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Reacting, fast and slow: how world leaders shaped government responses to the COVID-19 pandemic

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ABSTRACT

The COVID-19 pandemic created extraordinary challenges for governments to safeguard the well-being of their people. To what extent has leaders' reliance on scientific advice shaped government responses to the COVID-19 outbreak? We argue that leaders who tend to orient themselves on expert advice realized the extent of the crisis earlier. Consequently, these governments would adopt containment measures relatively quickly, despite the high uncertainty they faced. Over time, differences in government responses based on the use of science would dissipate due to herding effects. We test our argument on data combining 163 government responses to the pandemic with national- and individual-level characteristics. Consistent with our argument, we find that countries governed by politicians with a stronger technocratic mentality, approximated by holding a PhD, adopted restrictive containment measures faster in the early, but not in the later, stages of the crisis. This importance of expert-based leadership plausibly extends to other large-scale societal crises.

KEYWORDS crisis; leadership; expertise; COVID-19; policy-making; public health

Introduction

To successfully overcome a crisis, effective leadership is vital. Any crisis – including the COVID-19 pandemic – requires leaders to make sense of a rapidly evolving and highly uncertain situation that threatens their societies' fundamental values (Boin et al., 2005). Faced with this uncertainty during COVID-19, governments adopted a range of different policies at very different speeds. As a result, leaders' decisions and attributes have come under academic (e.g., Al Saidi et al., 2020; Aldrich & Lotito, 2020; Glenn

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et al., 2021) and public scrutiny (e.g., Karnitschnig, 2020; Miller, 2020). Anecdotal evidence suggests leaders' reliance on scientific advice (or absence thereof) was pivotal in the early stage of the outbreak. Some leaders were more reluctant to incorporate scientific expertise in their daily decision-making than others. For instance, the U.S. response has been heavily criticized because President Donald J. Trump largely ignored scientific advice (e.g., Evanega et al., 2020). By contrast, German Chancellor Angela Merkel, and her government's early response, was hailed by the media because of her science background (Miller, 2020). This raises the following question: To what extent has leaders' reliance on scientific advice shaped government responses to the COVID-19 outbreak?

To answer this question, we integrate scholarship on crisis management and experts' role in public policy (Bækkeskov, 2016; Boin et al., 2005; Rosenthal & 't Hart, 1991). Scholarly work has repeatedly emphasized the importance of leadership during crises – from hurricanes (Boin et al., 2010) to financial crises (De Clercy & Ferguson, 2016; van Esch & Swinkels, 2015), and from terror attacks (Jong, 2017) to disease outbreaks (Boin et al., 2005). Key organizational and psychological determinants of crisis decision-making include, for example, leaders' beliefs (Brummer, 2016; Swinkels, 2020), different personalities in crisis recognition (Jong, 2017; van Esch & Swinkels, 2015), or opportunities for reform (Boin & 't Hart, 2003).

We develop an argument on one aspect of leaders' technocratic mentality (Putnam, Putnam, 1977): their differential use of scientific evidence in sense- and decision-making. Amongst leaders exposed to a crisis early, some relied on scientific evidence to make sense of the crisis and, consequently, their governments acted relatively quickly. This argument's observable implication is that countries with leaders more inclined to orient themselves on scientific expertise implemented containment measures in the early stages of the pandemic when uncertainty around responses remained high. However, as a global blueprint for pandemic response emerged in March 2020, world leaders could draw on their peers' experiences as alternative sources for inspiration. Consequently, leaders' use of science would become less important, and governments primarily oriented their policy decisions on the emerging global consensus.

We test this argument using regression analysis on novel data combining information on world leaders' educational background from 163 countries with their pandemic responses (Hale, Angrist, Kira, Petherick, et al., 2020). Drawing on educational and professional socialization literature, we operationalize reliance on scientific evidence through world leaders' academic training. We find evidence consistent with our argument. Amongst countries with a COVID-19 outbreak in the first two months of the pandemic, governments whose leaders hold doctorates implemented restrictive containment measures earlier than those with lower education levels. Around the time

when the World Health Organization (WHO) declared COVID-19 a global pandemic, on 11 March 2020, these differences become statistically insignificant. We probe the plausibility of our quantitative findings by briefly discussing the role of leadership in the government response of four countries – Vietnam, the U.S., Portugal, and Chile.

By highlighting how the reliance on scientific evidence shaped government responses to the COVID-19 outbreak, our study emphasizes one understudied aspect of effective crisis governance in the debate on the causes and consequences of policy responses to crises (Bækkeskov, 2016; Boin & Lodge, 2016; McConnell & Tormey, 2020; Rosenthal & 't Hart, 1991; Stark, 2014; Steinebach & Knill, 2018). In the context of the COVID-19 pandemic, a decisive and swift response to the outbreak – guided by scientific evidence – may have lowered the number of infections considerably, thereby saving thousands of lives early on (Stewart & Sample, 2020; Plümper & Neumayer 2020).

