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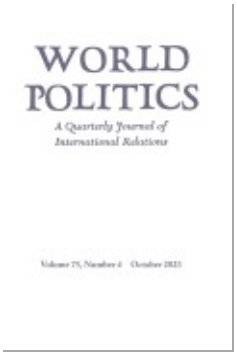

World Politics, Volume 75, Number 4, October 2023, pp. 735-778 (Article)

Published by Johns Hopkins University Press
DOI: *https://doi.org/10.1353/wp.2023.a908774*

DEMOCRACY AND MASS SKEPTICISM OF SCIENCE

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ABSTRACT

Since the Age of Enlightenment, many thinkers and philosophers have viewed democracy and science as two aspects of modernity that reinforce each other. This article highlights a tension between the two by arguing that certain aspects of contemporary democracy may aggravate the mass public's anti-intellectual tendency and thus potentially hinder scientific progress. The authors analyze a new global survey of public opinion on science using empirical strategies that exploit cross-country and cross-cohort variations in experience with democracy, and show that less-educated citizens in democracies distrust science much more than do their counterparts in nondemocracies. Further analyses suggest that the increase in skepticism in democracies is not the result of greater religiosity or weaker scientific literacy; instead, it is more likely driven by a shift in the mode of legitimation, which reduces states' ability and willingness to act as key public advocates for science. These findings shed light on the institutional sources of science-bashing in many long-standing democracies.

Introduction

As the twin pillars of modernity, democracy and science are widely believed to go together. Ever since the Age of Enlightenment, advancements in democratic values and institutions have often occurred in tandem with major breakthroughs in science and technology.[1] According to prominent philosophers and social theorists, an open, democratic society enjoys a unique advantage in promoting intellectual and scientific progress because it supports such values as rationality, reason, and freedom of thought and speech—all of which are also vital for sustaining scientific discoveries.[2] Historically, the struggle for modernization in many developing countries was often aimed at a simultaneous transition from autocracy to democracy and from a traditional, backward society to one governed by science and reason.[3]

[1] Israel 2009.
[2] Merton 1973; Polanyi 1962; Popper [1945] 1966.
[3] Schwarcz 1986.

World Politics 75, no. 4 (October 2023) 735–778

The compatibility between democracy and science has long been considered a truism, but the COVID-19 pandemic exposed a troubling tension between the two.[4] In a number of major democracies, including the United States, the United Kingdom, Brazil, and India, a significant segment of the public appears to hold grave doubts, if not outright hostility, toward both science and scientists.[5] From the widespread distrust of top health experts to the popularity of conspiracy theories, from the controversies over mask-wearing and vaccination to the opposition to lockdown and social-distancing measures, the democratic masses have engaged in a variety of antiscience discourses and behaviors that have not only been a source of frustration to the scientific community, but have also significantly limited the quality and effectiveness of countries' pandemic responses.[6] How do we explain the rampant antiscience sentiments under a political system that is supposedly an ally of science?

In this article, we address this puzzle by offering a nuanced perspective on the relationship between democracy and science. We distinguish between two different tasks related to scientific progress: (1) conducting cutting-edge research and inquiries that advance science; and (2) making the public at large appreciate the value of science and voluntarily follow scientifically informed prescriptions and guidelines. We argue that although democracy provides important freedoms for pursuing the first task, it may have a comparative disadvantage with respect to the second. Specifically, we argue that two common features that characterize contemporary democracies—relatively low public trust in political authority and weak reliance on science as an ideological resource for legitimation—reduce the government's ability and willingness to act as an advocate for science before the general public. The lack of robust state sponsorship has many perverse implications, not the least of which is to undermine science's standing in the battle against antiscience narratives and ideologies. This absence of sponsorship explains why many liberal democracies that excel at producing leading scientists

[4] The COVID-19 outbreak has reinvigorated public interest in this tension, but the concern about widespread antiscience sentiment in democracy is not new. Hofstadter 1963, for example, explains the longstanding anti-intellectual tradition in the United States with reference to features of American democracy. More recently, studies have documented the rise of antiscience ideologies and movements in the United States and several other major democracies since the 1970s and the steady decline in public confidence in science and professional experts in those countries, especially among self-identified conservatives; Holton 1993; Otto 2016. See also Eyal 2019; Gauchat 2012; Nichols 2017.

