview of the main methodological problems in measuring COVID-19 cases, as listed by Angelopoulos et al (2020).

2.4 Quantifying Political Regime Type

Several organizations estimate political indices from a set of political, economic and social variables, as a means to monitor regime type. Most notable are the Center for Systemic Peace (2018), Economist Intelligence Unit (2019), Freedom House (2020), Fraser Institute (2020), V-Dem Institute (Coppedge et al., 2020), Timbro (2020), Cato Institute (2020), and Heritage Institute (2020). Because of differing methodologies, organizational missions and sample sizes, as well as to avoid multicollinearity, several of these indices serve as explanatory variables and as substitutes to each other. Although there are fears that the pandemic may institute and strengthen authoritarian systems in the future (Thomson & Ip, 2020), there is no reverse causality yet, as the democracy scores have been estimated prior to 2020. Limitation of the data is that these indices are estimated by organizations from democratic Anglo-Saxon countries, so the assessment of foreign systems may be missing local information or data that may change the score.

2.5 Models and Hypothesis

The core OLS linear regression models with robust standard errors feature the base, full and adjusted types of models.

Base model

$$y_i = \beta_0 + \beta_1 x_i + \epsilon_i \tag{1}$$

Full model

$$y_i = \beta_0 + \beta_1 x_i + \beta_2 + ... + \beta_l + \epsilon_i \tag{2}$$

Adjusted model

$$y_i = \beta_0 + \beta_1 x_i + ... + \beta_{l_{99\%}} + \epsilon_i \tag{3}$$

Where:

- y_i: outcome, represented by JHU or OWID data
- β_0: intercept
- x_i: explanatory variable, represented by CSP, EIU, FH, FI or VDEM data
- β_l: list l of all relevant non-duplicate control variables
- $\beta_{l_{99\%}}$: list l of all control variables which are correlated with y_i at 99% confidence level and have more than 100 observations
- ϵ_i: error term

While qualitative studies provide potential reasons for why democratic or autocratic systems may have an advantage in managing emergencies like the coronavirus pandemic, it is not possible to estimate a potential accurately. Quantitative estimates provided early assessments on limited data in the few months after the global outbreak, whereas this study addresses approximately 6-7 months of the pandemic in each country. Thus, the null hypothesis is that there is no effect of regime type $\hat{\beta}_0$ on . The alternative hypothesis is determined as a rejection of the null hypothesis at the 99% confidence level ($p < 0.01$).

$$h_0 : \hat{\beta}_1 = 0 \tag{4}$$

$$h_a : \hat{\beta}_1 \neq 0 \tag{5}$$

3 Empirical Results

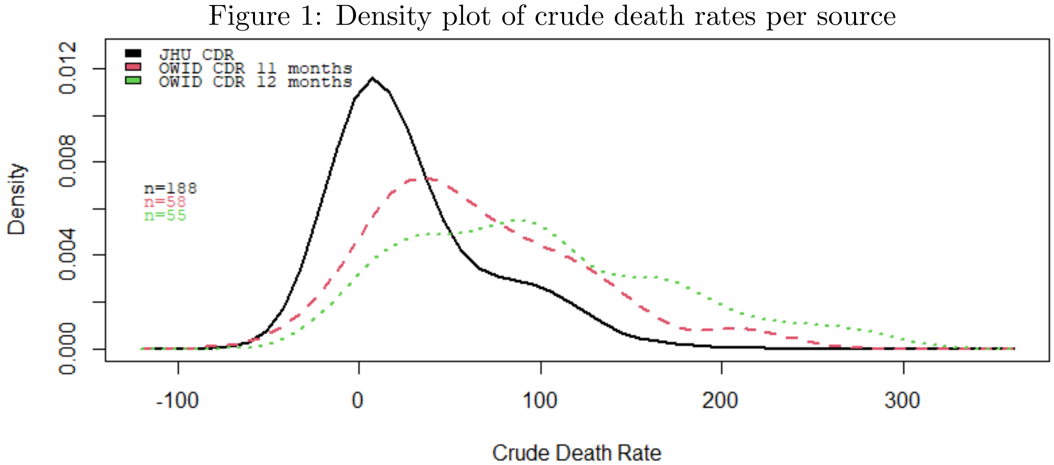
3.1 Data

The sample consists of 188 countries. Three variables represent COVID-19 crude death rate† based on the data collected by the John Hopkins University (further: JHU) and the Oxford University-based Global Change Data Lab (hosted on the Our World in Data website; further: OWID). Due to the unavailability of data for Australia, Mongolia and the Phillippines for the month of December 2020, OWID data has been also adjusted for 11 months, to show any differences in the estimations. The limitation of the data for the outcome variables is that the COVID-19 pandemic reached different countries at a different time; however, most countries reported the first cases in February and March 2020 (See Appendix 6). Four variables were used for the estimation of the level of autocracy/democracy and one for economic freedom. The table below showcases the core data for each of the outcome (i.e. dependent) and explanatory (i.e. independent) variable used in the models.

Table 1: Description of explanatory and outcome variables

Type	#	Name	Source	Size	Mean ($\hat{\mu}$)	SD ($\hat{\sigma}$)
Outcome	1	jhu.crude_death	John Hopkins University	188	28.8	39.0
(crude death rate)	2	owid.excess11_crude	Global Change Data Lab	58	65.0	56.9
	3	owid.excess12_crude	Global Change Data Lab	55	98.8	73.0
Explanatory	1	csp.revised_polity	Center for Systemic Peace	163	4.2	6.1
(score)	2	eiu.demos2019	Economist Intelligence Unit	164	5.5	2.2
	3	fh.demos2020	Freedom House	27	43.4	26.9
	4	fi.econ2018	Fraser Institute	161	6.8	0.9
	5	vdem.regime	V-Dem Institute	171	4.8	2.7

Figure 1: Density plot of crude death rates per source



Density distributions of JHU and OWID data are right skewed, with higher standard deviation and higher mean for CDR of excess death. Normalized distribution of different political scores show a left skew towards more democratic systems. This left skew is the result of a trend of democratization in the past century (Coppedge et al., 2021), and it affects the possibility to estimate models across democratic and non-democratic systems equally. Tables 2-7 demonstrate the distribution of sample size, JHU and OWID (12 month) data per category in each polity score.

†Formulas used for CDR in Appendix 3.

Figure 2: Density plot of normalized political and democratic scores

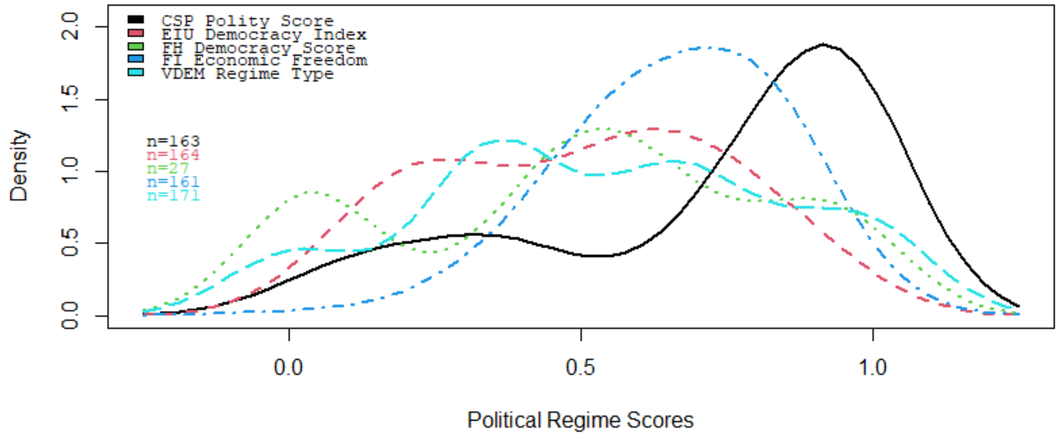


Table 2: Outcome variables per each csp.revised_polity category

	Polity	Count	JHU	Mean JHU	OWID	Mean OWID
1	-10.00	3	3	15.69	1	11.05
2	-9.00	3	3	7.86	1	60.45
3	-8.00	2	2	18.06	1	40.47
4	-7.00	8	8	16.14	1	185.26
5	-6.00	3	3	8.47		
6	-5.00	1	1	1.29		
7	-4.00	7	7	8.46		
8	-3.00	7	7	6.39	1	27.46
9	-2.00	5	5	2.13	1	22.18
10	-1.00	3	3	2.06		
11	0.00	3	3	8.04		
12	1.00	1	1	1.67		
13	2.00	2	2	3.25		
14	3.00	3	3	3.03		
15	4.00	6	6	15.23	2	131.13
16	5.00	8	8	13.20		
17	6.00	12	12	9.28	1	44.51
18	7.00	17	17	26.72	1	280.90
19	8.00	18	18	41.07	9	115.24
20	9.00	18	18	65.04	7	138.45
21	10.00	33	33	47.91	25	79.34
22		25	25	29.39	4	127.11

Table 3: Outcome variables per binary csp.revised_polity

	Polity	Count	JHU	JHU%	OWID	OWID%
1	Democratic	118	118	62.80	45	23.90
2	Not democratic	45	45	23.90	6	3.20
3		25	25	13.30	4	2.10

Table 4: Outcome variables per each eiu.demos2019 score

	Demos	Count	JHU	Mean JHU	OWID	Mean OWID
1	1.00	3	3	2.01		
2	2.00	12	12	9.76	1	60.45
3	3.00	26	26	8.41	4	106.14
4	4.00	19	19	10.64		
5	5.00	18	18	21.25	1	98.57
6	6.00	25	25	35.54	9	140.55
7	7.00	24	24	47.99	8	107.11
8	8.00	23	23	56.92	19	94.33
9	9.00	12	12	49.43	9	59.30
10	10.00	2	2	8.27	2	4.97
11		24	24	21.96	2	195.66