The remainder of this article is structured as follows. In Section 2, we develop our theoretical argument on technocratic mentality and the speed of crisis responses. Section 3 presents our research design and introduces data on world leaders and government responses to COVID-19. We discuss our main findings and probe their plausibility by contrasting leadership in four countries in Section 4 and 5, respectively. The final section concludes by discussing the implications of our findings for crisis governance and public leadership.

Use of evidence during crises: why some leaders react faster

As unique as the COVID-19 pandemic may seem at first sight, it is part of a larger group of phenomena that social scientists interested in crisis governance have long studied. Although distinctive in its scope and severity in recent history, it shares with other crises three characteristic elements (Rosenthal et al., 1989). First, the COVID-19 outbreak *threatened the fundamental value* of safeguarding citizens health – by June 2021, the total number of COVID-19 deaths worldwide exceeded 3.8 million. Second, it *evolved rapidly*, thus requiring decision-makers to respond under considerable time pressure. In early January 2020, only selected people knew about a novel virus spreading in China; merely three months later, most societies had introduced policy measures so restrictive few would have thought possible. Third, as a new, rapidly spreading and deadly disease, COVID-19 brought *substantial uncertainty* to governments. The consequences of policies are always somewhat unpredictable. However, crises exacerbate such uncertainty to levels few societies regularly encounter (Bækkeskov & Öberg, 2017; Boin et al., 2005; Rosenthal et al., 1989).

Particularly in the early stages of a crisis, sense-making and decision-making are at the heart of effective leadership (Boin et al., 2005). First,

sense-making describes the task of recognizing the existence (and severity) of a crisis and understanding its origins. Doing so is subject to individual biases and institutional hurdles. Consequently, world leaders differed widely in their sense-making of COVID-19 (Glenn et al., 2021). Second, decision-making requires leaders to evaluate and adopt policies to mitigate the crisis at a time of considerable uncertainty (Boin et al., 2005). Decision-making is strongly affected by leaders' ability to coordinate diverse groups of policy-makers and stakeholders. During COVID-19, national and local governments' decision-making varied widely, and some of that variation has been attributed to the leaders facilitating these decisions (Al Saidi et al., 2020; Dirani et al., 2020; Reicher & Stott, 2020). Explanations have focused on the role of leaders' gender (Aldrich & Lotito, 2020), incumbency (Baccini & Brodeur, 2020), and leadership styles (Glenn et al., 2021).

We add to this literature by developing an argument on leaders' reliance on scientific evidence during crises. In the early stages of a crisis, leaders need to filter signal from noise and create a coherent narrative to facilitate crisis response (Boin et al., 2005). Those leaders whose countries were exposed to COVID-19 early faced 'first-mover disadvantages' (Lipscy, 2020, pp. 14–15; Plümper & Neumayer 2020) because of the substantial uncertainty surrounding the severity of the virus and the necessity to take unprecedented steps to mitigate it. Thus, such first-mover disadvantages render sense-making challenging and decisions needed to be taken based on little available data at the time.

By listening to scientific experts, leaders could grasp the magnitude of the COVID-19 threat earlier and, in turn, adopt restrictive containment policies quickly. Scholarship on crisis management has highlighted the importance of scientific expertise in reducing uncertainty during crises (Bækkeskov, 2016; Rosenthal & 't Hart, 1991; Stern, 1991). Alongside the media, experts can narrow the policy options that both governments and the public deem worthy of consideration due to their expert authority (Bækkeskov & Öberg, 2017). Discussions on COVID-19 have often highlighted the crucial role experts have played in the sense-making and decision-making process during the pandemic (Al Saidi et al., 2020). Virologists and public health experts argued to 'flatten the curve' early on in the pandemic. For example, Dr Christian Drosten, head of the virology institute at the Charité Berlin, discussed the dangers of droplet and smear infections in an interview with German state TV *ARD* in January, five days before the first case in Germany was reported. He also mentioned travel restrictions and contact tracing as potentially necessary containment and health measures if the virus spread more widely (ARD, 2020). While the relative merits of particular policy measures were up for debate, health experts largely agreed on the basic necessity to stop the spread of COVID-19 early on (Horton, 2020;

McKee & Stuckler, 2020). Leaders that needed to make sense of the novel situation could rely on experts for a somewhat coherent narrative.

What determines whether leaders draw on scientific expertise to fill lacking best practices? The public policy literature has discussed that individuals differ substantially in their 'technocratic mentality' (Putnam, 1977, p. 386) – the extent to which they employ technocratic reasoning (Ribbhagen, 2013). Technocratic reasoning refers to the reliance on scientific facts in decision-making to maximize the effectiveness of policy interventions. Technocratically inclined officials tend to understand their role in apolitical terms; are more sceptical towards ideological and political considerations in decision-making; believe that political conflict is ill-advised; and lean towards a pragmatic rather than political analysis of policy (Putnam, 1977). Technocratic reasoning is commonly differentiated from political reasoning, which is based on ideology and political interests to maximize the representation of constituencies (Fischer, 1990; Ribbhagen, 2013).[1] In practice, the two modes of reasoning feature concomitantly in most policy decisions. However, leaders will be more inclined towards one of the two types of reasoning. For example, former U.S.-President Donald J. Trump tilts heavily towards political reasoning – often judging facts by their correspondence to his ideology or political interests (Rutledge, 2020). German Chancellor Angela Merkel, on the other hand, has a much more technocratic approach highlighting the best available evidence on particular issues (Miller, 2020). Indeed, individuals often vary substantially in their attitudes towards technocratic decision-making (Bertsou & Caramani, 2020).

