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Confidence in public institutions is critical in containing the COVID‐19 pandemic

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Abstract

This paper investigates the relative importance of confidence in public institutions to explain cross‐country differences in the severity of the coronavirus disease 2019 (COVID‐19) pandemic. We find that a 1 SD increase (e.g., the actual difference between the United States and Finland) in confidence is associated with 56.3% fewer predicted deaths per million inhabitants. Confidence in public institutions is one of the most important predictors of deaths attributed to COVID‐19, compared to country‐level measures of health risks, the health system, demographics, economic and political development, and social capital. We show for the first time that confidence in public institutions encompasses more than just the unobserved quality of health or public services in general. If confidence only included the perceived quality, it would be associated with other health and social outcomes such as breast cancer recovery rates or imprisonment as well, but this is not the case. Moreover, our results indicate that fighting a pandemic requires citizens to cooperate with their governments, and willingness to cooperate relies on confidence in public institutions.

KEYWORDS

confidence in public institutions, COVID‐19, death rate, machine learning

Key points

- There is substantial heterogeneity in COVID‐19 prevalence and deaths across countries.

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- We employ regression and machine learning methods to identify the most critical predictors of deaths attributed to the pandemic.
- We find that confidence in public institutions is one of the most important predictors of deaths attributed to COVID-19.
- Our results suggest that effective policy implementation during pandemics relies on confidence in public institutions.

INTRODUCTION

There is substantial heterogeneity in coronavirus disease 2019 (COVID-19) prevalence and deaths across countries (Sorci et al., 2020). The severity of the pandemic has been shown to correlate with the prevalence of comorbidities and the demographic composition of countries (Sorci et al., 2020), their political systems (Karabulut et al., 2021), the role of culture in terms of following regulations and obeying laws (Gelfand et al., 2021), the timing and stringency of social distancing measures (Deb et al., 2020; Nouvellet et al., 2021), access to vaccines (Mallapaty et al., 2021; Meslé et al., 2021), mass testing (Kahanec et al., 2021), social capital (Bartscher et al., 2021), government effectiveness (Liang et al., 2020), the geographical mobility of people (Nouvellet et al., 2021), and what this paper is focusing on, confidence in public institutions (Elgar et al., 2020; Helliwell et al., 2021). As ample evidence shows that higher confidence in public institutions increases compliance with health regulations, such as social distancing or quarantining (Bargain & Aminjonov, 2020; Bavel et al., 2020; Brodeur et al., 2021; Lalot et al., 2020; Soveri et al., 2021), confidence could be a key element in containing the pandemic.

A series of papers have emerged in the last 2 years looking at the role of confidence in public institutions in the containment of the pandemic (e.g., Amara et al., 2022; Lenton et al., 2022; Yuan et al., 2022 see Table A5 in Supporting Information: Appendix A for a detailed review). While most of this literature agrees that confidence in public institutions is negatively correlated with the severity of the pandemic, there are exceptions. Chang et al. (2022) show that public trust in the government is significantly negatively correlated with COVID-19 infections and deaths, while Charron et al. (2022) document that trust in public institutions is negatively correlated with excess mortality across European regions. Lenton et al. (2022), on the other hand, found that although the resilience of countries (how quickly the number of cases and deaths goes down after a peak in the pandemic) is positively correlated with generalized trust in people, it is not significantly associated with confidence in public institutions.

As confidence in public institutions is not randomly allocated to countries, such empirical work can only look for its correlational relationship with pandemic outcomes. To decrease selection bias, the main approach of the literature is to control for all observable characteristics of countries that could be related both to the pandemic and confidence in public institutions. In this endeavor, however, the articles mentioned above use different sets of control variables (see a comparison in Table A5 in Supporting Information: Appendix A), and it is not clear whether the statistical associations found by each of them would survive after controlling for a more comprehensive set of empirically important measures.

Building on these precedents discussed in the previous paragraphs, this paper investigates the importance of confidence in public institutions (the government, parliament, the press, the political parties, the courts, and the police) in predicting the severity of the COVID-19 pandemic. We make three contributions to the literature. First, while the previous

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socioeconomic literature used divergent sets of potentially important control variables for similar exercises, we cover all types of these factors. We identify 15 variable sets used in the previous studies and include variables from each set as control variables. In contrast, previous studies cover only 4–7 sets of these variable groups at a time (Table A5 in Supporting Information: Appendix A).

Second, to the best of our knowledge, ours is the first paper to look at the relative predictive power of these country-level socioeconomic factors in general and confidence in public institutions in particular. As it is detailed in Section "Empirical methods," we use regression and machine learning methods to predict the severity of the pandemic, captured by the number of deaths attributed to COVID-19 per million people. We exploit data on 75 countries (selected based on data availability, see more details in Section "Data") and follow the number of deaths until March 21, 2021. This end date is ideal, as mass vaccination was still at an early stage in all countries in the sample. Thus, we measure pandemic outcomes before the effects of mass vaccination phased in, which was of unequal pace and magnitude by country.