Table 5: Outcome variables per fh.demos2020 status

	FH Status	Count	JHU	Mean JHU	OWID	Mean OWID
1	Consolidated Authoritarian Regime	7	7	16.85	4	133.01
2	Semi-Consolidated Authoritarian Regime	1	1	95.27	1	280.90
3	Transitional or Hybrid Regime	9	9	79.91	5	121.75
4	Semi-Consolidated Democracy	4	4	90.48	4	169.44
5	Consolidated Democracy	6	6	63.59	6	89.78
6	Uncategorized	161	161	23.21	35	79.84

Table 6: Outcome variables per each fi.econ2018 category

	Econ. Freedom	Count	JHU	Mean JHU	OWID	Mean OWID
1	3.00	1	1	3.62		
2	4.00	1	1	3.35		
3	5.00	11	11	10.45		
4	6.00	42	42	12.37	2	129.86
5	7.00	56	56	32.60	16	117.17
6	8.00	48	48	51.59	32	88.38
7	9.00	2	2	0.51	2	9.19
8		27	27	17.33	3	150.59

Table 7: Outcome variables per each vdem.regime category

	Regime	Count	JHU	Mean JHU	OWID	Mean OWID
1	0.00	19	19	10.13	3	26.32
2	1.00	3	3	7.91	1	60.45
3	2.00	1	1	7.46		
4	3.00	45	45	8.75	5	127.22
5	4.00	14	14	36.69	3	151.47
6	5.00	10	10	16.36		
7	6.00	34	34	45.20	9	157.12
8	7.00	11	11	27.66	5	83.13
9	8.00	9	9	39.34	7	67.59
10	9.00	25	25	55.57	20	75.43
11		17	17	31.41	2	195.66

3.2 Control Variables

Due to the size of the unit- countries with heterogeneous political, economic, demographic and sociocultural idiosincracies - and the variables considered in the study, there are many potential controls for per country data. There is also the uncertainty of whether certain variables were omitted Although COVID-19 is a relatively novel disease, researchers have already found correlations at 95% confidence level between (JHU) COVID-19 death rates and other ”per country” variables (Knittel & Ozaltun, 2020; Larochelambert et al., 2020; Liang et al., 2020): % of population over 65, % of population living in owner-occupied housing, median home value, % ethnic minorities, % of workers taking public transit, smoking, diabetes, obesity and BMI, being uninsured, number of ICU beds per capita, average summer and winter temperatures, level of air pollution (in PM2.5), COVID-19 tests per 100 people, government effectiveness score, transport infrastructure quality score (logistics performance index), 25-65 degree latitude intervals, inactive lifestyle, life expectancy, and government containment.

Control variables which were added for the purposes of this paper include: distance to China to account for intensity of spread, binary variable for landlocked countries to account for sea-based trade, false news to potentially account for misreporting, neopatrimonialism to account for centralization, and equality of resource access. Geographical parameters are not correlated with the outcome, while neopatrimonialism and domestic government-sourced dissemination false news are correlated at 99%.

Sources for certain control variables were problematic, because of a very limited number of observations. These variables, alongside those that are irrelevant to the polity model (e.g. 25-65 latitude) or are difficult to estimate (e.g. % living in owner-occupied housing, % uninsured), were excluded. Many of the remaining variables were confirmed to be correlated with JHU CDR in the following tables, the majority at 99% confidence level. The inverse relationship between state fragility and CDR is statistically significant, ranging from -3.3 to -0.7 smaller CDR per unit, depending on the aggregate estimate. Disaggregated estimates in the form of government effectiveness and legitimacy are also correlated, with substantive -5.8 per unit for both variables. Fragmented politics are not correlated.

Table 8: Fragility

	Dependent variable:				
	jhu.crude_death				
	(1)	(2)	(3)	(4)	(5)
csp.fragment	−1.47				
csp.fragile2018		−3.26***			
csp.fragile_effect			−5.84***		
csp.fragile_legit				−5.75***	
ffp.fragile2020					−0.71***
Constant	29.66***	55.40***	51.38***	53.52***	74.81***
Observations	164	164	164	164	174
R^2	0.001	0.27	0.27	0.21	0.21
Adjusted R^2	-0.01	0.27	0.27	0.21	0.21
Residual Std. Error	38.29	32.66	32.68	33.99	33.50
F Statistic	0.13	60.79***	60.52***	43.77***	45.68***
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 9: Population

	Dependent variable:				
	jhu.crude_death				
	(1)	(2)	(3)	(4)	(5)
un.pop	-0.00				
oecd.trust2017		-1.84^{*}			
wb.above65_2019			3.44^{***}		
who.tobacco				1.18^{***}	
t.popul2020					0.63^{**}
Constant	29.20^{***}	69.27^{***}	-2.42	5.69	55.28^{***}
Observations	188	30	178	142	33
R^2	0.001	0.02	0.35	0.08	0.06
Adjusted R^2	-0.004	-0.02	0.35	0.08	0.03
Residual Std. Error	39.06	44.20	30.03	37.37	39.81
F Statistic	0.27	0.49	96.74^{***}	12.97^{***}	1.89
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 10: Geography and Economics

	Dependent variable:				
	jhu.crude_death				
	(1)	(2)	(3)	(4)	(5)
cepii.dist_china	0.001				
cepii.landlocked		-2.63			
wb.lpi_avg1218			30.49^{***}		
wb.gdppc2019				0.001^{***}	
wb.urban_perc2019					0.68^{***}
Constant	20.06^{***}	28.88^{***}	-57.67^{***}	19.58^{***}	-10.88^{*}
Observations	183	183	164	174	185
R^2	0.01	0.001	0.20	0.11	0.16
Adjusted R^2	0.003	-0.005	0.19	0.10	0.16
Residual Std. Error	38.49	38.63	34.34	35.91	35.97
F Statistic	1.53	0.13	39.50^{***}	21.12^{***}	34.75^{***}
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 11: Health

	Dependent variable:				
	jhu.crude_death				
	(1)	(2)	(3)	(4)	(5)
ncd.mean_bmi	6.38^{***}				
oecd.gdp_health2019		2.33			
who.gdp_health2018			5.85^{***}		
vdem.health_acc				9.08^{***}	
who.hospitals1k2_2013					-0.32^{*}
Constant	-135.27^{***}	41.26^{**}	-8.36	23.98^{***}	26.11^{***}
Observations	181	37	180	171	130
R^2	0.13	0.02	0.16	0.14	0.002
Adjusted R^2	0.13	-0.01	0.16	0.13	-0.01
Residual Std. Error	35.17	43.07	35.96	35.11	36.11
F Statistic	27.01^{***}	0.60	34.59^{***}	27.09^{***}	0.27
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 12: Political

	Dependent variable:				
	jhu.crude_death				
	(1)	(2)	(3)	(4)	(5)
vdem.eq_resource	46.74***				
vdem.neopatri		−49.22***			
vdem.govfakenews			6.46***		
owid.excess11_crude				0.59***	
owid.excess12_crude					0.46***
Constant	1.07	50.88***	29.08***	18.63***	14.26**
Observations	171	171	171	58	55
R^2	0.13	0.15	0.06	0.53	0.55
Adjusted R^2	0.12	0.15	0.05	0.53	0.54
Residual Std. Error	35.36	34.84	36.68	31.83	30.97
F Statistic	24.37***	30.14***	10.65***	64.35***	64.74***
Note:			*p<0.1; **p<0.05; ***p<0.01		

UN Population checks for model validity, as CDR already takes account of population. Level of citizen trust in government (OECD, 2017) and populist party votes (Timbro, 2020) were correlated at 90% ($p < 0.1$) and 95% ($p < 0.05$) confidence levels, respectively. Despite a study showing correlation between trust and CDR at 95% confidence level (Piscopo, 2020), that result has not been replicated here. Correlations with percentage of population aged 65 or above, smokers, in urban areas, BMI, GDP per capita, % GDP spent on health, and health access are statistically significant at 1%. Correlation with OWID excess CDR ($p < 0.01$) shows that there is approximately half excess CDR for each unit of COVID-19-related CDR.

3.3 Models

Base models cover the 15 different variations (3 outcome × 5 explanatory variables) without control variables.

Base models

$$y_iJHU = \qquad y_iOWID11 = \qquad y_iOWID12 =$$

$$\beta_0 + ... + \epsilon_i$$

$$\beta_1 CSPx_i \qquad \beta_1 EIUx_i \qquad \beta_1 FHx_i$$
$$\beta_1 FIx_i \qquad \beta_1 VDEMx_i$$

Full models cover the 15 variations of 5 explanatory, 3 outcome, and all 14 control variables. Total number of models with control variables added one by one is 225 (See: Appendix 7).

Full model (example: y = JHU, x = CSP)

$$\begin{aligned} y_iJHU = \beta_0 + \beta_1 x_i CSP + \beta_2 Fragile + \beta_3 BMI + \beta_4 Eq.Res. + \beta_5 Neopatr. + \\ \beta_6 FakeNews + \beta_7 Trust + \beta_8 Above65 + \beta_9 GDPPC + \beta_{10} LPI + \beta_{11} Urban + \\ \beta_{12} GDPhlth + \beta_{13} Hospit. + \beta_{14} Smoking + \beta_{15} HltAcc + \epsilon_i \end{aligned}$$

3.4 Base Linear Models

According to the base linear OLS, correlation between different democracy scores and JHU CDR is statistically significant at 1%. The models explain the outcome in a range of $r^2 = 0.14$ to $r^2 = 0.24$. The direction is positive, meaning that for every unit increase in each measure of democracy, there is an increase in different levels. There is no correlation between the scores and excess deaths, although the inverse is shown: that the closer the regime is to a democracy, the less excess deaths are evident. There is likely endogeneity in these base models, however, as scores as x are likely correlated with other variables, which are omitted here. Although the robust standard errors account for it, the scatterplots show some level of heteroskedasticity: the more democratic the country, the larger the variance in CDR.