We argue that in the context of COVID-19, leaders with a technocratic mentality would have been more likely to listen to virologists, sidestep their ideology, and facilitate swift decision-making by highlighting necessity over democratic deliberations. Therefore, the first hypothesis posits:

> **H1:** Countries with leaders who rely more on technocratic reasoning react quicker in the early stages of a crisis.

The relevance of expertise decreases once a shared problem perception and coherent playbook for responses emerges of other countries' actions (Glenn et al., 2021; Lipscy, 2020). In turn, uncertainty regarding sense-making eventually decreases. By Mid-March 2020, the WHO had declared COVID-19 a global pandemic and governments were judged by the public on a common yardstick of responses. World leaders who recorded the first case of COVID-19 in their countries later could learn from the decisions and narratives developed in January and February. Similar patterns have been observed for earlier pandemics like Ebola, MERS, or SARS, where countries with early outbreaks recorded heavy casualties and were slow in adapting to the crisis. Put differently, governments of countries affected later can overcome uncertainty by relying on international precedents if information-

sharing, learning, and international cooperation take place (Lipscy, 2020). Indeed, COVID-19 responses show substantial herding behavior – governments implemented broadly similar measures across varying contexts (Hale, Angrist, Kira, Goldszmidt, et al., 2020). Thus, we argue that the emerging consensus lessened reliance on experts because a generalized playbook for the pandemic response had evolved, and world leaders – regardless of their technocratic mentality – oriented themselves on other countries. Consequently, our second hypothesis is as follows:

> **H2:** Countries with leaders who rely more on technocratic reasoning do not react quicker once a common view of a crisis has emerged.

Our argument, therefore, explains (a) how the consideration of science in policymaking should impact the response to an early COVID-19 outbreak (H1); and (b) why technocratic mentality should lack explanatory power in the later stages of a crisis (H2).

Data and research design

Data

To test these two hypotheses, we created a new dataset combining national, governmental, and individual-level information for a sample of 163 countries. We use data from the Oxford Coronavirus Government Response Tracker (OxCGRT) to measure the timing of government responses regarding containment and closure of an economy (Hale, Angrist, Kira, Petherick, et al., 2020) as per 30 June 2020. Our dependent variable – time to first restrictive containment measure – corresponds to the number of days between the first restrictive measure and the first reported case of COVID-19 in a given country (the index case). A restrictive containment measure (i.e., required, rather than recommended) is any of the following: school closing; workplace closing; cancelling public events; restrictions on gatherings; closing of public transport; stay-at-home requirements; restrictions on internal movement; and restrictions on international travel.[2] In robustness checks, we also examine the time of the first containment measure to the date on which a country recorded 10 (cumulative) cases. For the full definition of all variables and the sample of countries, see Appendix A.[3]

To operationalize our argument on technocratic mentality, we draw on the personal biography approach used to study leadership in comparative politics and international relations (Krcmaric et al., 2020). Accordingly, individuals' professional and educational background is crucial to understand their opinions and use of expertise (Ban & Patenaude, 2019; Chwieroth, 2007; Krcmaric et al., 2020). For example, Putnam (1977) links technocratic mentality directly to the educational background of government bureaucrats. We emphasize graduate training as one essential socializing factor affecting

technocratic mentality. There is a longstanding interest across disciplines in how graduate training can shape students' beliefs and behaviors (Austin, 2002; Bess, 1978; Gardner, 2007; Mendoza, 2007). Specific disciplines and universities socialize individuals into certain beliefs that might influence policy (Chwieroth, 2007; Gift & Krcmaric, 2017). Additionally, graduate training introduces students to a range of norms and values, including academic freedom or scrutiny of accepted wisdom (Kuh & Whitt, 1986). Individuals with such experience will be more likely to value the academic process of knowledge production and to adhere to (at least) some of these principles even upon completion of their academic training. In short, graduate training tends to socialize individuals into technocratic attitudes (Coffé & Michels, 2014).

Therefore, our primary explanatory variable of interest is the education level of the leader – chief government executive – of a country. We identified chief government executives from the Rulers, Elections, and Irregular Governance Dataset (Bell, 2016) and governments' official websites. We then coded, based on official CVs, newspaper reports, and online encyclopaedias, a dummy variable equal to 1 if the leader received comprehensive academic training, i.e., was awarded a doctorate (excl. honorary doctorates); and 0 otherwise. In addition, we coded the week of the index case in a given country and use the month in robustness checks (Hale, Angrist, Kira, Petherick, et al., 2020).