Our third contribution is that while Elgar et al. (2020) conclude that further investigation is needed to uncover the mechanisms behind the significant statistical relationship between confidence and COVID-19 deaths, we take a step further and look into its potential drivers. In particular, we test whether confidence in public institutions measures some unobserved qualities of health or public services by investigating its relationship with breast cancer survival rate and imprisonment rate. We assume that any meaningful (conditional) statistical relationship between confidence in public institutions and these two alternative outcomes would suggest that confidence in public institutions might capture some latent features of the health or the public system that is not observed by observable data like public spending or the number of hospital beds.

We include all countries in our estimations for which data is available. We find that confidence in public institutions is key for explaining cross-country heterogeneity in the severity of the pandemic. In our main regression specification, 1 SD higher confidence is associated with a 56.3% (or in raw numbers, 350.9) lower number of deaths per million population. This relationship is significant at the 1% level and robust to an extensive series of robustness checks, including restricting the sample to democracies and Organization for Economic Co-operation and Development (OECD) countries, using alternative outcome variables (number of cases, fatality rate, and excess deaths compared to the previous 5 years), earlier observation periods, different estimation methods, and applying a variable selection model to identify the empirically most efficient set of control variables. Machine learning methods, random forest regressions, and a least absolute shrinkage and selection operator (lasso) suggest that confidence in public institutions is among the most important predictors of the number of deaths attributed to COVID-19.

In terms of channels, we find no evidence that in countries with higher confidence in public institutions, people would reduce their mobility more than in countries with lower confidence. However, we find that the role of confidence is two times as large in countries conducting comprehensive contact tracing as in countries not using this method. This result suggests that in countries where confidence in public institutions is higher, people are more willing to comply with rules and regulations that would require them to become visible to the authorities, for example, by supplying their personal data for contact tracing. Furthermore, while confidence in public institutions has a strong and robust statistical association with the severity of the pandemic, it is not associated with either breast cancer recovery rates or imprisonment. This result suggests that confidence in public institutions encompasses more than simply the perception of people about how well institutions work in general, which is unobserved in the available data. If it only encompassed the latent quality of public services, confidence in public institutions should be correlated with other health and social outcomes as well, but this is not the case.

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Lastly, all our results up until this point are estimated before mass vaccination started. Exploiting vaccination data until January 1, 2022, we also find evidence that confidence in public institutions is related to the vaccination rate. In our main model, 1 SD higher confidence is associated with a 3.4 percentage points higher vaccination rate (in terms of the number of fully vaccinated people per 100 population). This relationship is significant at the 10% level. This result supports that confidence in public institutions is indeed related to compliance with government guidelines.

DATA

We provide a detailed description of the data (including the definitions of all variables) in Supporting Information: Table A1. The final database and all Stata codes for gathering the data and replicating the complete analysis are available on GitHub.[1]

We measure country-level confidence in public institutions before the pandemic using the joint World Value Survey (WVS) and European Value Survey (EVS) 2017–2021 data set (EVS/WVS, 2020). The interviews were conducted in 2017–2020 (see the end of fieldwork by country in Supporting Information: Table A2). Note that in 5 countries out of the 75 that we use, fieldwork ended in March–August 2020, after the onset of COVID-19. Thus, we provide a robustness check where we exclude these countries in Supporting Information: Appendix B.

First, we estimate the survey-weighted country-level averages of individual answers to the following question (and multiply them by −1): "I am going to name a number of organizations. For each one, could you tell me how much confidence you have in them: is it a great deal of confidence" (coded as 1), "quite a lot of confidence" (coded as 2), not very much confidence (coded as 3), or none at all (coded as 4). We use six items: the government, the press, the police, the political parties, the parliament, and the courts.[2] Then, we conduct principal component analysis (PCA) on the six country-level aggregates and use the first predicted score (share of explained variation: 0.75; Cronbach's α: 0.93) as an index of *confidence in public institutions*.[3] The correlation matrix of these measures is presented in Supporting Information: Table A3.

We replicate our main results on the individual items of confidence and provide two further robustness checks regarding these data. First, individual-level nonresponse varies between 0% and 9.3% across countries (Supporting Information: Table A4). Thus, we control for the share of nonresponse (missing values) in a country in addition to our standard control variables. Second, there seem to be some nondemocratic countries where confidence in institutions is surprisingly high (China, Vietnam, and Tajikistan; Figure 1). This may be due to a type of conformity bias toward the authorities. To mitigate the effect of these outliers, we replicate our main results by restricting the sample to democracies (i.e., excluding countries from the sample that are categorized as "not free" by Freedom House [FH], 2020) and to OECD countries. We also provide a robustness check where we keep all countries and introduce an interaction term of confidence in institutions and democracy.