Figure 3: Base linear models.
Top to bottom: csp.revised_polity, eiu.demos2019, fh.demos2020, fi.econ2018, vdem.regime. Left to right: jhu.crude_death, owid.excess11_crude, owid.excess12_crude

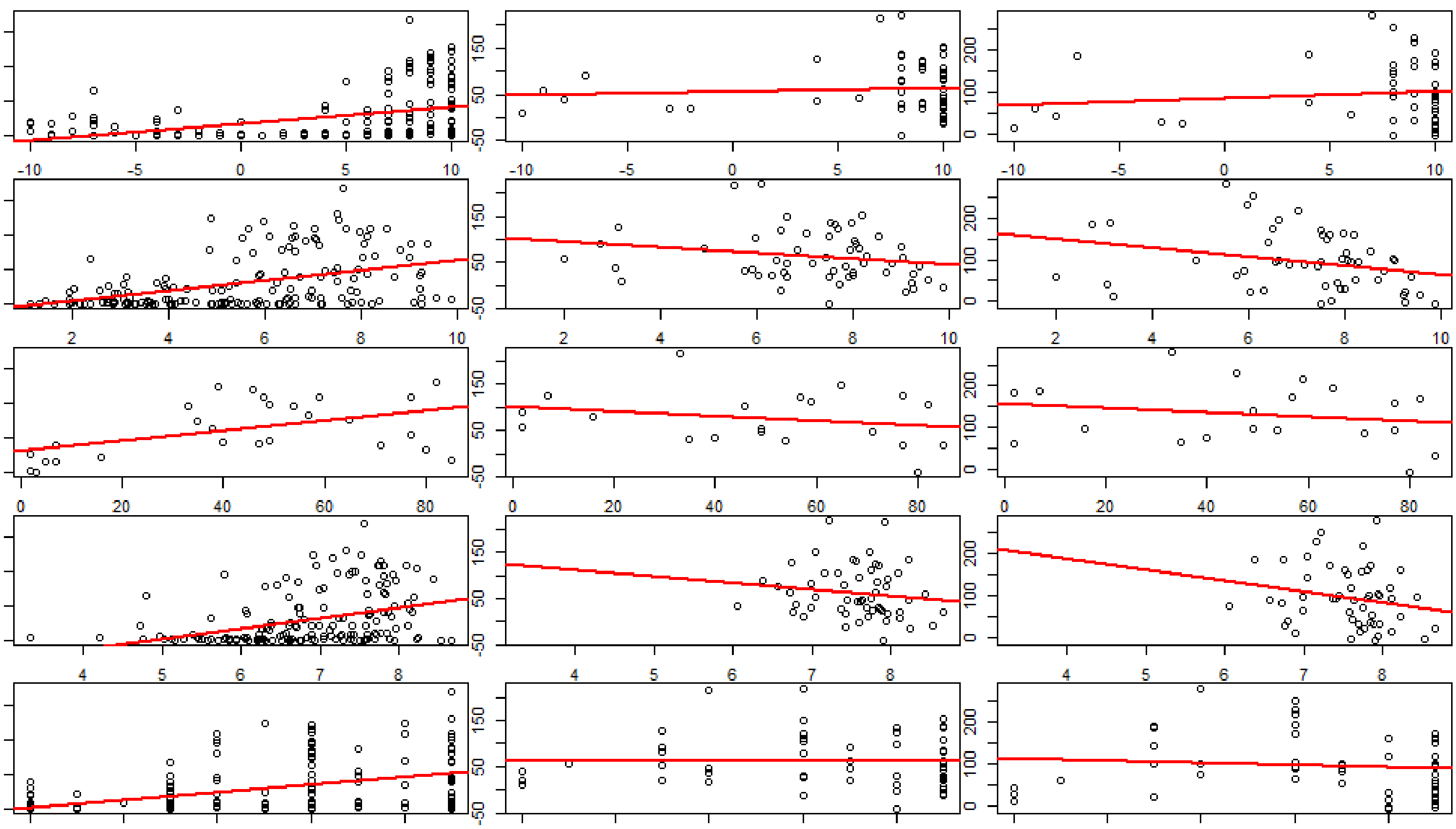


Table 13: Base Models: JHU COVID-19 Crude Death Rate

	Dependent variable:				
	jhu.crude_death				
	(1)	(2)	(3)	(4)	(5)
csp.revised_polity	2.47***				
eiu.demos2019		7.36***			
fh.demos2020			0.73***		
fi.econ2018				15.12***	
vdem.regime					5.68***
Constant	18.21***	−10.58**	30.51***	−72.80***	1.16
Observations	163	164	27	161	171
R^2	0.16	0.18	0.24	0.14	0.17
Adjusted R^2	0.15	0.18	0.20	0.13	0.17
Residual Std. Error	34.55	34.50	35.96	35.65	34.44
F Statistic	30.63***	36.29***	7.70**	25.59***	34.80***
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 14: Base Models: OWID 11-Month Excess Crude Death Rate

	Dependent variable:				
	owid.excess11_crude				
	(1)	(2)	(3)	(4)	(5)
csp.revised_polity	0.83				
eiu.demos2019		−6.21*			
fh.demos2020			−0.53		
fi.econ2018				−14.23	
vdem.regime					−0.60
Constant	57.30***	107.26***	102.61***	170.47*	66.67***
Observations	54	56	20	55	56
R^2	0.01	0.04	0.06	0.02	0.001
Adjusted R^2	-0.01	0.02	0.01	0.001	-0.02
Residual Std. Error	55.96	54.43	57.45	55.53	55.53
F Statistic	0.31	2.26	1.17	1.05	0.05
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 15: Base Models: OWID 12-Month Excess Crude Death Rate

	Dependent variable:				
	owid.excess12_crude				
	(1)	(2)	(3)	(4)	(5)
csp.revised_polity	1.61				
eiu.demos2019		−10.89*			
fh.demos2020			−0.55		
fi.econ2018				−26.26	
vdem.regime					−2.72
Constant	84.95***	173.13***	158.82***	294.29**	113.26***
Observations	51	53	20	52	53
R^2	0.01	0.08	0.04	0.04	0.01
Adjusted R^2	-0.01	0.06	-0.01	0.02	-0.01
Residual Std. Error	71.04	68.25	73.86	70.10	70.69
F Statistic	0.73	4.30**	0.75	2.18	0.56
Note:					*p<0.1; **p<0.05; ***p<0.01

3.5 Full and Adjusted Linear Models

The results of full linear models with all listed control variables are skewed and with few remaining observations. Due to the difficulty of combining data in which different countries are represented, 17 observations remain for 4 out of 5 democracy scores after all controls are accounted for. Thus any interpretation of the results would be inaccurate. Tables illustrate the extreme difference between variables, as well as unrealistic CDR, even when the correlation is statistically significant.

Table 16: Full Models: JHU COVID-19 Crude Death Rate

	Dependent variable:				
	jhu.crude_death				
	(1)	(2)	(3)	(4)	(5)
csp.revised_polity	34.06				
eiu.demos2019		−539.28***			
fh.demos2020			−0.70		
fi.econ2018				−136.71	
vdem.regime					37.21
ffp.fragile2020	7.86	−13.63**	−8.93	1.59	0.89
ncd.mean_bmi	63.21	140.72***	248.00	24.54	−44.21
vdem.eq_resource	416.08	−1,498.99***	−797.63	−131.67	473.29
vdem.neopatri	793.41	−3,330.34***	−1,209.10	−46.88	1,245.49
vdem.govfakenews	91.90	−150.81***	−53.24	−9.26	40.74
oecd.trust2017	26.70	110.13***	−6.91	0.38	−58.97
wb.above65_2019	0.78	9.94***		6.49	2.13
wb.gdppc2019	0.001	0.01***		0.001	−0.001
wb.lpi_avg1218	197.07	−233.65*		−136.57	106.39
wb.urban_perc2019	−3.51	12.19***		0.87	−1.33
who.gdp_health2018	−20.97	136.30***		22.88	−9.56
who.hospitals1k2_2013	−3.00	78.45**		0.90	−10.11
who.tobacco	−6.41	23.69***		−0.60	−4.42
vdem.health_acc	13.75	35.20		46.62	−11.03
Constant	−2,980.85	405.49	−5,228.58	541.24	314.14
Observations	17	17	8	17	17
R^2	0.77	0.98	1.00	0.81	0.83
Adjusted R^2	-2.74	0.76		-2.01	-1.75
Residual Std. Error	79.81	20.27		71.60	68.45
F Statistic	0.22	4.35		0.29	0.32

Note: *p<0.1; **p<0.05; ***p<0.01

Table 17: Full Models: OWID 11-Month Excess Crude Death Rate

	Dependent variable:				
	owid.excess11_crude				
	(1)	(2)	(3)	(4)	(5)
csp.revised_polity	−7.08				
eiu.demos2019		149.40			
fh.demos2020			−62.77		
fi.econ2018				−19.97	
vdem.regime					5.16
ffp.fragile2020	−0.04	3.79	17.46	0.47	0.45
ncd.mean_bmi	42.28	13.29	−361.15	49.49	40.15
vdem.eq_resource	1, 227.96	2, 108.53	3, 911.41	1, 126.92	1, 203.39
vdem.neopatri	908.06	2, 312.91	−411.71	823.28	998.63
vdem.govfakenews	36.26	103.16	277.35	37.86	45.10
oecd.trust2017	−78.12	−129.64	616.14	−66.47	−73.96
wb.above65_2019	−21.46	−28.28		−20.14	−20.65
wb.gdppc2019	−0.001	−0.003		−0.001	−0.001
wb.lpi_avg1218	422.80	554.20		393.11	428.32
wb.urban_perc2019	−4.03	−7.66		−3.54	−3.90
who.gdp_health2018	39.82	11.85		36.15	31.07
who.hospitals1k2_2013	110.84	121.17		105.17	102.65
who.tobacco	2.45	−3.23		2.10	1.47
vdem.health_acc	−102.40	−143.62		−88.15	−95.43
Constant	−3, 179.39	−4, 294.50	9, 391.59	−3, 161.67	−3, 199.36
Observations	16	16	8	16	16
R^2	1.00	1.00	1.00	1.00	1.00
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 18: Full Models: OWID 12-Month Excess Crude Death Rate