[5] See *BBC News*. 2020. "Coronavirus: Bill Gates 'Microchip' Conspiracy Theory and Other Vaccine Claims Fact-Checked." May 30. At https://bbc.in/3ci7kmv, accessed March 23, 2023. See also *Guardian*. 2020. "Vaccines, 5G, Bill Gates: Why Are Australians Gathering to Spread Coronavirus Conspiracy Theories?" May 11. At https://bit.ly/2Yvho4v, accessed March 23, 2023.

[6] Cepaluni, Dorsch, and Branyiczki 2022; Cheibub, Hong, and Przeworski 2020.

and groundbreaking scientific discoveries now face considerable difficulties in making the less-educated members of their societies accept and follow even the most basic scientific principles and practices.

To substantiate this argument, we analyze a new global survey on the public's attitude toward science from 143 countries matched with country-level information on political regimes. We exploit two distinct sources of variation—cross-country variations in political regimes and cross-cohort variations in democratic experience within the same country—to estimate the effect of democracy on trust in science for citizens with different levels of education. We find that educated citizens are strongly committed to science regardless of regime type but that less-educated citizens in democracies report considerably less trust in science than their counterparts in nondemocratic systems. The magnitude of this difference amounts to about one-fifth to one-quarter of the sample standard deviation. Using a granular classification of nondemocratic regime types, we further find that the trust deficit among the less-educated is more pronounced when comparing democracies with single-party regimes and military regimes, both of which represent the relatively more "modern" and "rational" types of autocracies that need science as a source of legitimacy.[7] By contrast, the trust gap is much smaller when we compare democracies with nondemocracies that are dominated by personalistic rulers.

We then conduct a series of additional analyses to probe the specific mechanisms that link democracy to lower mass trust in science. One obvious link is that in a democracy, the less-educated may be more influenced by religion because the political system offers more religious freedom.[8] Another possibility is that citizens in nondemocracies may view science more favorably because they possess a higher level of scientific literacy. Contrary to these conjectures, we find that greater religiosity at best explains only a small part of the overall effect of democracy on science-related trust, and that no systematic regime-based differences exist in terms of ordinary citizens' actual command of scientific knowledge. Instead, we show that a relatively low level of trust in government plays a more important role in accounting for the democratic public's skepticism toward science, mediating about 30 to 37 percent of democracy's overall effect for respondents without a college degree.

To shed further light on how democracy affects states' need for science as a legitimating tool, we analyze two additional data sources. One

[7] Regarding classification of nondemocratic regimes, see Geddes, Wright, and Frantz 2018.
[8] Baker, Perry, and Whitehead 2020; J. Evans and M. Evans 2008.

is the full text of constitutions from the Comparative Constitution Project; the other is an original data set of national honors and decorations awarded by governments to recognize extraordinary accomplishments of domestic and foreign citizens.[9] We use the frequency with which science is referenced in constitutions and the percentage of scientists among recipients of national honors as indicators for the extent to which a state relies on science as the basis of political legitimacy. We find that on average democracies are less likely than nondemocracies to reference science in their constitutions, and that they award a smaller share of high state honors to scientists. These patterns support our claim that a changed mode of legitimation explains why democratic governments are both less able and less willing to publicly advocate for science than are their nondemocratic counterparts.