We retrieve the data on the number of COVID-19-induced deaths from the online resource: https://ourworldindata.org/ (Ritchie et al., 2020). They collect COVID-19 data from the COVID-19 Data Repository by the Center for Systems Science and Engineering at Johns Hopkins University. We look at the total number of confirmed deaths per one million inhabitants for all countries until March 21, 2021 in our main models. Following Gelfand et al. (2021), we take logs and use the log number of deaths as our primary outcome variable. We replicate our main results using several alternative outcome measures: the raw number of deaths per one million inhabitants, the log number of cases, the log fatality rate (the ratio of deaths to cases), excess deaths in 2020, and the log of excess deaths in 2020, the mean

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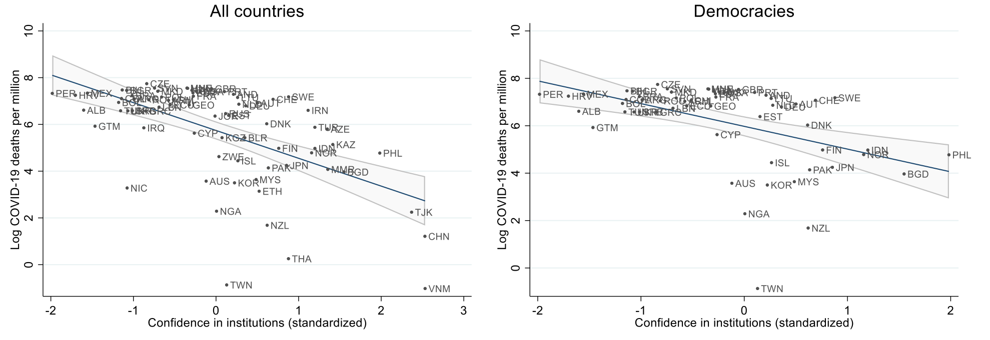

FIGURE 1 Log total deaths attributed to coronavirus disease 2019 (COVID-19) and confidence in institutions. Number of countries: 75 and 58. The confidence in institutions measure is standardized to mean 0 and SD 1. The subsample of democracies: countries categorized as "Not free" by Freedom House are excluded from the baseline sample (Freedom House, 2020). The list of countries is shown in Supporting Information: Table A1.

positivity rate of tests, and the log number of tests and 14 alternative observation periods ending between October 21, 2020 and December 21, 2021. Furthermore, we also control for the *method of how countries register deaths as attributed to COVID-19*, whether it is based on clinical diagnosis or is test-based (Karanikolos & McKee, 2020). Lastly, we repeat the analysis using the vaccination rate (share of those fully vaccinated per 100 population) on January 1, 2022 as the outcome variable.

Following the literature, in the main analysis and the robustness checks, we control for a rich set of country-level characteristics, all measured before the onset of COVID-19 (see more Supporting Information: Table A1): economic and social development (gross domestic product [GDP] per capita, life expectancy, Gini index); political development (government efficiency [Worldwide Governance Indicators] and democracy score [FH], summarized into an index using PCA), the lack of corruption index by Transparency International, demography (share of those above age 65, mortality rates before the pandemic, share of migrants as a % of the population); health (summary index using PCA, from the following health measures: body mass index [BMI] and share of deaths by risk factors (Institute for Health Metrics and Evaluation, 2019), including alcohol and smoking, air pollution, dietary risk, and known comorbidities (high blood pressure, obesity, diabetes mellitus, chronic kidney diseases, air pollution); the resources of the health system (health expenditures per capita, number of hospital beds per thousand people, number of medical doctors per thousand people; again, summarized into a PCA index); presence of the epidemic (number of days since the first reported death in the country); population, population density; 5-year survival rate of breast cancer; average years of education; social capital (trust in people via PCA from joint EVS/WVS, 2020 data and voter turnover from International IDEA); tightness of following rules (Gelfand et al., 2021). Gelfand et al. (2021) measure tightness via six survey questions, for example, how much do you agree with that "There are many social norms that people are supposed to abide by in this country," "There are very clear expectations for how people should act in most situations," "In this country, if someone acts in an inappropriate way, others will strongly disapprove," and "People in this country almost always comply with social norms."

We also use two contemporaneous measures. *Mobility* is the average change in Google mobility trends data (number of visitors) in retail, pharmacies, transit stations, and workplaces. More negative values indicate larger percentage drops in mobility until March 16, 2021, relative to median mobility between January 3, 2020 and February 6, 2020. *Stringency is* a composite index based on nine response indicators, including school

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closures, workplace closures, testing policy, and travel bans from the Oxford COVID-19 Government Response Tracker (Hale et al., 2021). We use the highest value for each country by March 21, 2021 in our main specifications and provide alternative models using the mean.

Note that our setup does not allow us to look at the causal effects of reduced mobility or social distancing measures. These two contemporaneous measures are likely affected by the severity of the pandemic in a country, and thus they are considered *bad controls* (Angrist & Pischke, 2009). We use them to show that even if we control for them, there is still a meaningful statistical relationship between confidence in institutions and the deaths attributed to COVID-19. Furthermore, we also use two elements of stringency measures separately: *restrictions on personal gatherings of small groups* and *comprehensive contact tracing*.

The descriptive statistics of our key variables are reported in Table 1, while their correlation table is reported in Table A6 in Supporting Information: Appendix A. The descriptive statistics of all remaining variables that we use in the paper are reported in Table A4 in Supporting Information: Appendix A. As Table 1 shows, there are some outlier values in the data set. For instance, the total cases per million, deaths, and share of migrants are reported to be outstandingly low in China, Taiwan, and Vietnam. On the other hand, the share of migrants is 59.71 in Andorra (as in most cases, migrants would only get citizenship after 20 years). In some countries like New Zealand and Australia, the number of excess deaths is negative and close to zero, implying that the pandemic did not have a toll in terms

TABLE 1 Descriptive statistics of our main measures.