Our analysis accounts for a range of country-specific characteristics that impact leaders' sense- and decision-making. First, sense-making depends on the (perceived) risk of a crisis and its distribution within a population. Since older people are most at risk of contracting COVID-19 (and of suffering complications) (Zhou et al., 2020), we control for the number of people aged 65 or older (log) (WDI, 2020). In addition, we include fixed effects for continents to absorb any variation common to a given region. Second, leaders' decision-making is embedded in a country's institutional arrangements and capacity (Boin et al., 2005). Democracies and richer countries tend to have higher capacities to treat infected people and collect relevant data on the spread of the pandemic (Aldrich & Lotito, 2020). We, therefore, include a measure of health care quality (GHSI, 2019), a variable for the extent to which a country is classified as a liberal democracy (Coppedge et al., 2020), and GDP per capita (log) to account for overall differences in state capacity (WDI, 2020). In robustness checks, we use alternative measures for the severity of the crisis and state capacity: the population density (because the virus spreads more quickly in densely populated areas), the number of hospital beds per capita (GHSI, 2019), and a measure of the quality of government to account for the differential ability to make-sense within government bureaucracies (Teorell et al., 2020). Our argument assumes that leaders could have relied on scientific expertise if they wanted to. To relax this assumption and allow for scientific expertise

in fighting pandemics to differ by country, we control for the national capacity to produce virology research by including the number of journal articles in virology produced by all universities in a given country (log) (Scimago, 2020). In addition, global scripts are often transmitted through geographical proximity (Simmons & Elkins, 2004), and we calculate the number of days between the index case in each country and its respective UN sub-region.

Finally, we control for potential individual-level confounders. First, gender has been discussed as an important factor that may affect pandemic response (Aldrich & Lotito, 2020). Second, world leaders can use personal experience to overcome first-mover disadvantages, which we approximate by age. In additional analyses, we also include a dummy variable for a leader's military background since a military career may correlate with their preferences for swift and hierarchical decision-making (Bell, 2016). Further, graduate training itself may not be the only marker of a technocratic mentality, but also the degree's subject. For example, commentators have linked leaders' pandemic response to education in natural sciences (Miller, 2020). We thus coded a dummy variable equal to 1 if a leader has a degree in science (e.g., Physics, Biology, Medicine); and 0 otherwise.

Estimation technique

To estimate the relationship between world leaders' education and their response to the COVID-19 outbreak, we fit the following OLS regression:

$$\begin{aligned} \mathrm{Y}_i = &\beta_0 + \beta_1 \mathrm{PhD}_i + \beta_2 \mathrm{WeekCase1}_i + \beta_3 (\mathrm{PhD} \times \mathrm{WeekCase1})_i \\ &+ \beta_4{}' \mathrm{X}_i + \varepsilon_i \end{aligned} \tag{1}$$

where Y is our dependent variable, the number of days to implementing the first restrictive containment measure from the index case in country i. We include a dummy for doctoral degree, PhD, and a running variable for the week in which the first case was reported, WeekCase1. Our explanatory variable of interest is the interaction between these two. The interpretation of the coefficients on these variables is as follows: β_1 indicates the association of academic training with the response speed for countries with the first reported case in week 0, which is only China in our sample (the Chinese President Xi Jinping holds a doctorate in Law); β_2 corresponds to the marginal effect of recording the first reported case in a given week without a doctoral degree; β_3 denotes the marginal effect of having a doctoral degree as the week of the first reported case changes. Thus, to understand the relationship between academic training and government response speed at different points in time of the COVID-19 outbreak, we evaluate all three coefficients together. X_i is a vector of control variables,

as discussed above. To correct for heteroscedasticity, we present estimates with robust standard errors.

Results

Descriptive statistics

Before presenting the results of the regression analysis, we provide descriptive statistics for our dependent variable and the education of world leaders. Figure 1 plots the date of the first reported COVID-19 case (x-axis) against the date of the first restrictive containment measure (y-axis) in the 163 countries in our sample. Along the dashed diagonal line, the first restrictive containment measure coincides with the index case. Most countries with a case reported before 1 March 2020 implemented restrictive measures after the index case (to the left of the diagonal). For instance, China cancelled all public events and restricted gatherings of 10 people or less on 22 January 2020, 22 days after the first reported case on 31 December 2019. Sweden records the maximum value of our dependent variable, adopting its first containment measure 58 days after its first case of COVID-19. Substantial herding occurs in the first two weeks of March (Hale, Angrist, Kira, Goldszmidt, et al., 2020), which coincides with the WHO's declaration of COVID-19 as a pandemic. Nonetheless, there are a few outliers. Indonesia closed public schools 27 days before the first official case was reported; Mongolia implemented restrictive measures pertaining to schools, workplace, and