Our findings about the effect of democracy on citizens' scientific attitudes, and the mediating role of political trust in particular, speak to a long and influential body of cross-country research on the relationship between political institutions and the sociocultural values of the mass public.[10] A central finding that emerges from this literature is that, since the mid- to late twentieth century, public trust in government has steadily declined in major democracies.[11] Citizens have become more "critical," more "assertive," and "less deferential" to various political and public authorities.[12] Many researchers consider this change in the public ethos to be a largely positive development that will empower citizens and enhance democratic accountability.[13] But our findings suggest that this critical turn of political culture might not always have positive consequences. In societies in which a sizable share of citizens is still not well educated, the unchecked growth of a critical mindset may lead to widespread distrust of institutions that constitute the very foundation of democracy and modernity.

More broadly, our study contributes to a deeper understanding of the nature of contemporary democratic institutions. Since the end of the Cold War, a large and influential body of comparative scholarship has explored the effects of the liberal democratic system (vis-à-vis nondemocratic systems) on various domains of political and economic

[9] Regarding the Comparative Constitution Project, see Elkins, Ginsburg, and Melton 2009.

[10] E.g., Almond and Verba [1963] 2016; Inglehart 1977; Inglehart and Welzel 2005; Norris 1999; Dalton and Welzel 2014.

[11] Dalton 2004.

[12] For "critical," see Norris 1999; for "assertive," see Dalton and Welzel 2014; for "less deferential," see Nevitte 2014.

[13] Norris 1999; Welzel and Dalton 2014.

governance.[14] These works generally hold a relatively sanguine view of liberal democracy, seeing it as representing "the end of history" in terms of institutional options for human societies.[15] Into the twenty-first century, however, the less-than-stellar records of some advanced democracies in handling major financial, political, and public-health crises have stimulated critical reflections on what democracy can and cannot do. Recent studies find that liberal democracies are not necessarily better than other types of regimes at reducing inequality or delivering public goods, and may be more prone to periodic financial crises and ideological polarization.[16] We contribute to this rapidly expanding body of literature by examining another area in which democracy was long believed to hold an unconditional advantage. We do not deny that an open and pluralistic system can provide important benefits for scientific discoveries, but our analysis suggests that the same system may have trouble disseminating the fruits of those discoveries because it tends to exacerbate the lay public's suspicion about science.

This study is also related to a growing body of scholarship on the determinants of public trust in science. The existing research has explained citizens' attitudes toward science mainly in terms of individual-level attributes, such as educational attainment, literacy in scientific knowledge, and partisanship ideology.[17] But the research has paid relatively little attention to the role of macrolevel institutional factors. The few studies that consider the role of contextual variables have drawn their explanations and evidence almost exclusively from the experiences of the United States or Western Europe. We extend this literature in two ways. First, we expand its analytical scope by bringing in political institutions as another key macrolevel explanatory variable that may influence citizens' attitudes toward science. Second, we expand its geographical scope from a single country or a few developed nations to a global sample of countries with diverse cultural and socioeconomic conditions.[18] Our analysis suggests that different political systems may have distinct comparative advantages and disadvantages in dealing with different aspects of science. Our findings have important practical implications at a time when devising scientifically informed solutions to some of humanity's greatest

[14] E.g., North and Weingast 1989; Olson 1993; Schultz and Weingast 2003.

[15] Fukuyama 1992.

[16] For reducing inequality, see Dorsch and Maarek 2019; Piketty 2020. For delivering public goods, see M. Ross 2006. For financial crises, see Lipscy 2018; and for ideological polarization, see Gimpelson and Treisman 2018.

[17] E.g., Gauchat 2012; J. Miller 1983; Sturgis and Allum 2004.

[18] E.g., Allum et al. 2008; G. Evans and Durant 1995; Gauchat 2012.

challenges, such as pandemics and climate change, requires global collaboration among different types of political regimes.