Variable	Observations	Mean	SD	Min	Max
Ln total deaths per million	75	5.741	2.046	−1.022	7.742
Confidence in institutions	75	0	1	−1.983	2.531
No. of days since the first death	75	369.427	21.848	233	424
Log population	75	16.688	1.716	11.255	21.087
Log population density	74	4.338	1.119	1.164	7.143
Log GDP per capita	73	9.755	0.837	7.456	11.079
Gini	67	35.566	7.431	24.09	53.5
Index of democracy and government	74	0	1.327	−2.514	2.042
Log mortality rate before the pandemic	75	8.953	0.386	7.9	9.808
Share of those above age 65	73	12.736	6.32	2.751	27.049
Life expectancy	75	76.873	5.343	54.69	84.63
Share of migrants	74	8.484	10.383	0.071	59.714
Trust in others	75	−0.061	0.794	−1.842	1.796
Resources of the health system	72	0	1.317	−2.34	2.333
Index of health risks	75	0	2.174	−6.191	4.295
Stringency of COVID-19 measures	72	82.8	15.475	24.07	100
Decrease in mobility	63	−19.11	7.848	−39.694	−5.484

Note: The descriptive statistics of the remaining variables are presented in Table A4 in Supporting Information: Appendix A.
Abbreviations: COVID, coronavirus disease; GDP, gross domestic product; Ln, log number.

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of deaths. Nigeria has the lowest life expectancy at 54.69 years. In terms of the pairwise correlations of our main measures, per-capita GDP is highly correlated with democracy, life expectancy, healthcare resources, and the share of those above age 65 (Table A6 in Supporting Information: Appendix A), and the correlation is high among these variables as well. This is not surprising as these variables capture the most prominent features of developed countries.

Figure 1 shows the raw association between the log number of deaths per million population and confidence in public institutions. The statistical relationship between deaths and confidence in institutions is significantly negative.

EMPIRICAL METHODS

We start by estimating linear regressions to investigate the statistical relationship between the log number of deaths attributed to COVID-19 per million people and confidence in institutions. In Model 1, we do not include any additional control variables and have 75 countries. In Models 2–7, we add the above-mentioned control variables sequentially to the model. In our preferred specification, Model 7, we have 55 countries. We provide robustness checks where we also control for variables that would further reduce our sample size. As we only have 55 countries in our preferred specification, we re-estimate all models using full information maximum likelihood (FIML) estimation. FIML infers available information from the total sample of 75 countries, even if some variables are missing for some countries. Throughout the analysis, we assume that conditional on all other variables we have, country-level variables are missing at random.

Once we have established a robust statistical relationship between confidence in institutions and the number of deaths attributed to COVID-19, we investigate the relative importance of this measure in predicting the outcome. We use two machine learning algorithms for this purpose: lasso and random forest regression.

The lasso procedure determines the empirically optimal set of control variables, applying a regularization on the coefficient estimates. Holding out a subset of the sample, we estimate the model on the training sample and test the model's predictive power on the held-out part. We use 100-fold cross-validation (we repeat the sampling and model estimation 100 times). The procedure selects the optimal subset of explanatory variables that produces a model with the lowest mean-squared prediction error in predicting the outcome variables in the held-out subsamples (Ahrens et al., 2020). As a result of this process, we find the most efficient set of control variables and re-estimate our main results controlling for these variables only. Furthermore, we also interpret the lasso coefficients as indicators of relative predictive importance.

As both the ordinary least-squares regression and the lasso procedure assumes a linear relationship between the number of deaths and the explanatory variables, we also employ a random forest regression to model any potential nonlinearities and interaction terms. In particular, we are interested in the relative predictive importance of the control variables in predicting the number of deaths. The relative importance of predictors is determined by the Increase in mean-squared errors (MSE) measure, which captures the increase in MSE should predictors be replaced by their own randomly permuted values (Hastie et al., 2009).

Last, we provide two further robustness checks. We look at how the estimated coefficient in the main model using our 55-country sample compares to the distribution of the same coefficients estimated on 35-country simulated random samples to show that country choice is not leading our results. Then, we estimate quantile regressions to investigate whether the association between confidence and COVID-deaths changes along the distribution of the log number of deaths.

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RESULTS AND ROBUSTNESS CHECKS

Based on our regression results, the log number of deaths attributed to COVID-19 is significantly lower in countries where confidence in public institutions is higher (Table 2 and Supporting Information: Table B1). This relationship prevails even after sequentially adding the following control variables to the model (Supporting Information: Table B1): number of days since first death, population, population density, GDP per capita, Gini, index of political development, mortality rate before the pandemic; share of those above age 65, life expectancy, the share of migrants, trust in others, resources of the health system, index of health risks, stringency of COVID-19 measures, and decrease in mobility. In our preferred specification, Model 7, we find that 1 SD higher confidence in public institutions is associated with 56.3%[4] ($\beta = -0.828$, $p < 0.01$) fewer deaths per a million population (Table 2 and Figure 2).