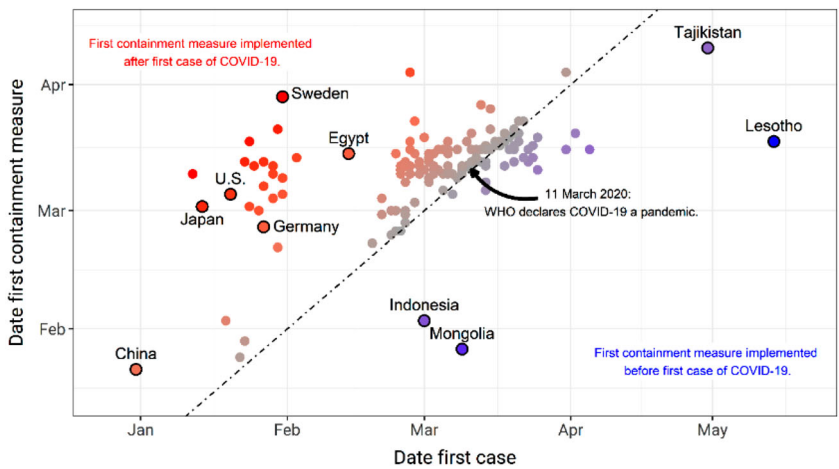

Figure 1. Responses to the COVID-19 outbreak.

Notes: Each point denotes one country in our sample. On the x-axis, we plot the date of the index case; on the y-axis, the date of the first restrictive containment measure. Data are from OxCGRT (Hale, Angrist, Kira, Petherick, et al., 2020). Countries along the dashed diagonal line implemented the first restrictive containment measure on the day of the index case.

public events on 27 January 2020, 42 days before the first official case of COVID-19 (to the right of the diagonal). Similarly, Tajikistan and Lesotho swiftly adopted restrictive measures – 20 and 57 days before their index case, respectively. The latter corresponds to the minimum value of our dependent variable. These numbers are unlikely to represent the decision-making processes, though: Tajikistan's index case was reported only 30 April, after weeks of denials by the country. By contrast, Lesotho only started testing in May for lack of capacity.

In Figure 2, we map world leaders' educational background. In the 163 countries in our sample, 26 chief executives hold doctorates (for a list, see Appendix B1; for the distribution by month of first case, see Appendix B2). There are major economies both led by executives with and without doctorates. For example, the Chinese, Vietnamese, or German leaders all received academic training. By contrast, chief executives in Brazil, South Africa, or the U.S. did not attain a doctorate. While the education level predates our dependent variable, concerns of endogeneity may arise if leaders self-select into countries based on the population's characteristics. That is, highly educated populations may have a higher demand for technocratic leadership and elect highly-educated politicians as government executives. We address this concern in robustness checks.

Regression analysis

In Table 1, we display regression estimates from four different specifications. Model 1, in which we only control for education, corresponds to a simple

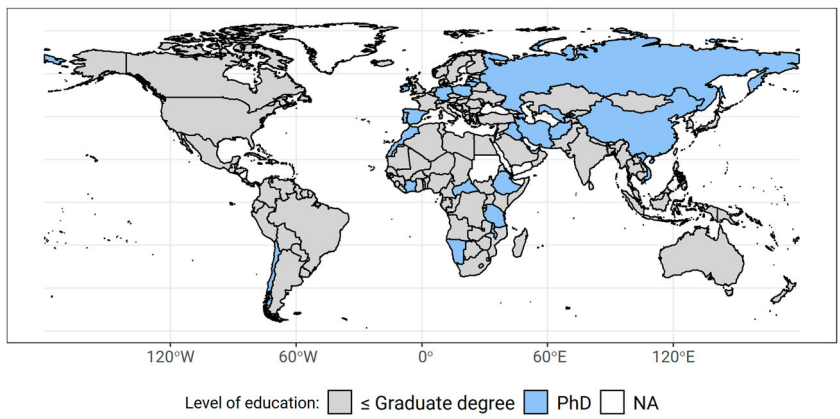

Figure 2. Education of world leaders.

Notes: 163 countries in our sample. PhD if a world leader holds a doctoral degree (excl. honorary doctorates).

Table 1. Regression estimates.

	Dependent variable: Days to first restrictive containment measure			
	(1)	(2)	(3)	(4)
PhD vs. non-PhD	0.468	-28.113***	-43.482***	-45.038***
	(2.689)	(9.876)	(9.332)	(9.895)
Week of index case		-5.510***	-6.173***	-6.424***
		(0.389)	(0.365)	(0.494)
PhD # week of index case		2.680***	4.110***	4.297***
		(0.946)	(0.944)	(1.020)
Country-level controls				
Health care quality			0.255	0.255*
			(0.158)	(0.153)
Population 65+ (log)			-0.439	-0.578
			(0.733)	(0.721)
GDP per capita (log)			-5.101**	-4.880**
			(2.551)	(2.411)
Lib. democracy			-1.653	-6.865
			(4.165)	(5.071)
World leader-level controls				
Male vs. Female			-2.796	-2.541
			(2.481)	(2.440)
Age			0.073	0.132
			(0.074)	(0.084)
Constant	8.839***	62.892***	106.310***	107.190***
	(1.586)	(4.221)	(21.754)	(21.297)
Continent FEs	No	No	No	Yes
Observations	163	163	130	130
R^2	0.0001	0.733	0.792	0.805
F Statistic	0.015	145.302***	50.799***	36.790***

Notes: Robust standard errors in parentheses. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

comparison of government responses to the first reported case of COVID-19. As expected, we fail to reject the null hypothesis that the coefficient is not significantly different from zero at conventional thresholds of statistical significance. Thus, world leaders' education does not explain the speed of government responses *per se*.