Argument

A long and distinguished body of scholarship has examined the relationship between political institutions and scientific development. Developed at a time when Western democracies' main rivals were totalitarian regimes such as Nazi Germany and the Soviet Union, the canonical works in this literature typically argue for a mutually reinforcing relationship between democracy and science. Michael Polanyi, for example, argues that a liberal political system is ideal for scientific development because it protects the autonomy of the scientific community.[19] Karl Popper suggests that values supported by an open, democratic society, such as rationalism and freedom of thought and speech, are essential for scientific progress.[20] Robert Merton, moreover, makes the case that a democratic order is closely integrated with the ethos of science, which includes such characteristics as universalism, communality, disinterestedness, and organized skepticism.[21] Although these prominent theorists differ in their specific postulations, they share the view that an open, democratic system that restrains the government's executive power and respects individual freedom provides the ideal political environment for science to flourish.

These canonical works offer important insights into the advantages that liberal polities have in fostering scientific progress, but their discussion is often confined to the activities of scientists. This focus is understandable, given that scientists are the primary producers of scientific knowledge, but it is nonetheless incomplete, because scientific progress, especially in the modern era, is a society-wide project that involves extensive input from the mass public.[22] Not only does the public contribute to scientific research by supplying funding (through taxes) and future researchers, but its willingness to follow scientifically informed guidelines and prescriptions also has important bearings on how quickly and effectively certain critical technologies or environmental/public-health

[19] Polanyi 1962.
[20] Popper [1945] 1966.
[21] Merton 1973.
[22] Kitcher 2001. A sizable body of research has studied individual-level determinants of public understanding and perceptions of science. That literature's debate centers on the importance of "scientific literacy" as a predictor of individuals' attitudes toward science; e.g., J. Miller 1983; Withey 1959. For a critique of this approach, see Irwin and Wynne 1996.

policies can be implemented.[23] So far, discussion in the literature on whether and how regime types influence public attitudes toward science has been limited. We argue that the relationship is not so straightforward, and that contemporary liberal democracies do not necessarily enjoy an advantage compared to nondemocracies.

The starting point of our argument is that even though science is an important contributor to the making of the modern world, it does not automatically enjoy the trust or support of the mass public.[24] As many authors have noted, the practice of science contains highly elitist and even exclusionary elements that make it largely inaccessible to lay citizens.[25] This elitist tendency is especially pronounced in the modern era, as scientific research has become increasingly specialized and organized.[26] Rapid scientific and technological progress also creates additional risks and uncertainties in society in the form of economic displacement, social disruption, and environmental degradation.[27] These perverse effects have led many who have been affected by these uncertainties to question science's ability to improve their livelihood and welfare.

For ordinary citizens, therefore, trusting science often means believing in the competence and benevolence of a distant and esoteric community (that is, researchers and scientists) whose work they have little direct control or knowledge of.[28] Such a faith-like belief is sometimes hard to develop and sustain without someone actively advocating on science's behalf. Historically, scientists themselves have acted as promoters of their own work to the public during the early phase of scientific development.[29] In the modern era, this responsibility has increasingly fallen on the state. Existing research has documented a number of ways in which the state can shape public opinion about science. For example, the rising mass awareness of and literacy in science and mathematics in Western Europe and North America at the turn of the twentieth century can largely be attributed to national governments' decisions to incorporate these subjects into national curricula and mandate the teaching of them in public schools.[30] In many developing countries, states have also engaged in public campaigns to educate citizens about the merits of science. Those campaigns have emphasized

[23] E.g., Cologna and Siegrist 2020; Palamenghi et al. 2020.
[24] Eyal 2019; Holton 1993.
[25] Guston 1993; Macleod 1997.
[26] Galison and Hevly 1992.
[27] Beck 1992; Giddens 1991.
[28] Shapin 2007.
[29] Burnham 1987.
[30] Kamens and Benavot 1991; Layton 1973.

science's connection with personal well-being or such lofty collective goals as national solidarity and social and economic modernization.[31] Moreover, governments can make symbolic gestures to elevate and legitimize science and its practitioners, such as by affirming its importance in key political documents or by awarding honors to recognize the work of outstanding scientists.[32]