Considering the number of deaths per a million population as the dependent variable (Supporting Information: Table B3), we find that 1 SD higher confidence in public institutions is associated with 350.9 fewer deaths ($p < 0.01$) per million. To put this into perspective, for instance, if people in the United States (confidence in public institutions = –0.19) had about

TABLE 2 Log total deaths attributed to COVID-19 and confidence in institutions (Model 7 of Supporting Information: Table B1).

Explanatory variables	Estimated coefficients	95% Confidence intervals	Robust *p* values
Confidence in institutions, standardized	–0.828	–1.169 to –0.486	0.000
Days since the first death	0.014	–0.003 to 0.031	0.100
Log population	–0.124	–0.431 to 0.183	0.419
Log population density	0.180	–0.213 to 0.573	0.361
Log GDP per capita	0.510	–0.787 to 1.806	0.431
Gini	–0.006	–0.052 to 0.041	0.803
Index of political development	0.240	–0.664 to 1.145	0.593
Log mortality rate before the pandemic	–1.427	–4.689 to 1.836	0.382
Share of those above age 65	0.034	–0.243 to 0.311	0.806
Life expectancy	–0.168	–0.416 to 0.080	0.178
Share of migrants	–0.044	–0.114 to 0.026	0.214
Trust in others	0.049	–0.462 to 0.561	0.847
Resources of the health system	0.712	–0.034 to 1.457	0.061
Index of health risks	0.211	–0.059 to 0.482	0.122
Stringency of COVID-19 measures	0.032	0.005 to 0.058	0.021
Decrease in mobility	–0.029	–0.081 to 0.022	0.257
Constant	19.575	–25.830 to 64.979	0.388
Observations	55		
R^2	0.769		

Note: Linear regression model estimated by OLS. Outcome variable: log total deaths attributed to COVID-19 per one million inhabitants.

Abbreviations: COVID, coronavirus disease; GDP, gross domestic product; OLS, ordinary least squares.

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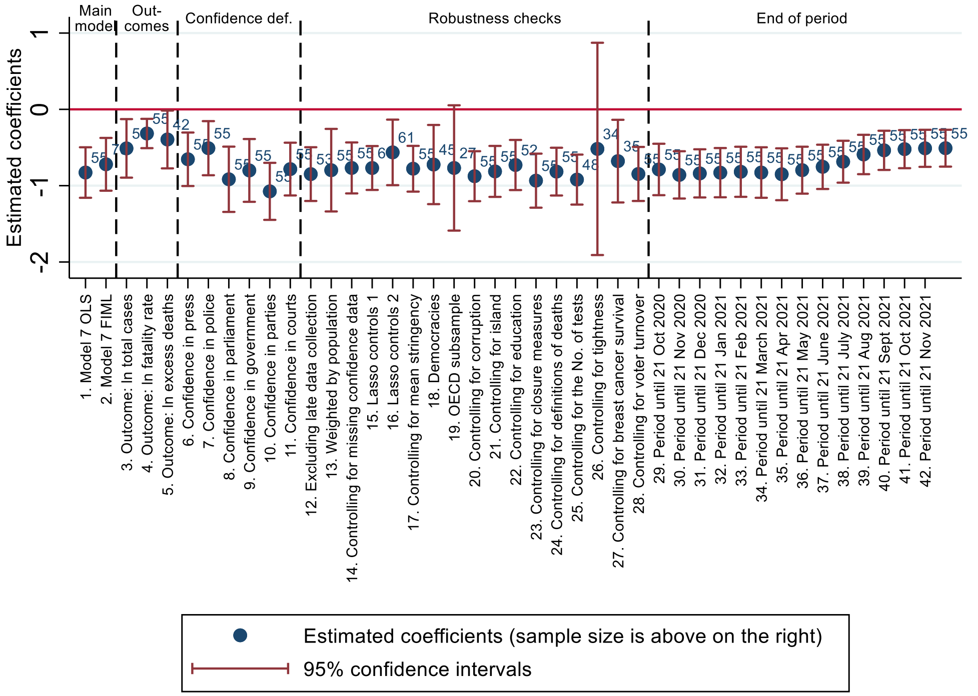

FIGURE 2 Robustness checks. All models (except for Models 15 and 16) control for days since first death, population, population density, gross domestic product (GDP) per capita, Gini index, index of political development, mortality rate before the pandemic, share of those above 65, life expectancy, share of migrants, trust in others, healthcare resources, index of health risks, stringency of coronavirus disease (COVID-19) measures, and decrease in mobility. On top of these measures, Model 14 also controls for the share of missing values of confidence in the individual-level data of the country; Model 20 also controls for an index of corruption; Model 21 also controls for whether the country is an island; Model 22 also controls for educational attainment; Model 23 also control for closure measures; Model 24 also controls for the way how COVID-related deaths are defined; Model 25 also control for the number of COVID tests, Model 26 also controls for the measure of tightness (following the rules), Model 27 also controls for breast cancer survival rate, and Model 28 also controls for voter turnout. Model 17 controls for all the main controls as the original specification, but controls for the mean of stringency of COVID-related measures in a country instead of the maximum. Model 15 controls for a subset of the main controls as set by a lasso procedure: the days since first death, index of political development, healthcare resources, index of health risks, stringency of COVID-19 measures and decrease in mobility. Model 16 controls for a subset of more detailed measures as set by a Lasso procedure: health expenditures, number of doctors per a thousand population, body mass index (BMI), obesity rate, blood sugar and kidney-related illnesses, physical activity, days since first COVID death, population density, index of political development, life expectancy, share of migrants, stringency of COVID-19 measures and decrease in mobility.