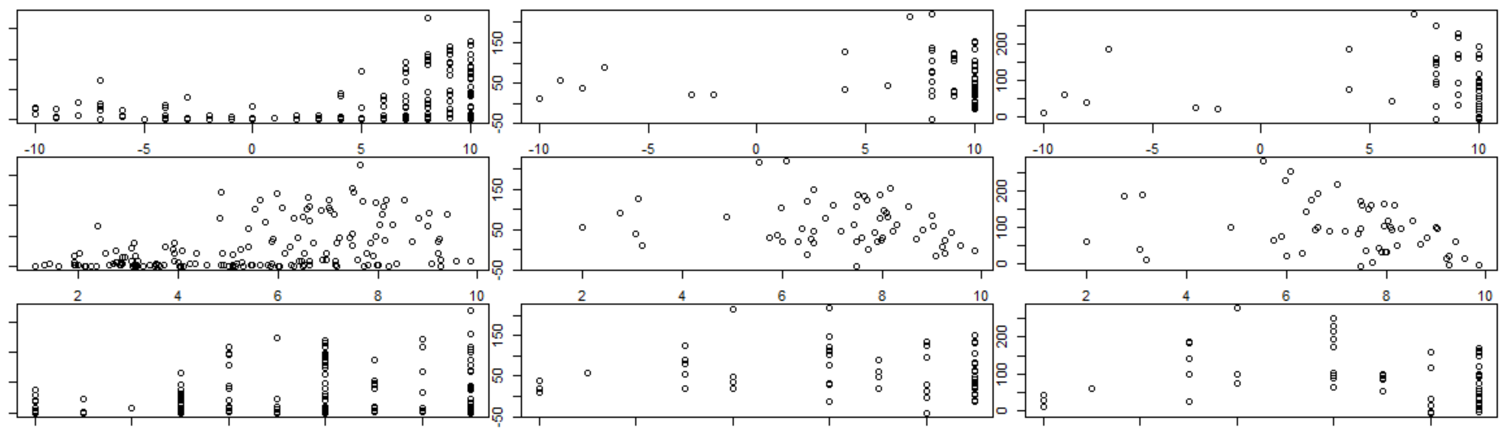
	Dependent variable:				
	owid.excess12_crude				
	(1)	(2)	(3)	(4)	(5)
csp.revised_polity	12.73				
eiu.demos2019		−268.57			
fh.demos2020			−45.98		
fi.econ2018				35.90	
vdem.regime					−9.28
ffp.fragile2020	−2.16	−9.05	4.07	−3.08	−3.05
ncd.mean_bmi	35.29	87.40	−226.95	22.32	39.12
vdem.eq_resource	1,822.55	239.55	2,858.32	2,004.18	1,866.71
vdem.neopatri	1,735.32	−790.15	−164.67	1,887.73	1,572.50
vdem.govfakenews	78.27	−42.00	185.95	75.39	62.37
oecd.trust2017	−118.56	−25.94	366.68	−139.51	−126.05
wb.above65_2019	−25.43	−13.16		−27.79	−26.87
wb.gdppc2019	−0.002	0.002		−0.002	−0.001
wb.lpi_avg1218	420.01	183.81		473.40	410.09
wb.urban_perc2019	−3.11	3.41		−3.98	−3.34
who.gdp_health2018	38.90	89.18		45.50	54.64
who.hospitals1k2_2013	137.95	119.37		148.13	152.66
who.tobacco	0.80	11.01		1.43	2.56
vdem.health_acc	−124.76	−50.66		−150.38	−137.28
Constant	−3,585.51	−1,580.90	6,360.28	−3,617.38	−3,549.61
Observations	16	16	8	16	16
R^2	1.00	1.00	1.00	1.00	1.00
Note:					*p<0.1; **p<0.05; ***p<0.01

Adjusted linear models limit the number of independent and control variables by introducing filters such as number of observations ($n \geqslant 100$), statistically significant correlation with JHU CDR (where $p < 0.01$), and no multicollinearity. Only exception to the first rule is the excess CDR dependent variable. This means the exclusion of FH democracy score, FI economic freedom score, trust, hospital access, neopatrimonialism[‡], false news.

Adjusted model (example: y = JHU, x = CSP; n of β_n unadjusted)

$$y_i JHU = \beta_0 + \beta_1 x_i CSP + \beta_2 Fragile + \beta_3 BMI + \\ \beta_8 Above65 + \beta_9 GDPPC + \beta_{10} LPI + \beta_{11} Urban + \\ \beta_{12} GDPhlth + \beta_{14} Smoking + \beta_{15} HltAcc + \epsilon_i$$

Figure 4: Adjusted models.
Top to bottom: csp.revised_polity, eiu.demos2019, vdem.regime. Left to right: jhu.crude_death, owid.excess11_crude, owid.excess12_crude



The graph and the table illustrate the correlations in the final models. Adding the relevant controls, the adjusted linear models fail to reject the null hypothesis at 99% confidence level ($p \geqslant 0.01$). The constant is significantly below the minimum of the JHU CDR (min = 0), which does not allow the regression line to be displayed on the graphs. Only correlations at 1% significance are the mean BMI of the population and the percentage of population above the age of 65.

Excess CDR deaths are not correlated with any variable at 1%, neither for 12 nor 11 months. This perhaps shows that it is too early to estimate the excess deaths during the pandemic, whether or not there is hidden or accidental misreporting.

[‡]For demonstration of multicolinearity, see Appendix 1.

Table 19: Adjusted Model

	Dependent variable:								
	JHU, OWID-11, OWID-12								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
csp.revised_polity	1.05**			1.66			2.64		
eiu.demos2019		0.42			−9.47			−14.88	
vdem.regime			2.07			2.47			2.12
ffp.fragile2020	0.40	0.35	0.49	1.71**	0.94	1.68*	1.55	0.59	1.52
ncd.mean_bmi	5.88***	6.17***	6.32***	10.19	7.75	9.69	7.98	8.67	8.82
wb.above65_2019	2.31***	2.72***	2.55***	0.29	1.23	0.65	1.43	3.68*	2.29
wb.gdppc2019	−0.0002	−0.0002	−0.0002	−0.001	−0.0005	−0.001	−0.0002	−0.0001	−0.0003
wb.lpi_avg1218	19.02**	18.08*	20.12**	39.26	28.80	31.43	11.60	4.26	8.16
wb.urban_perc2019	0.16	0.06	0.11	0.02	0.02	0.07	0.03	−0.12	−0.05
who.gdp_health2018	1.93*	2.68**	2.13*	5.34	8.33	5.69	3.25	7.78	4.23
who.tobacco	−0.01	0.11	0.12	−0.85	−0.21	−0.67	−0.24	0.55	0.13
vdem.health_acc	−2.35	−3.17	−2.58	2.85	0.47	2.76	−11.99	−11.50	−11.17
Constant	−244.93***	−247.64***	−272.09***	−434.99*	−275.85	−414.35**	−253.95	−167.47	−284.18
Observations	124	126	128	51	53	53	48	50	50
R^2	0.50	0.48	0.49	0.24	0.27	0.25	0.28	0.32	0.28
Adjusted R^2	0.46	0.44	0.45	0.05	0.10	0.07	0.08	0.15	0.10
Residual Std. Error	28.81	29.64	29.22	54.65	52.81	53.61	65.73	63.02	64.77
F Statistic	11.32***	10.80***	11.44***	1.29	1.57	1.40	1.43	1.85*	1.55
Note:	*p<0.1; **p<0.05; ***p<0.01								

3.6 Discussion

While initially significant at 1%, polity and democracy scores are likely confounded by many different variables that constitute a regime and a government, whether auto-, ano- or democratic. By excluding the effect of multicollinearity and bringing omitted variables into the model, the conlusion becomes rather disappointing but likely realistic. This is compounded by the fact that no significant effect has been found in the estimated excess deaths. In the model where the healthcare access variable was excluded, the CSP Polity variable reaches significance at 1% for correlation with JHU CDR. However, there is no apparent reason to exclude the variable.

When considering correlation at 5% significance, CSP Polity score shows an 1:1 unit effect on CDR, while logistics position index has an effect of 1:19. Part of this is because the index ranges from 2 to 4.2, whereas the polity score ranges from -10 to 10. However, even when lowering the confidence level, causality is unlikely due to intermediate variables such as mobilization, policy responsiveness, policy "harshness", enforcement, and similar. Three interpretations are thus possible. One explanation is that the data in autocratic countries is behind the (mostly-)Western democratic countries in terms of quality and quantity, so the level of reporting does not reflect the actual position of autocratic countries. This applies to excess deaths as well, where reports of deaths from any cause are delayed so not to alarm citizens or the international community. Another explanation is that, due to better mobilization or swift reaction, or even the ability to enforce freedom-limiting decrees with little reprecussions, authoritarian systems are better at managing crises. However, it is not possible to reach that interpretation by only using the data here, as there are little examples. Finally, it is possible that another omitted variable can explain the larger variance in democratic systems. Preparation is one example, where the availability of hospital beds or PPE may have played a significant role (Sen-Crowe et al., 2021).