In Model 2, we regress the number of days to the first restrictive containment measure on our variables of interest, i.e., the interaction of education and the week of the index case and their base levels. In Model 3, we include country- and individual-level control variables as discussed above. Finally, in Model 4, we present our preferred specification, which also includes fixed effects for continents to absorb any variation common to regions. The estimates from these three models support our argument. The point estimate of the coefficient on PhD is negative and highly significant ($p < 0.01$). Substantially, Model 4 implies that in countries reporting their index case in week 0, world leaders with a PhD are expected to adopt restrictive containment measures 45 days earlier than their peers without doctoral training. The point estimate of the coefficient on WeekCase1 is also negative ($p < 0.01$), illustrating that countries tend to react faster, relatively speaking, if they recorded their first case of COVID-19 later (holding leaders' education

at 0), possibly because they faced less uncertainty. The estimate of the coefficient on the interaction term is positive ($p < 0.01$), indicating that the speed of government responses converges over time.

In Figure 3, we illustrate these dynamics (estimates from our preferred specification, Model 4). In the early weeks of the pandemic, the predicted response time to the index case for world leaders with doctorates, depicted by the dashed, blue fitted line, lies below the gray fit for world leaders without academic training. That is, governments headed by world leaders who received academic training reacted faster than others. Once we observe herding effects, in March, the difference between the two lines becomes statistically insignificant. This holds despite the two discussed outliers, with first cases reported at the end of April and May, Tajikistan and Lesotho, respectively (included in the estimation, but not depicted in Figure 3). The world leaders of these two countries do not have doctorates, but their governments reacted faster than others, thereby providing a more stringent test to our hypothesis.

Robustness and extensions

Our results are robust to outliers, alternative model specifications, placebo checks, and additional control variables, presented in Appendix C. First, we address the concern that our results may be driven by early cases of COVID-19 by calculating the speed of government responses to the day of 10 cumulative cases (rather than the index case) (Table C1). Second,

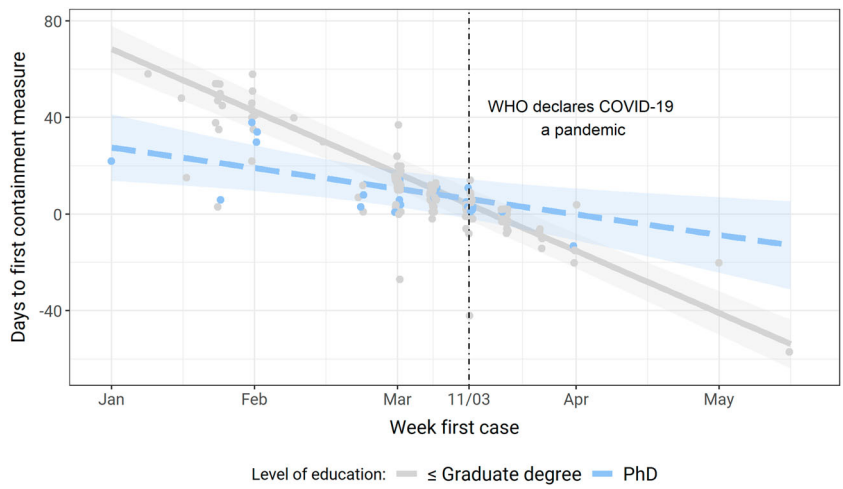

Figure 3. Predicted time to first containment measure.

Notes: The fitted lines are from Table 1, Model 4. The points (jittered to reduce overlap) are observed data for 161 countries in our sample, excl. countries that reported their index case after 15 April 2020 (Tajikistan and Lesotho) 95% confidence intervals depicted.

interacting leaders' education with the week of the index case is statistically demanding due to the high number of parameters to be estimated; we thus estimate the models using the month of the index case (Table C2). Third, we show that our results are robust to omitting outliers: China was the first country with an outbreak (Table C3); Tajikistan and Lesotho only reported their first case after 15 April 2020 (Table C4). Fourth, we include additional control variables to guard against omitted variable bias at the country-level (Table C5, Model 2), individual-level (Table C5, Model 3), and geographic diffusion (Table C5, Model 4), as discussed in Section 3. Fifth, we conduct two placebo tests. Our theoretical argument pertains to the speed with which governments responded to the COVID-19 outbreak rather than its stringency. Although the estimates of the coefficients on the relevant variables are statistically different from 0, the predicted stringency index in our sample does not differ meaningfully by leaders' education and week of index case (Table C6). The question of how other aspects of technocratic mentality relate to the stringency of policies adopted is left for future research. Besides, our argument focuses on leaders' technocratic mentality, as approximated by their education level – rather than that of their people. To address this concern of endogeneity, we replace the dummy for leaders' education by the level of tertiary education of the population (Table C7). As expected, the interaction term is not statistically different from 0 at conventional thresholds in our preferred specification, supporting our operationalization.