In theory, any type of regime can take up these proscience advocacy measures, but we argue that contemporary democracies may use such measures less often and less effectively than other regimes, for two interrelated reasons. One reason has to do with ability; the other with incentive. First, a key precondition for state-sponsored advocacy to work is that the government itself must enjoy a sufficiently high level of authority and credibility in the eyes of its citizens. Yet, compared to nondemocracies, the operation of a democracy—with its tolerance of an adversarial style of politics and open dissent—tends to produce an opposition culture, one that challenges and deconstructs the political authority.[33] A sizable body of survey-based studies shows that while the majority of citizens in Western democracies held a relatively high level of allegiance to political institutions in the years immediately after World War II, public trust in governments, parliaments, and other institutions that wield political authority has undergone a steady and significant decline over the last half century.[34] Cross-country comparisons suggest that citizens in democracies are on average less likely to express confidence in government than citizens in nondemocracies.[35] Studies of public opinion dynamics during democratization also show that significant gains in democratic development in a country are often accompanied by notable declines in public trust in political institutions, even when general socioeconomic conditions are improving.[36] Debates are still ongoing about the exact cause of this apparent trust deficit in democratic governments, and how the deficit might affect overall government

[31] Gaukroger 2006; Wei and Brock 2012. For an extensive review of government-sponsored initiatives to promote mass scientific awareness and support, see Trench and Bucchi 2021.

[32] Price 2014; Maurer et al. 2011.

[33] Patterson 1994.

[34] Dalton and Welzel 2014; Norris 1999. According to Dalton and Shin 2014, for example, many citizens in modern democracies hold opinions consistent with what they label as "dissatisfied democrats"—citizens who support the general idea of democracy but are nonetheless critical of their own national government.

[35] van der Meer 2017.

[36] Dalton and Shin 2014, 105.

performance.[37] But certainly, a relatively low level of political trust does not bode well for democratic governments' ability to persuade the public. When citizens are accustomed to viewing the political authority with suspicion, they are not likely to change their opinion about other issues based on the government's recommendation. In some cases, given the perceived closeness between the state and science, skepticism of science may even be directly fueled by the suspicion of or resistance to state actions, which are sometimes taken in the name of scientific principles.[38]

Besides the issue of ability, we argue that contemporary democratic states also have comparatively weaker incentive to bolster the public image of science, because they rely less on science for political legitimation. In democracies, the legitimacy of state actions rests ultimately on popular consent, which is expressed procedurally through citizens' participation in democratic institutions such as elections.[39] Although science—by virtue of its impersonal, objective, and impartial appearance—was historically used by some liberal democracies to justify centralizing executive actions in a system with nominally decentralized political power, much of what science did was to supplement, rather than replace, the main procedure-based source of democratic legitimacy.[40] This legitimating function of science has become more restricted than in previous times in contemporary democracies with the rise of the postmaterialist culture of politics, which emerged in advanced democracies in the late

[37] Researchers offer many explanations to account for citizens' apparently low political trust in democracies, including greater tolerance of dissent, lack of control over public discourse/censorship, the presence of a distinct anti-authoritarian culture, and the perverse effect of partisan competition. Researchers also differ in their assessments of the consequences. Some worry that low political trust may eventually erode citizens' support for democratic institutions; Crozier, Huntington, and Watanuki 1975; Nye, Zelikow, and King 1997. Others are more optimistic, arguing that the decline may simply result from citizens' rising expectations for democracies and that a healthy dose of vigilance can be beneficial for enhancing civic engagement and democratic accountability; Dalton and Welzel 2014; Norris 2011.