4 Conclusion

How well do autocratic and democratic systems manage emergencies such as the COVID-19 pandemic? To answer this question, the models in this paper estimated three cases using COVID-19 data from JHU, excess deaths from OWID, and a sizable number of polity and democracy scores and control variables across a variety of sources. Base model is the first case, where coefficients for the effect of polity/democracy on were significant at 1%. The full model included every control variable that could be collected (or estimated) relatively accurately, based on the previous COVID-19 studies. The adjusted model featured instead a smaller number of control variables; the number of controls was truncated, because the full model demonstrated multicollinearity between the explanatory and some of the control variables from the VDEM dataset.

The verdict is that there is no statistically significant effect at 1% significance (99% confidence level, or $p < 0.01$) of either explanatory score on the JHU crude death rate or excess deaths. Only correlations between BMI, age and crude death rate have been replicated in the larger models. At 5% significance, there is a substantively smaller 1:1 effect of the polity score on CDR, but such correlation can be interpreted widely. With no capacity to reject the null hypothesis, the answer to the question is ambivalent, likely best represented in "depends on other variables."

Future research opportunities have an abundance of avenues, although data quality is still variable. The CoronaNet project, for example, keeps track of many different policies that illustrate how immediate the policy response was. Although the formatting of the data is still problematic, it will be possible to estimate "temporary authoritarianism" in the future, based on the length of policies, harshness, geographic reach, and types of powers gained. Such temporary authoritarianism would demonstrate some form of transitory critical juncture when a federal or any more centralized government is provided significant decision-making power. Another avenue is the correlation between neopatrimonialism, fake news, populism and COVID-19 case reportage.

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6 Appendix

6.1 Appendix 1: Multicollinearity

Figure 5: Collinearity between csp.revised_polity and various VDEM variables.

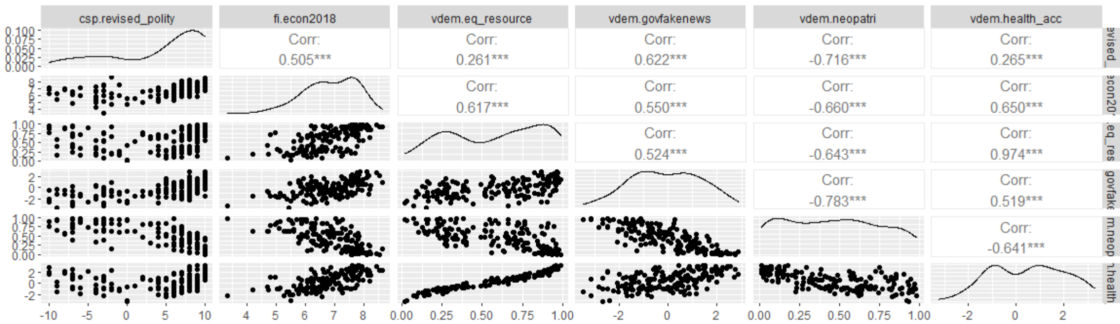


Table 20: Multicollinearity: VDEM and Polity Scores (1)

	Dependent variable:							
	Polity/Democracy Scores							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
vdem.neopatri	−14.47***				−6.50***			
vdem.eq_resource		5.51***				4.40***		
vdem.govfakenews			2.67***				1.18***	
vdem.health_acc				1.04***				0.85***
Constant	10.93***	1.06	4.62***	3.77***	8.45***	2.89***	5.63***	5.04***
Observations	163	163	163	163	163	163	163	163
R^2	0.51	0.07	0.39	0.07	0.77	0.32	0.56	0.34
Adjusted R^2	0.51	0.06	0.38	0.06	0.77	0.31	0.55	0.33
Residual Std. Error	4.25	5.88	4.77	5.87	1.07	1.84	1.48	1.81
F Statistic	169.06***	11.74***	101.82***	12.16***	532.28***	74.42***	202.79***	81.60***
Note:								*p<0.1; **p<0.05; ***p<0.01

Table 21: Multicollinearity: VDEM and Polity Scores (2)

	Dependent variable:							
	Polity/Democracy Scores							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
vdem.neopatri	−81.53***				−7.38***			
vdem.eq_resource		94.81***				4.63***		
vdem.govfakenews			14.39***				1.44***	
vdem.health_acc				19.17***				0.90***
Constant	81.49***	−26.71**	45.00***	20.75***	8.17***	2.10***	4.94***	4.37***
Observations	27	27	27	27	171	171	171	171
R^2	0.83	0.39	0.58	0.42	0.64	0.23	0.56	0.26
Adjusted R^2	0.82	0.36	0.57	0.39	0.64	0.23	0.56	0.25
Residual Std. Error	11.33	21.48	17.76	20.96	1.64	2.41	1.83	2.37
F Statistic	122.04***	15.89***	34.81***	17.94***	303.87***	51.48***	214.19***	58.04***
Note:								*p<0.1; **p<0.05; ***p<0.01

6.2 Appendix 2: Transformations

JHU_COVID

- Create a per country and type summary of sum of cases
- Check for NA in the summary

UN_POP

- Download from https://population.un.org/wpp/Download/Standard/Population/ → Total Population - Both Sexes → 'Estimates' Sheet
- Clean the unnecessary headers and rows for regions (leave only countries)
- Leave only 2020 as the relevant year

Other data

- Deleted unnecessary columns
- Added country codes

FH_PRESS

- Deleted unnecessary columns for years prior to the last available year (2016)
- Deleted rows with no data (inexistent countries)

OWID_EXCESS_MORTALITY

- Deleted unnecessary columns
- Deleted rows for year 2021
- Deleted countries with fewer data: Belarus, Canada, Costa Rica, Egypt, Georgia, Montenegro, Tunisia
- Did study with two boundaries (12 months, n = 57; 11 months, n = 60) because of countries with no data for December: Australia, Mongolia, Philippines
- Created a new calculation of the p-score for excess deaths per country for the 11 and 12 months of 2020

OECD_GDP_HEALTH

- All financing schemes > Current expenditure on health (all functions) > All providers > Share of gross domestic product

6.3 Appendix 3: Formulas

Crude Death Rate[§]

JHU Crude Death Rate

$$CDR = \frac{\sum Deaths_{2020}}{Population_{2020}} \times 100 \tag{6}$$

OWID Crude Death Rate

$$CDR = \frac{\sum Deaths_{2020} - Deaths_{2015-2019}}{Population_{2020}} \times 100 \tag{7}$$

P-Score[¶]

$$P\_score = \frac{\sum Deaths_{2020} - \sum \mu Deaths_{2015-2019}}{\sum \mu Deaths_{2015-2019}} * 100 \tag{8}$$

Case Fatality Ratio[‖]

While Reich (2012) and Angelopoulos et al. (2020) recommend using the relative CFR formula for estimates from real-time data in an on-going pandemic, estimates here are made with observed CFR, due to the cutoff point on the 31st of December 2020 and the timing of the study (March 2021).

Naive Case Fatality Ratio (in %)

$$CFR_{naive} = \frac{Deaths}{Cases} * 100 \tag{9}$$

Observed Case Fatality Ratio (in %)

$$CFR_{obs} = \frac{Deaths}{Deaths + Recovered} * 100 \tag{10}$$

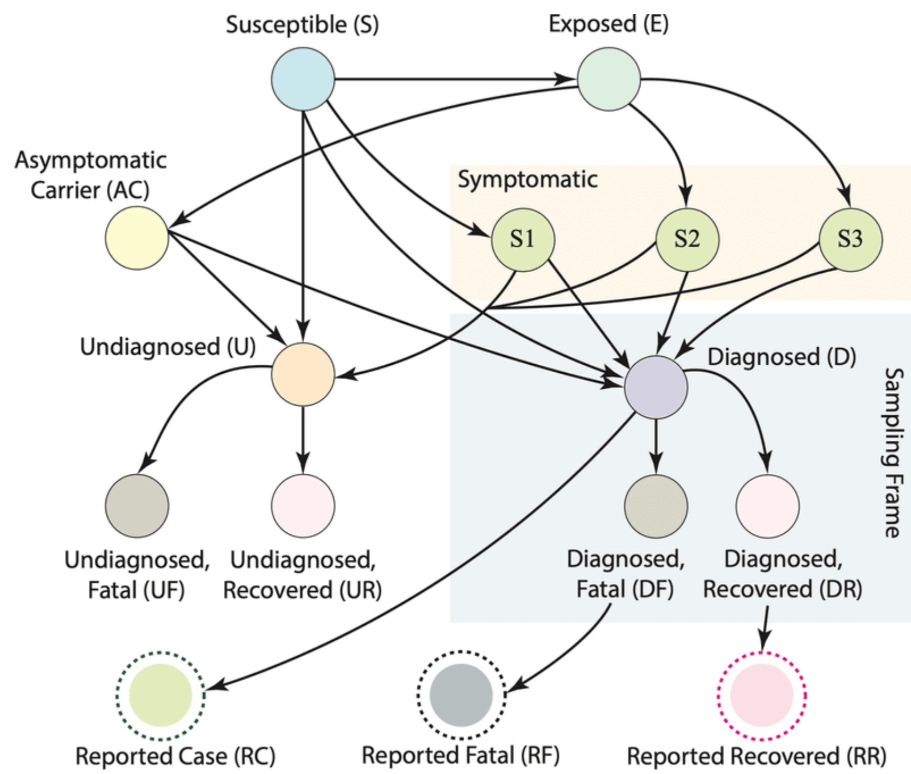
Relative Case Fatality Ratio (in %; Reich, 2012; Angelopoulos et al. 2020)

$$CFR_{rel} = \mathbb{E}[N^{(2)}_{t_{on},g}] \approx N_{t_{on},g} + \beta_0 + \alpha_{t_{on}} + \gamma_g \tag{11}$$