Additionally, we illustrate a possible extension of our work in Appendix D. We disaggregate time to first containment measure by policy reform. We find that, even between containment measures, there is considerable variation. For instance, our argument seems particularly relevant for school closures, public events cancellation, and internal movement restrictions. By contrast, government responses seem to be less driven by leaders' reliance on scientific advice in other realms, such as international travel restrictions. This is consistent with recent work suggesting that the COVID-19 pandemic allowed governments to use external border controls to externalize mitigation measures without any apparent scientific consensus (Kenwick & Simmons, 2020). Our argument does not attempt to explain these differences, and we leave it for future research to investigate these dynamics in detail.

A closer look at four typical cases

To substantiate the results from our statistical analysis, we select, *ex-post*, four typical cases – countries that are 'especially representative of the phenomenon under study' (Gerring, 2007, p. 49). These cases illustrate the plausibility of the findings from the regression analysis rather than test our hypotheses *per se*. Our argument depends on (a) the use of science by a government

Table 2. Theoretical expectations for selected countries.

		Index case	
		Jan/Feb	Mar/Apr
Education of government leader	**PhD**	(1) ***Fast response*** The situation is characterized by high uncertainty, and countries with leaders who rely more on science react faster than others. Examples: Vietnam	(3) ***Herding*** Once a shared problem perception emerged (Boin et al., 2005), herding sets in. Examples: Portugal; Chile
	≤Graduate degree	(2) ***Slow response*** The situation is characterized by high uncertainty, and countries with leaders who rely less on science react slower. Examples: U.S.	

executive (approximated by their education level), and (b) the date of the first case. We, therefore, classify observations along these two dimensions in Table 2. Countries in quadrant (1) recorded their first case of COVID-19 in the first two months of the outbreak and are governed by leaders with doctorates, such as Vietnam. Our argument stipulates that these countries have responded relatively quickly to the outbreak due to their reliance on science. Countries in quadrant (2), such as the U.S., reported their index case also in January or February 2020, but their chief government executives do not hold a doctorate. Consequently, they are expected to largely ignore scientific advice, which should slow down their government response to COVID-19. In quadrant (3), countries recorded their index case in March or April, when a global blueprint on an appropriate course of action was emerging. This consensus allowed leaders from those countries, including Portugal and Chile, to orient themselves on other countries' experience. We selected these four countries – Vietnam, the U.S., Portugal, and Chile – to illustrate government responses in politically, geographically, economically, and socially distinct settings.

Vietnam (quadrant 1) reported its first case of COVID-19 on 23 January 2020. Its leader, Nguyễn Phú Trọng, who holds a PhD in Politics, and the vice prime minister, Vũ Đức Đam, who has attained a PhD in Economics, treated the pandemic seriously from the beginning and worked closely with experts from its Ministry of Health (Huynh, 2020). Key to a swift response was the early establishment of a Taskforce Group on COVID-19 prevention and control (one week after the index case), including members from ministries, media, and civil society organizations (Ha et al., 2020). Further, the prime minister stated repeatedly that the Vietnamese government was determined 'to sacrifice economic benefits for public

health' (Vietnam News Agency, 2020), illustrating the primacy of health concerns over business interests.

Contrast this approach to sense-making with the U.S. (quadrant 2). President Donald J. Trump, who holds a Bachelor's degree in Finance, can be seen as the ideal-typical leader using scientific advice strategically. According to the *Washington Post*, he was deeply distrustful of experts, stemming from his belief that their analyses reported in the media were biased to undermine his re-election chances (Rucker et al., 2019). In short, President Trump evaluated evidence by the level of correspondence it has with his prior beliefs or statements (Drezner, 2020). In line with our expectations, the country's sense-making process was clouded by President Trump's lack of engagement with scientific experts. He was reluctant to admit the new reality and repeatedly downplayed the pandemic and he refused to draw on scientific research in his sense-making (Evans & Hargittai, 2020; Rutledge, 2020).

On the other hand, Portugal and Chile (quadrant 3) could rely on other countries' experience when making sense of the crisis. For example, the Portuguese health authorities responded quickly to the pandemic. Their sense-making, at the time, was based on the devastating health impact of the disease in Italy (Mahase, 2020). Health minister Sales argued that: 'The Portuguese response to the global coronavirus outbreak has, since the very beginning, been based on the best scientific advice and on other countries' experience' (Jones, 2020). The late arrival of the virus played a crucial role in Portugal's preparedness. As one Portuguese health expert put it: 'Portugal had the opportunity to watch what other countries were going through, to see what measures were being taken, and to learn from those experiences. Portugal ended up implementing more or less the same measures as other countries … ' (Jones, 2020). Chile also drew on the Italian experience as an early warning signal of how quickly things could get awry if containment measures are not implemented quickly. Chilean President Sebastian Pinera argued that 'Chile is much better prepared than Italy to deal with this situation' (Cerda, 2020). His government created a scientific committee early on. However, it is not clear that the government always relied on these experts. For example, the myriad issues in the communication and interpretation of data (e.g., the number of deaths) ultimately lead to the resignation of the Minister of Health on 14 June 2020 (Bartlett, 2020). Nonetheless, it implemented a 'dynamic-quarantine approach', which 'was said to be the most common [strategy] implemented around the world' (Glenn et al., 2021, p. 86).