1 SD higher confidence in public institutions, such as people in Finland (confidence in public institutions = 0.76), our model would predict about 116,000 fewer deaths attributed to COVID-19.

In line with the medical strand of the literature (e.g., Caramelo et al., 2020; Dietz & Santos-Burgoa, 2020; Gao et al., 2020), the index of health risks, which summarizes how large the contribution of specific risk factors to death rates before the pandemic was (such as obesity, high blood sugar, high blood pressure, etc.), shows a positive correlation with the number of deaths attributed to COVID-19, although this relationship is not significant (Table 2). Theoretically, countries facing a higher COVID-19 burden must have higher related healthcare spendings, although we cannot check this as we have no available data on this. Nevertheless, this proposed association could be the reason why the index

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capturing the available resources (but not the quality) of the health system could show a weak positive correlation with the number of deaths. As in Gelfand et al. (2021) and Sorci et al. (2020), the stringency of the social distancing measures is positively correlated with the number of deaths, probably because countries hit harder by COVID-19 established more rigorous restrictions. Similarly, a decrease in mobility is associated with more deaths as people respond to the severity of the pandemic, although this relationship is small and insignificant.

We report the detailed results of all robustness checks in Supporting Information: Appendix B and summarize all comparable estimates on our main variable of interest in Figure 2. There are several ways to measure how severe the pandemic is in a country, and they all have their advantages and disadvantages. We have chosen the number of deaths attributed to COVID-19 per one million people as our primary outcome variable because this measure could be the least prone to underreporting. While the number of cases in a country relies heavily on their testing protocols, those who become very sick (and thus unfortunately die) usually get tested (or diagnosed). The protocols attributing deaths to COVID-19, however, also differ country by country (HSRM, 2020). Despite these potential problems, we find similarly strong associations if we replicate model 7 using the following alternative outcome variables (Supporting Information: Table B3): the raw number of total deaths per million people ($\beta = -350.876$, $p < 0.01$), log number of cases per million people ($\beta = -0.511$, $p < 0.05$), log fatality rate ($\beta = -0.316$, $p < 0.01$), excess deaths in 2020 compared to the average of 2015–2019 ($\beta = -4.711$, $p < 0.1$), and the log of excess deaths ($\beta = -0.395$, $p < 0.1$). Looking at the share of positive tests as an outcome again reveals a negative relationship ($\beta = -0.051$, $p < 0.01$), while we find no association with the log number of tests ($\beta = 0.034$, $p = 0.822$). Furthermore, our results stay very similar if we use the log number of deaths as an outcome variable and control for the different protocols of countries in attributing deaths to COVID-19 ($\beta = -0.934$, $p < 0.01$) (Supporting Information: Table B6).

Figure 2 plots the main estimated coefficients across all robustness checks. The first block (*Main model*) shows the main estimate of the statistical relationship between log number of deaths attributed to COVID-19 per million inhabitants and confidence in public institutions, estimated by OLS and FIML. The second block (*Outcomes*) plots three comparable estimates using the log number of cases, the log fatality rate, and the log number of excess deaths as outcome variables. The third block (*Confidence definitions*) shows the same estimates as the main model using confidence in specific institutions instead of the summary index. The block *Robustness checks* shows estimates in alternative model specifications, subsamples, and extra explanatory variables. The last block (*End of period*) plots the estimates using alternative observation periods.

Looking at confidence in specific institutions instead of the summary measure reveals that they all matter similarly (Table B4 in Supporting Information: Appendix B). In terms of the magnitude of the coefficients, the one on confidence in political parties is the highest ($\beta = -1.074$, $p < 0.01$), followed by parliament ($\beta = -0.916$, $p < 0.01$) and the government ($\beta = -0.800$, $p < 0.01$).

These results also prevail if we estimate models 1–7 by FIML instead of OLS to keep the sample size at 75. Supporting Information: Table B2 shows that the estimated coefficient on confidence in institutions decreases from −1.190 ($p < 0.01$) to −0.720 ($p < 0.01$) between models 1 and 7, but remains highly significant. The point estimate of model 7 indicates that a 1 SD increase in confidence is associated with a 51.3% decrease in the number of deaths, conditional on our set of country-level characteristics.

Both the lasso and the random forest algorithms find that confidence in public institutions is one of the most important predictors of the number of deaths attributed to COVID-19. When the regressors of the main specification are included in the models (lasso 1 in Table B5 and Figure B1 in Supporting Information: Appendix B), confidence in public institutions

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has the highest relative predictive importance compared to all control variables. As the lasso and random forest procedures can handle relatively large number of explanatory variables compared to the number of observations, we repeat the same procedures using the individual items of the PCA scores for health risks, resources, and political systems as covariates (lasso 2 in Table B5 and Figure B2 in Supporting Information: Appendix B). In these models, confidence in public institutions is the most important (lasso) or the second most important factor after BMI (random forest) to predict the outcome.