[§] For JHU (Dong, Du & Gardner, 2020) and OWID (Roser et al., 2021) data.
[¶] Determined according to Roser et al. (2021)
[‖] Determined according to WHO (2020 August) and Angelopoulous et al. (2020)

6.4 Appendix 4: Reproduced table on sources of measurement bias (Angelopoulos et al, 2020)

Sources of bias arising from COVID-19 health surveillance data



Edge	Notes and some potential sources of sampling and estimation bias
S → R	Social distancing, occupation, family size, behavior.
S → U	COVID-negative people who are not diagnosed.
S → D	Assay specificity and sensitivity, test availability.
S → S1	Group characteristics such as genetics and immunity. Exposure to flu.
E → AC,S2	Infectious dose, route of transmission, and group characteristics.
E → S3	Presence of other underlying medical conditions.
AC → U,D	Random sampling, contact tracing, test availability.
S1 → U	Assay specificity and sensitivity, case severity.
S2 → U	Assay specificity and sensitivity, case severity, test availability.
S3 → U	Misattribution of symptoms, assay specificity and sensitivity, comorbidities.
S1 → D	Misattribution, assay specificity and sensitivity, group characteristics.
S2 → D	Delays in seeking care, interventions like contact tracing, group characteristics.
S3 → D	Assay specificity and sensitivity, contact tracing and test availability.
U → UF, UR	Group characteristics, particularly comorbidities.
D → DF	Misattribution, group characteristics, imperfect reporting.
D → DR	Survey nonresponse, group characteristics, imperfect reporting.
D → RC	Imperfect reporting: errors, case definition, release of incorrect data, time lag.
DF → RF	Imperfect reporting, national reporting guidelines, ease of reporting.
DR → RR	Imperfect reporting, national reporting guidelines, ease of reporting.

6.5 Appendix 5: Abbreviations and counts

Table 22: All variables

	Abbreviations	n	Note
1	country	188	Country name
2	cc	188	ISO3 Country code
3	jhu.confirmed	188	JHU: Confirmed COVID-19 Cases (Unused)
4	jhu.death	188	JHU: Confirmed COVID-19 Deaths
5	jhu.recovered	188	JHU: Confirmed COVID-19 Recoveries (Unused)
6	un.pop	188	UN: Population, 2020
7	jhu.concluded	188	JHU: Concluded COVID-19 Cases
8	jhu.crude_death	188	JHU: Crude Death Rate
9	jhu.crude_confirmed	188	JHU: Crude Case Rate (Unused)
10	jhu.crude_recovered	188	JHU: Crude Recovery Rate (Unused)
11	jhu.crude_concluded	188	JHU: Crude Concluded Rate (Unused)
12	jhu.cfr	188	JHU: Case Fatality Ratio (Unused)
13	csp.p5	164	CSP: Polity5 Case Indicator (Unused)
14	csp.fragment	164	CSP: Polity Fragmentation (Unused)
15	csp.revised_polity	163	CSP: Revised Combined Polity Score (p5)
16	csp.durable_polity	163	CSP: Regime Durability (p5)
17	csp.fragile2018	164	CSP: Regime Fragility, 2018
18	csp.fragile_effect	164	CSP: Regime Fragility, Effectiveness
19	csp.fragile_legit	164	CSP: Regime Fragility, Legitimacy
20	eiu.demos2019	164	EIU: Democracy Index, 2019
21	eiu.demos2018	164	EIU: Democracy Index, 2018
22	eiu.demosChange	164	EIU: Democracy Index Change, 2018-2019
23	ffp.fragile2020	174	FFP: Fragility, 2020
24	fh.demosPerc	27	FH: Democracy Percentage (Unused)
25	fh.demosScore2020	27	FH: Democracy Score (a), 2020 (Unused)
26	fh.demos2020	27	FH: Democracy Score (b), 2020
27	fh.demosStatus	27	FH: Democracy Score Status
28	fh.polRights	187	FH: Political Rights
29	fh.civLiber	187	FH: Civil Liberties
30	fh.globalScore	187	FH: Global Score
31	fh.globalStatus	187	FH: Global Score Status
32	fh.press2016	187	FH: Freedom of Press, 2016
33	fh.pressStatus	187	FH: Freedom of Press Status
34	fi.econ2018	161	FI: Economic Freedom, 2018
35	ncd.mean_bmi	181	NCD: Mean BMI, 2019
36	t.popul2020	33	T: Populism Index, 2020
37	vdem.regime	171	VDEM: Regimes of the World, 2020
38	vdem.polyarchy	171	VDEM: Multiplicative Polyarchy Index
39	vdem.eq_resource	171	VDEM: Equal Distribution of Resources Index
40	vdem.neopatri	171	VDEM: Neopatrimonial Rule Index
41	vdem.govfakenews	171	VDEM: Government Dissemin. of False Info Domestic
42	oecd.trust2017	30	OECD: Trust in Government, 2017
43	owid.excess11	58	OWID: Excess Deaths, 11 Months of 2020
44	owid.excess12	55	OWID: Excess Deaths, 12 Months of 2020
45	cepii.dist_china	183	CEPII: Distance from China in km
46	cepii.landlocked	183	CEPII: Landlocked Countries
47	oecd.gdp_health2019	37	OECD: % GDP Spent on Healthcare, 2018
48	wb.above65_2019	178	WB: % Population Older than 65, 2019
49	wb.gdppc2019	174	WB: GDP per Capita, 2019
50	wb.lpi_avg1218	164	WB: Logistics Performance Index, 2012-2018 (average)
51	wb.urban_perc2019	185	WB: % Urban Population, 2019
52	who.gdp_health2018	180	WHO: % GDP Spent on Healthcare, 2018
53	who.healthposts1k2_2013	107	WHO: Health Posts per 100k, 2013
54	who.hospitals1k2_2013	130	WHO: Hospitals per 100k, 2013
55	owid.excess11_crude	58	OWID: Crude Excess Death Rate, 11 Months 2020
56	owid.excess12_crude	55	OWID: Crude Excess Death Rate, 12 Months 2020
57	who.tobacco	142	WHO: % Tobacco Use, Adults, 2019
58	vdem.health_acc	171	VDEM: Health Accessibility Index
59	jhu.first_case	188	JHU: First Recorded Case in Country

6.6 Appendix 6: Data per Country

Note: Column names truncated for visibility. Countries determined according to the intersection of data in UN-DESA estimated population.

- CC: Country code
- POP: United Nations Department of Economic and Social Affairs, estimated population (2020)
- CSP: Center for Systemic Peace, revised polity score V (2020)
- EIU: Economist Intelligence Unit, democracy index (2019)
- FH: Freedom House, democracy score (2020)
- FI: Fraser Institute, economic freedom index (2020)
- VDEM: V-DEM Institute, regime type (2020)
- JHU: John Hopkins University, crude death rate of COVID-19 deaths for 12 months (2020)
- OWID11: Our World in Data, crude death rate of excess deaths for 11 months (2020)
- OWID12: Our World in Data, crude death rate of excess deaths for 12 months (2020)

Table 23: Explanatory and outcome variables per country

	Country	CC	First Case	POP	CSP	EIU	FH	FI	VDEM	JHU	OWID11	OWID12
1	Afghanistan	AFG	2020-02-24	38928341	-1	3			3	6		
2	Albania	ALB	2020-03-09	2877800	9	6	47	8	4	41		
3	Algeria	DZA	2020-02-25	43851043	2	4		5	3	6		
4	Andorra	AND	2020-03-02	77265						109		
5	Angola	AGO	2020-03-20	32866268	-2	4		5	3	1		
6	Antigua and Barbuda	ATG	2020-03-13	97928						5		
7	Argentina	ARG	2020-03-03	45195777	9	7		6	6	96		
8	Armenia	ARM	2020-03-01	2963234	7	6	33	8	4	95	216	281
9	Australia	AUS	2020-01-26	25499881	10	9		8	9	4	-14	
10	Austria	AUT	2020-02-25	9006400	10	8		8	9	69	63	95
11	Azerbaijan	AZE	2020-03-01	10139175	-7	3	2	6	3	26	91	185
12	Bahamas	BHS	2020-03-16	393248				8		43		
13	Bahrain	BHR	2020-02-24	1701583	-10	3		7	0	21		
14	Bangladesh	BGD	2020-03-08	164689383	-6	6		6	3	5		
15	Barbados	BRB	2020-03-17	287371				6	8	2		
16	Belarus	BLR	2020-02-28	9449321	-7	3	7	6	3	15		
17	Belgium	BEL	2020-02-04	11589616	8	8		8	9	168	132	149
18	Belize	BLZ	2020-03-23	397621				7		62		
19	Benin	BEN	2020-03-16	12123198	7	5		6	4	0		
20	Bhutan	BTN	2020-03-06	771612	7	5		7	5	0		
21	Bolivia	BOL	2020-03-11	11673029	7	5		6	4	79		
22	Bosnia and Herzegovina	BIH	2020-03-05	3280815		5	39	7	5	123		
23	Botswana	BWA	2020-03-30	2351625	8	8		8	7	2		
24	Brazil	BRA	2020-02-26	212559409	8	7		7	6	92	77	89
25	Brunei	BRN	2020-03-09	437483				7		1		
26	Bulgaria	BGR	2020-03-08	6948445	9	7	59	8	6	109	111	217
27	Burkina Faso	BFA	2020-03-10	20903278	6	4		6	6	0		
28	Burma	MMR	2020-03-27	54409794	8	4		6	3	5		
29	Burundi	BDI	2020-03-31	11890781	-1	2		6	3	0		
30	Cabo Verde	CPV	2020-03-20	555988	10	8		7	6	20		
31	Cambodia	KHM	2020-01-27	16718971	-4	4		7	3	0		
32	Cameroon	CMR	2020-03-06	26545864	-4	3		6	3	2		
33	Canada	CAN	2020-01-26	37742157	10	9		8	9	41		
34	Central African Republic	CAF	2020-03-15	4829764	6	1		5	3	1		
35	Chad	TCD	2020-03-19	16425859	-2	2		6	3	1		
36	Chile	CHL	2020-02-23	19116209	10	8		8	7	87	91	99
37	China	CHN	2020-01-22	1439323774	-7	2		6	0	0		
38	Colombia	COL	2020-03-06	50882884	7	7		7	6	85		
39	Comoros	COM	2020-04-30	869595	-3	3			3	1		
40	Congo (Brazzaville)	COG	2020-03-15	5518092	-4	3		5	3	2		
41	Congo (Kinshasa)	COD	2020-03-11	89561404	-3	1		5	3	1		
42	Costa Rica	CRI	2020-03-06	5094114	10	8		8	9	43		
43	Cote d'Ivoire	CIV	2020-03-11	26378275	4	4		6	5	1		