The differences observed in sense-making seemed to have translated into some variation in decision-making as well. Vietnam closed public schools merely six days after their index case – in stark contrast to the U.S., which adopted its first restrictive containment measure only 45 days after the index case. Portugal, one of the last European countries to report a case of

COVID-19, closed public schools merely seven days after its first case and Chile did so twelve days after its index case (followed by workplace closing one day later).

Taken together, these case episodes illustrate substantial differences in sense-making and decision-making. Countries such as Vietnam (quadrant 1) relied extensively on experts to make sense of the crisis and to decide on an appropriate course of action. Thus, they recognized the extent of the crisis early – despite facing uncertainty and a first-mover disadvantage – and acted quickly. By contrast, countries such as the U.S. (quadrant 2) were oblivious to scientific advice. These countries failed to incorporate science in their decision-making and underplayed the severity of the crisis. Finally, countries such as Portugal and Chile (quadrant 3) relied on scientific advice related to other countries' experiences and an emerging global consensus.

Conclusion

We argued that leaders inclined to use scientific evidence in their decision-making – one aspect of technocratic mentality – reacted quicker in the early stages of the COVID-19 pandemic. Our empirical analysis supports this argument: Amongst countries that recorded the first case of COVID-19 in January and February, those led by a chief government executive with academic training implemented restrictive measures relatively early. Once herding set in, around mid-March, these effects disappear.

Before discussing the implications of our findings, we note three limitations. First, by attributing the government response to a leader's decision and traits, our argument may seem reductionist. However, our goal was not to explain all variation in government responses but to explicate the role of leadership and reliance on scientific evidence. Such an x-centred design allowed us to study the role of technocratic mentality. Nonetheless, future research should try to understand the relative importance of this explanation compared to, for example, institutional or capacity constraints (Hegele & Schnabel, 2021). Such studies could also investigate how technocratic mentality relates to other traits of leaders and how these affect crisis responses. Second, our statistical analysis relies on quantitative indicators of government responses and leader traits, which abstract from nuances to facilitate a systematic comparison across countries. While the four cases highlight our argument's plausibility, the exact causal mechanisms and scope conditions still need to be established. Third, the estimation of the interaction term on education and the week of the index case in a given country is statistically demanding; we addressed this concern of statistical power in robustness checks with more parsimonious model specifications.

What do the findings imply for leadership during COVID-19? First, countries whose leaders received academic training responded faster to an early outbreak, potentially saving thousands of lives (Stewart & Sample, 2020). Our argument suggests that this was partly due to a difference in the reliance on scientific evidence, which facilitated earlier sense- and decision-making. Second, we find that the use of science does not hold explanatory power once herding effects were observed in mid-March. Our findings may offer a pivotal piece to the puzzle of understanding how countries negotiate the potentially conflicting goals of protecting public health, safeguarding their economy, and respecting legal constraints. Of course, the use of scientific advice likely interacts with other socio-economic factors and institutional variation in countries, including the source of expertise (Heinzel & Liese, 2021).

Beyond the COVID-19 pandemic, our findings advance on earlier studies in crisis governance and public policy. The literature has shown that experts impact public debates and government policy during crises (Bækkeskov, 2016; Bækkeskov & Öberg, 2017; Rosenthal & 't Hart, 1991). Our study documents that their influence may depend on the responsiveness of government officials. Some leaders are more technocratically inclined and follow expert advice during crises. Other leaders might only listen to scientific advice, when it is in leaders' strategic interest, e.g., due to concerns about future scrutiny and blame of their decision-making (Bækkeskov, 2016). This points to a controversial aspect of technocratic governance. Experts can 'freeze deliberations' through their endorsements of policy options (Bækkeskov & Öberg, 2017). When experts offer competing interpretations, leaders might favor one expert community over another. Thus, in societies with technocratically inclined leaders, crisis decision-making may not necessarily follow deliberative ideals. The early signs of the COVID-19 pandemic suggest actions that incur these deliberative costs may have saved thousands of lives by facilitating more coherent and swift responses. However, the reliance on technocratic decision-making also intensifies the need for leadership to be scrutinized in times of crisis.

Notes

1. Most discussions focusing on democratic societies use the term 'democratic reasoning'. We employ political reasoning instead because our sample includes competitive or full autocracies.
2. We focus exclusively on the introduction of containment measures because these are arguably less dependent on state capacity than, say, health measures. While chief executives can introduce containment measures subject to approval of relevant stakeholders relatively easily (e.g., restrictions of large gatherings), health measures (e.g., increasing testing capacity) require substantial investment.
3. The Appendix is available online as Supplementary material.

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