In Table B5 in Supporting Information: Appendix B we support our results with further robustness checks: we weight by population, control for the share of nonresponse in the confidence measures, re-estimate the main model controlling for only covariates found to be important by the lasso procedure (confidence in institutions, number of days since the first death, the index of political development, resources of the health system, index of health risks, stringency of COVID-19 measures, decrease in mobility), restrict the sample to democracies[5] and OECD countries, and exclude two countries where the data collection on confidence was not completed by March 1, 2020; all resulting in statistically equivalent estimates as before. In Table B6 in Supporting Information: Appendix B, we show that controlling for further potentially important variables does not change our baseline estimates in a statistical sense. These additional control variables, if all added in one model, would radically decrease sample size; thus, we add them one by one on top of our main specification. Adding the tightness measure of Gelfand et al. (2021) does not make the magnitude of our estimated coefficient on confidence in institutions statistically significantly different ($\beta = -0.518$, 95% confidence interval [CI]: −2.022 to 0.986, $p = 0.476$) from our baseline estimate ($\beta = -0.828$, 95% CI: −1.169 to −0.486, $p = 0.000$) (two-tailed t-test $p = 0.6046$). In addition, we obtain similar estimates to our main specifications if we control for a measure of corruption, the number of COVID-19 tests, the 5-year survival rate of breast cancer, the average years of education, whether the country is an island, social capital measured as voting turnover, and use the mean of stringency measures in a country instead of the maximum that we used in our main model.

In our models, the number of observations is between 27 and 75, and our main result is estimated on a sample of 55 countries. These are fairly small samples, and it might matter which countries fall into them. Figure B3 in Supporting Information: Appendix B compares our main estimate in model 7 to the distribution of estimates on 35-country random samples. It shows that our main 55-country estimate is almost precisely in the middle of this distribution, suggesting that our results are reasonably robust to leaving out various subsamples of countries from the estimations.

POTENTIAL CHANNELS

In this section, we try to understand the relationship between confidence in public institutions and the severity of the pandemic more clearly. One potential concern could be that confidence in institutions measures some unobserved quality of the public sector, hence it is correlated with COVID-19 outcomes. If, for example, besides what we can measure in our data, people knew something more about how "good" their health system is, and this knowledge is reflected in their confidence in public institutions, we would expect to find a similarly strong statistical relationship between confidence in public institutions and other health-related outcomes. We would like to exclude this possibility, because this would mean that, at the end of the day, it is not confidence, but public service quality that matters for COVID-19 outcomes.

Thus, we first test whether confidence in institutions is associated with the 5-year survival rate of breast cancer (Table B8 in Supporting Information: Appendix B). This is an illness

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that is likely to be cured if caught early and appropriate care is given. The breast cancer survival rate captures many things at the same time, that is, how quickly people would go to see a doctor in case of health problems, how likely they are to attend regular screening, whether there is regular screening in the first place, and the quality of the health system that is not captured by other measures in the models (i.e., number of beds/doctors, health expenditures). Using this measure as an outcome variable, we find no significant association between confidence in public institutions and cancer survival.

Second, we test whether confidence in public institutions captures the unobserved quality of public services overall. Again, it is very hard to measure the quality of public services. We proxy the quality of public services, in general, using the share of the prison population. We assume that criminal behavior is the result of deep, long-term social problems that well-working public institutions should be able to solve without imprisonment. Thus, a high share of the prison population is a sign that public institutions are not successful in solving social problems, and we assume that our other measures cannot capture this. Nevertheless, the quality of the police force works in the opposite direction. To test whether confidence in public institutions captures people's perception of the quality of public services, we re-estimate our main model using the share of the prison population as an outcome variable. Again, we find no significant statistical association between confidence in public institutions and prison population (Table B8 in Supporting Information: Appendix B). We also look at whether there is an association between the decrease in people's mobility (again, measured with Google mobility trends data) and confidence in public institutions. We find no significant relationship (Table B8 in Supporting Information: Appendix B).

We make two further attempts to understand the nature of the relationship between confidence in institutions and COVID-19-related deaths better. First, we test the restriction compliance hypothesis and examine whether data sharing and cooperation in contact tracing can be a possible channel. In particular, we investigate whether confidence in public institutions matters more in countries that employ particular measures in Supporting Information: Table B9. We examine two submeasures of the stringency index: one captures whether countries had more restrictions on small private gatherings that are hard to force if people do not cooperate, and the other captures countries that applied comprehensive contact tracing that requires people to provide their own personal data as well as the data of others they had contacts with. We find that the association between confidence in public institutions and deaths attributed to COVID-19 does not differ across countries employing more or fewer restrictions on personal gatherings. On the other hand, in terms of contact tracing, we find heterogeneity: confidence in public institutions has a higher correlation with deaths in countries that relied more on contact tracing. This result points to cooperation in contact tracing as a potential channel between confidence in public institutions and deaths attributed to COVID-19. Theoretically, this result could also imply that confidence matters more in countries where the pandemic was less severe (i.e., it is probably difficult to trace contacts when there is a considerable number of cases). We test this by estimating quantile regressions in Table B10 in Supporting Information: Appendix B. While the estimated coefficient is somewhat larger at the 20th percentile of log deaths than at the 80th percentile, they do not differ in a statistical sense. Thus, the association we find between confidence and deaths exists along the whole distribution of deaths.