44	Croatia	HRV	2020-02-25	4105268	9	7	54	7	6	95	28	94
45	Cuba	CUB	2020-03-12	11326616	-5	3			0	1		
46	Cyprus	CYP	2020-03-09	1207361	10	8		8	9	10	31	36
47	Czechia	CZE	2020-03-01	10708982	9	8	77	8	8	108	124	160
48	Denmark	DNK	2020-02-27	5792203	10	9		8	9	22	7	14
49	Djibouti	DJI	2020-03-18	988002	3	3			3	6		
50	Dominica	DMA	2020-03-22	71991						0		
51	Dominican Republic	DOM	2020-03-01	10847904	7	7		8	5	22		
52	Ecuador	ECU	2020-03-01	17643060	5	6		6	6	80		
53	Egypt	EGY	2020-02-14	102334403	-4	3		5	2	7		
54	El Salvador	SLV	2020-03-19	6486201	8	6		7	6	20		
55	Equatorial Guinea	GNQ	2020-03-15	1402985	-6	2			3	6		
56	Eritrea	ERI	2020-03-21	3546427	-7	2			0	0		
57	Estonia	EST	2020-02-27	1326539	9	8	85	8	9	17	19	32
58	Eswatini	SWZ	2020-03-14	1160164	-9	3		6	0	18		
59	Ethiopia	ETH	2020-03-13	114963583	1	3		6	3	2		
60	Fiji	FJI	2020-03-19	896444	2	6		6	3	0		
61	Finland	FIN	2020-01-29	5540718	10	9		8	9	10	24	22
62	France	FRA	2020-01-24	65273512	10	8		7	9	99	80	93
63	Gabon	GAB	2020-03-14	2225728	3	4		6	3	3		
64	Gambia	GMB	2020-03-17	2416664	4	4		7	5	5		
65	Georgia	GEO	2020-02-26	3989175	7	5	38	8	6	63		
66	Germany	DEU	2020-01-27	83783945	10	9		8	9	40	27	53
67	Ghana	GHA	2020-03-14	31072945	8	7		7	8	1		
68	Greece	GRC	2020-02-26	10423056	10	7		7	7	46	62	83
69	Grenada	GRD	2020-03-22	112519						0		
70	Guatemala	GTM	2020-03-14	17915567	8	5		8	6	27		
71	Guinea	GIN	2020-03-13	13132792	4	3		6	3	1		
72	Guinea-Bissau	GNB	2020-03-25	1967998	6	3		5	5	2		
73	Guyana	GUY	2020-03-12	786559	7	6		7	6	21		
74	Haiti	HTI	2020-03-20	11402533	5	5		7	3	2		
75	Holy See	VAT	2020-03-06	809						0		
76	Honduras	HND	2020-03-11	9904608	7	5		7	3	32		
77	Hungary	HUN	2020-03-04	9660350	10	7	49	7	4	99	47	99
78	Iceland	ISL	2020-02-28	341250		10		8	8	8	12	15
79	India	IND	2020-01-30	1380004385	9	7		7	4	11		
80	Indonesia	IDN	2020-03-02	273523621	9	6		7	7	8		
81	Iran	IRN	2020-02-19	83992953	-7	2		5	3	66		
82	Iraq	IRQ	2020-02-24	40222503	6	4		6	3	32		
83	Ireland	IRL	2020-02-29	4937796	10	9		8	9	45		
84	Israel	ISR	2020-02-21	8655541	6	8		8	9	38	43	45
85	Italy	ITA	2020-01-31	60461828	10	8		8	8	123	135	161
86	Jamaica	JAM	2020-03-11	2961161	9	7		8	6	10		
87	Japan	JPN	2020-01-22	126476458	10	8		8	9	3	22	30
88	Jordan	JOR	2020-03-03	10203140	-3	4		8	0	38		
89	Kazakhstan	KAZ	2020-03-13	18776707	-6	3	5	7	3	15		
90	Kenya	KEN	2020-03-13	53771300	9	5		7	4	3		
91	Korea, South	KOR	2020-01-22	51269183	8	8		8	8	2	30	31
92	Kuwait	KWT	2020-02-24	4270563	-7	4		7	1	22		
93	Kyrgyzstan	KGZ	2020-03-18	6524191	8	5	16	7	3	21	81	99
94	Laos	LAO	2020-03-24	7275556	-7	2		7	0	0		
95	Latvia	LVA	2020-03-02	1886202	8	7	80	8	8	34	-40	-7
96	Lebanon	LBN	2020-02-21	6825442	6	4		7	4	22		
97	Lesotho	LSO	2020-05-13	2142252	8	7		7	6	2		
98	Liberia	LBR	2020-03-16	5057677	7	5		6	6	2		
99	Libya	LBY	2020-03-24	6871287	0	2		5	0	22		
100	Liechtenstein	LIE	2020-03-04	38137						102	64	124
101	Lithuania	LTU	2020-02-28	2722291	10	8	77	8	7	54	20	95
102	Luxembourg	LUX	2020-02-29	625976	10	9		8	9	79	49	73
103	Madagascar	MDG	2020-03-20	27691019	6	6		6	4	1		
104	Malawi	MWI	2020-04-02	19129955	6	6		6	4	1		
105	Malaysia	MYS	2020-01-25	32365998	7	7		8	3	1		
106	Maldives	MDV	2020-03-08	540542					5	9		
107	Mali	MLI	2020-03-25	20250834	5	5		6	4	1		
108	Malta	MLT	2020-03-07	441539		8		8	6	50	77	102
109	Marshall Islands	MHL	2020-10-28	59194						0		
110	Mauritania	MRT	2020-03-14	4649660	-2	4		6	3	7		
111	Mauritius	MUS	2020-03-18	1271767	10	8		8	7	1	47	52
112	Mexico	MEX	2020-02-28	128932753	8	6		7	6	98	219	252
113	Moldova	MDA	2020-03-08	4033963	9	6	35	7	6	74	31	63
114	Monaco	MCO	2020-02-29	39244						8		

115	Mongolia	MNG	2020-03-10	3278292	10	6		7	6	0	-12	
116	Montenegro	MNE	2020-03-17	628062	9	6	48	7	4	109		
117	Morocco	MAR	2020-03-02	36910558	-4	5		7	0	20		
118	Mozambique	MOZ	2020-03-22	31255435	5	4		6	3	1		
119	Namibia	NAM	2020-03-14	2540916	6	6		7	7	8		
120	Nepal	NPL	2020-01-25	29136808	7	5		6	6	6		
121	Netherlands	NLD	2020-02-27	17134873	10	9		8	9	67	84	100
122	New Zealand	NZL	2020-02-28	4822233	10	9		9	9	1	-9	-4
123	Nicaragua	NIC	2020-03-19	6624554	6	4		7	3	2		
124	Niger	NER	2020-03-20	24206636	5	3		6	5	0		
125	Nigeria	NGA	2020-02-28	206139587	7	4		7	5	1		
126	North Macedonia	MKD	2020-02-26	2083380	9	6	46	7	6	120	104	229
127	Norway	NOR	2020-02-26	5421242	10	10		8	8	8	-3	-5
128	Oman	OMN	2020-02-24	5106622	-8	3		7	0	29	38	40
129	Pakistan	PAK	2020-02-25	220892331	7	4		6	3	5		
130	Panama	PAN	2020-03-10	4314768	9	7		8	6	93		
131	Papua New Guinea	PNG	2020-03-20	8947027	5	6		6	3	0		
132	Paraguay	PRY	2020-03-08	7132530	9	6		7	6	32		
133	Peru	PER	2020-03-06	32971846	9	7		8	6	114		
134	Philippines	PHL	2020-01-30	109581085	8	7		7	4	8	18	
135	Poland	POL	2020-03-04	37846605	10	7	65	7	6	75	149	194
136	Portugal	PRT	2020-03-02	10196707	10	8		8	8	68	97	118
137	Qatar	QAT	2020-02-29	2881060	-10	3		7	0	9	11	11
138	Romania	ROU	2020-02-26	19237682	9	6	57	8	6	82	121	173
139	Russia	RUS	2020-01-31	145934460	4	3	7	7	3	39	127	188
140	Rwanda	RWA	2020-03-14	12952209	-3	3		7	3	1		
141	Saint Kitts and Nevis	KNA	2020-03-25	53192						0		
142	Saint Lucia	LCA	2020-03-14	183629						3		
143	Saint Vincent and the Grenadines	VCT	2020-03-14	110947						0		
144	Samoa	WSM	2020-11-18	198410						0		
145	San Marino	SMR	2020-02-27	33938						174	198	268
146	Sao Tome and Principe	STP	2020-04-06	219161					6	8		
147	Saudi Arabia	SAU	2020-03-02	34813867	-10	2		6	0	18		
148	Senegal	SEN	2020-03-02	16743930	7	6		6	7	2		
149	Serbia	SRB	2020-03-06	6926705	8	6	49	7	3	46	54	142
150	Seychelles	SYC	2020-03-14	98340				7	5	0		
151	Sierra Leone	SLE	2020-03-31	7976985	7	5		6	6	1		
152	Singapore	SGP	2020-01-23	5850343	-2	6		9	3	0	21	22
153	Slovakia	SVK	2020-03-06	5459643	10	7	71	8	7	39	48	88
154	Slovenia	SVN	2020-03-05	2078932	10	8	82	7	9	130	106	171
155	Solomon Islands	SLB	2020-10-12	686878	8				6	0		
156	Somalia	SOM	2020-03-16	15893219	5				0	1		
157	South Africa	ZAF	2020-03-05	59308690	9	7		7	7	48		
158	South Sudan	SSD	2020-04-05	11193729	0				0	1		
159	Spain	ESP	2020-02-01	46754783	10	8		8	9	109	152	160
160	Sri Lanka	LKA	2020-01-27	21413250	6	6		7	6	1		
161	Sudan	SDN	2020-03-13	43849269	-4	3		4	0	3		
162	Suriname	SUR	2020-03-14	586634	5	7		6	6	21		
163	Sweden	SWE	2020-02-01	10099270	10	9		8	9	86	42	59
164	Switzerland	CHE	2020-02-25	8654618	10	9		8	9	88	60	97
165	Syria	SYR	2020-03-22	17500657	-9	1		5	0	4		
166	Taiwan*	TWN	2020-01-22	23816775	10	8		8	9	0	2	3
167	Tajikistan	TJK	2020-04-30	9537642	-3	2	3	6	3	1		
168	Tanzania	TZA	2020-03-16	59734213	3	5		7	3	0		
169	Thailand	THA	2020-01-22	69799978	-3	6		7	0	0	21	27
170	Timor-Leste	TLS	2020-03-22	1318442	8	7		6	6	0		
171	Togo	TGO	2020-03-06	8278737	-2	3		6	3	1		
172	Trinidad and Tobago	TTO	2020-03-14	1399491	10	7		7	7	9		
173	Tunisia	TUN	2020-03-04	11818618	7	7		6	6	40		
174	Turkey	TUR	2020-03-11	84339067	-4	4		7	3	25		
175	Uganda	UGA	2020-03-21	45741000	-1	5		8	3	1		
176	Ukraine	UKR	2020-03-03	43733759	4	6	40	6	4	44	35	74
177	United Arab Emirates	ARE	2020-01-29	9890400	-8	3		7	0	7		
178	United Kingdom	GBR	2020-01-31	67886004	8	9		8	9	108	106	119
179	Uruguay	URY	2020-03-13	3473727	10	8		7	9	5		
180	US	USA	2020-01-22	331002647	8	8		8	9	104	136	162
181	Uzbekistan	UZB	2020-03-15	33469199	-9	2	2		1	2	57	60
182	Vanuatu	VUT	2020-11-10	307150					6	0		
183	Venezuela	VEN	2020-03-14	28435943	-3	3		3	3	4		
184	Vietnam	VNM	2020-01-23	97338583	-7	3		6	1	0		
185	West Bank and Gaza	PSE	2020-03-05	5101416		4				27		

186	Yemen	YEM	2020-04-10	29825968	0	2	6	0	2
187	Zambia	ZMB	2020-03-18	18383956	6	5	7	3	2
188	Zimbabwe	ZWE	2020-03-20	14862927	4	3	5	3	2

6.7 Appendix 7: Control variables added one-by-one

Tables reproduced on the next pages.

Table 24: One-by-One Control Models: JHU COVID-19 Crude Death Rate

	Dependent variable:														
	jhu.crude_death														
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
csp.revised_polity	2.47***	1.43***	1.66***	1.68***	1.87***	2.05***	−5.16	−7.58	−7.32	−1.29	−4.27	−3.48	12.18	34.26	34.06
ffp.fragile2020		−0.60***	−0.35***	−0.32*	−0.36*	−0.45**	0.89	0.73	1.17	2.06	2.04	2.09	5.20	7.91	7.86
ncd.mean_bmi			6.10***	6.10***	6.03***	5.53***	12.53	14.43	14.81	20.01**	18.35*	18.31*	37.32	60.50	63.21
vdem.eq_resource				2.89	4.57	3.74	129.70	104.16	104.98	154.32*	136.68	150.87	137.40	527.38	416.08
vdem.neopatri					7.80	−3.08	40.62	48.57	75.12	164.11	176.57	193.39	190.05	838.54	793.41
vdem.govfakenews						−4.80*	−8.96	−8.92	−5.73	5.37	6.74	7.57	19.84	92.61	91.90
oecd.trust2017							−0.35	−0.06	−0.44	−0.61	−1.31	−1.26	16.42	23.64	26.70
wb.above65_2019								2.18	2.85	0.22	0.34	0.02	0.32	−0.20	0.78
wb.gdppc2019									0.0003	−0.0001	0.0000	0.0000	0.002	0.001	0.001
wb.lpi_avg1218										74.58	85.57	80.23	102.80	200.45	197.07
wb.urban_perc2019											−0.57	−0.52	−2.90	−3.19	−3.51
who.gdp_health2018												1.06	6.13	−19.45	−20.97
who.hospitals1k2_2013													4.42	0.04	−3.00
who.tobacco														−5.89	−6.41
vdem.health_acc															13.75
Constant	18.21***	63.14***	−109.73***	−113.30***	−114.51***	−91.73**	−346.29	−388.18	−446.47	−940.59*	−858.80*	−870.04*	−1,664.22	−3,030.35	−2,980.85
Observations	163	161	160	160	160	160	29	29	29	29	29	29	17	17	17
R^2	0.16	0.29	0.38	0.38	0.38	0.39	0.25	0.26	0.27	0.38	0.39	0.39	0.68	0.76	0.77
Adjusted R^2	0.15	0.28	0.36	0.36	0.36	0.36	-0.01	-0.03	-0.08	0.04	-0.005	-0.07	-0.69	-0.90	-2.74
Residual Std. Error	34.55	31.96	30.14	30.24	30.31	30.14	44.42	45.04	45.93	43.40	44.40	45.74	53.62	56.92	79.81
F Statistic	30.63***	32.52***	31.29***	23.33***	18.62***	16.17***	0.98	0.88	0.78	1.12	0.99	0.85	0.50	0.46	0.22

Note: *p<0.1; **p<0.05; ***p<0.01

Table 25: One-by-One Control Models: OWID 12-Month Excess Crude Death Rate

	Dependent variable:														
	owid.excess12_crude														
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
fi.econ2018	15.12***	4.00	4.77	4.63	3.49	3.41	−71.35*	−74.89*	−80.41**	−77.26**	−79.82*	−82.86*	−99.26	−91.81	−136.71
ffp.fragile2020		−0.59***	−0.35*	−0.44**	−0.31	−0.36	1.27	1.23	2.03*	2.53***	2.45**	2.49**	2.64	2.91	1.59
ncd.mean_bmi			5.71***	5.85***	6.19***	5.84***	16.40**	18.94***	19.98***	24.75***	25.70***	25.42***	18.17	19.04	24.54
vdem.eq_resource				−8.51	−10.85	−11.18	102.23	67.39	66.78	118.40	126.56	173.35	242.13	263.21	−131.67
vdem.neopatri					−19.33*	−28.06*	−136.00	−147.58	−108.56	7.56	1.04	64.35	181.58	234.71	−46.88
vdem.govfakenews						−2.98	−11.23	−11.35	−5.67	4.91	3.99	6.82	3.41	9.11	−9.26
oecd.trust2017							1.06	1.50	0.91	0.67	1.08	1.21	−6.98	−6.94	0.38
wb.above65_2019								2.54	3.86**	1.67	1.80	0.97	2.77	2.75	6.49
wb.gdppc2019									0.001	0.0001	0.0001	0.0001	0.001	0.001	0.001
wb.lpi_avg1218										71.02	63.87	44.33	−59.04	−41.05	−136.57
wb.urban_perc2019											0.30	0.40	0.54	0.22	0.87
who.gdp_health2018												3.77	21.08	18.42	22.88
who.hospitals1k2_2013													6.47	4.74	0.90
who.tobacco														−0.66	−0.60
vdem.health_acc															46.62
Constant	−72.80***	41.52	−124.68**	−116.54**	−116.08**	−99.39*	84.33	28.98	−38.03	−474.78	−480.50	−457.54	−65.67	−185.70	541.24
Observations	161	159	159	156	156	156	29	29	29	29	29	29	17	17	17
R^2	0.14	0.21	0.28	0.28	0.29	0.30	0.39	0.41	0.44	0.55	0.55	0.57	0.78	0.78	0.81
Adjusted R^2	0.13	0.20	0.27	0.27	0.27	0.27	0.19	0.18	0.18	0.30	0.27	0.24	-0.20	-0.79	-2.01
Residual Std. Error	35.65	34.47	32.91	33.12	33.03	33.04	39.88	40.10	40.09	36.96	37.93	38.61	45.15	55.22	71.60
F Statistic	25.59***	20.27***	20.22***	15.03***	12.44***	10.51***	1.93	1.77	1.69	2.22*	1.93	1.74	0.80	0.50	0.29

Note: *p<0.1; **p<0.05; ***p<0.01