Lastly, we test whether there is a statistical association between confidence in public institutions and the vaccination rate (Table C1 in Supporting Information: Appendix C). In our main specification, we find that a 1 SD increase in confidence in public institutions is related to a 3.4 percentage points higher vaccination rate. This is a 6.3% effect that is significant on a 10% significance level.

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DISCUSSION

This article investigates the relative predictive importance of confidence in public institutions to explain cross-country differences in the severity of the COVID-19 pandemic. We look at the statistical association between the number of deaths attributed to COVID-19 and confidence in public institutions, while we control for the potentially important factors covered so far by the related socioeconomic literature. We find that the number of deaths is significantly lower in countries with higher confidence in public institutions, and this relationship is robust to an extensive series of robustness checks. Although these findings do not reflect causal relations, they measure a meaningful statistical relationship.

Our results are in line with Elgar et al. (2020), Helliwell et al. (2021), and Yuan et al. (2022) in finding that countries with less confidence in public institutions suffered more losses due to COVID-19. We show that this relationship is not attenuated by including additional socioeconomic measures that these papers did not take into account. Furthermore, all of our methods point to the conclusion that compared to country-level measures of individual health risks, the health system, demographics, economic and political development, and social capital, confidence in public institutions is one of the most crucial predictors of deaths attributed to COVID-19.

Besides confidence in public institutions, countries might also have cultural differences in terms of how tightly people tend to follow rules and norms in general. As mentioned earlier, the cultural tightness–looseness measure of Gelfand et al. (2021) aims at capturing these differences, and they find that the number of COVID-19 cases and deaths are lower in “tighter” countries (such as China, Vietnam, or Sri Lanka, e.g.) than in “looser” countries (like the United Kingdom or the United States, e.g.). While confidence in public institutions could be related to cultural tightness (i.e., might make more sense to follow the norms in a country where people trust public institutions), when we add tightness to our model as an additional control variable (at the cost of decreasing the sample size), our previously estimated statistical relationship between confidence in public institutions and COVID-19 deaths do not change in a statistical sense. Thus, we view confidence in public institutions and cultural tightness as two distinct concepts.

The statistically significant relationship between confidence in public institutions and the severity of the pandemic could be overestimated if there were some unobserved characteristics of countries that were positively correlated with both. While we cannot control for unobserved characteristics, we can look at the relationship between confidence in public institutions and other health and social outcomes. We do not find a significant statistical relationship between confidence and either the survival rate of breast cancer or the share of the prison population. Thus, confidence in public institutions is likely not a proxy of people's health behavior, their unobserved knowledge about the quality, or problem-solving ability of these institutions (that could theoretically predict well how effective institutions would be in containing COVID-19). Looking at the potential mechanisms behind these results, we find suggestive evidence that confidence in public institutions has a role in how effective contact tracing would work in a country, that is, how willing people might be to expose their personal data, social networks, and become visible to the authorities. This result coincides with those of Amara et al. (2022).

Our results imply that, as a complementary factor of restriction measures in pandemics, it is crucial to enhance the cooperativeness of citizens with the authorities and, as a result, increase implementation effectiveness. This is especially important in the case of those measures that cannot be enforced legally (i.e., providing personal data for contact tracing). As pandemics are expected to occur more often in the future, it is vital to enhance confidence in public institutions to build capacities to contain such crises.

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AUTHOR CONTRIBUTIONS

Anna Adamecz: Conceptualization; data collection; data analysis; writing—original draft; validation; verification of the data. **Ágnes Szabó-Morvai:** Literature search; data collection; data analysis; writing—review and editing; validation; verification of the data.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

We did not use any data or material from other sources which require permission. We use publicly and freely available data. All data and Stata codes used for this analysis are shared on GitHub (https://github.com/szabomorvai/covid_deaths).

ETHICS STATEMENT

This article utilizes country-level data collected by third parties and is available for further use. Moreover, the research involved no human participants or animals, thus, it was not required to be approved by an Ethics Committee.

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NOTES

1 https://github.com/szabomorvai/covid_deaths.

2 We also provide a robustness check in Table B11 in Supporting Information: Appendix B, where we also include the item "*The civil service*" in the index (Model 1; share of explained variation: 0.76; Cronbach's α: 0.94).

3 Constructing a latent "confidence in institutions" index (as opposed to using the items separately) provides the advantage of reducing measurement error in each question. However, when we replicate the main analysis with separate measures, the results are very similar.

4 As the dependent variable is log-transformed, we approximate the percentage change of y per unit change of x from the raw coefficients as $\exp(\beta) - 1$. For example, $\exp(-0.828) - 1 = -0.563$.

5 We provide a robustness test where we interact confidence in institutions with democracy in Table B11 in Supporting Information: Appendix B.

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