[38] Historically, many antiscience movements have been part of a broader populist democratic struggle against the perceived excessive expansion of state and expert authority. One notable example is the antivaccination movement in the United States during the Progressive Era (1890s–1920s), which became "a populist crusade that emphatically repudiated the authority of governmental and medical 'experts' to define personal and public health"; Johnston 2006, 178. In Brazil, the Vaccine Revolts of 1904 were also driven in part by resentment of the government's aggressive public health policies; Castelfranchi 2018. More recently, Hilgartner, Hurlbut, and Jasanoff have argued that the rising antiscience sentiment among the American public today is not so much about the worth of scientific knowledge, but rather about "the authority of experts to decide how people should live their lives"; Hilgartner, Hurlbut, and Jasanoff 2021, 893.

[39] Dahl 1956.

[40] For the use of science to justify centralizing executive actions, see Ezrahi 1990. When political trust is comparatively low, democratic governments' attempts to use science as a legitimizing mechanism may backfire and hurt the credibility of science itself. As Eyal 2019 puts it, the "scientization of politics" can sometimes exacerbate the politicization of science in the eyes of the lay public.

1960s and diffused to the developing world as international organizations and democratization expanded over subsequent decades.[41] The new political culture questioned the state's ability to carry out large collective projects (and even the desirability of such projects), and placed greater value on individuals' unique, subjective experiences and identities than on objective evaluations with universal standards.[42] Under this new culture, effective electoral mobilization depends more on showcasing symbolic commitments to a broad spectrum of values and ideologies than on articulating a coherent and concrete national program aimed at achieving instrumental, materialist goals.[43] Naturally, this implies a depreciation in the legitimating utility of science and technology, which are first and foremost methods for achieving material progress.[44] In some cases, the pressure to garner electoral support—especially from voters who harbor antiscience sentiments—may even impel politicians to ally themselves with influential groups and individuals holding explicitly antiscience views or agendas.[45]

By contrast, the utility of science as a legitimating tool remains highly relevant for many nondemocratic regimes today. Lacking election-based legitimacy, these regimes often justify their rule by proclaiming to be rational, enlightened powers whose mission is to modernize a backward society.[46] To the extent that science and technology are central to the modernization project, it is in those regimes' political interest to ensure that citizens have a strong appreciation of science, even if not necessarily a deep understanding of it, so that the regime elites' appeal to modernization will resonate. In Singapore, for example, the ruling People's Action Party advocates for "incorporating science and tech into

[41] Deutsch and Welzel 2016; Gleditsch and Ward 2008; Welzel and Dalton 2016.

[42] Ezrahi 1990; Inglehart 1977.

[43] Ezrahi 1990, 280.

[44] According to Ezrahi 2004, 273, in contemporary mass democratic polities, "Science is no longer the resource it once was, with which policies and public choices could be legitimated. . . . Consequently, scientists are much less in demand by politicians who seek to legitimate their positions and actions." In the supplementary material, we provide evidence that postmaterialist values are more prevalent in democracies than in nondemocracies (see Table A.14), and that strong postmaterialism tends to reduce trust in science among the less-educated (see Table A.15).

[45] For example, although few US politicians are willing to openly disavow science, the preferences of evangelical Christians, a significant bloc in the Republican Party support base, increasingly shape that party's platforms on key policy issues; Moore 2021. In India, leaders of the ruling Bharatiya Janata Party regularly and publicly seek the blessings of god-men, charismatic gurus whose large followings could swing elections; Raza 2018.

[46] Almond and Powell 1966; Huntington and Moore 1970.

Singapore's DNA," and the party actively recruits into the civil service individuals who perform well in science-related subjects to showcase the system's "meritocratic" character.[47] Similarly, the Kemalist regime in Turkey regarded science as "the truest guide in life" and made disseminating scientific knowledge to the masses a central part of its modernization program.[48] Many other nondemocracies, from the military regimes in Brazil and Chile to one-party regimes in China and the Soviet Union, have declared advancing science and technology to be one of the key missions of the state, promoting it on state-run media and at major national political events, and even enshrining it in such foundational political documents as constitutions.[49] Although one might question the sincerity of those gestures, and their effectiveness for actual scientific development, the close connection between science and state legitimacy nonetheless implies that nondemocracies often have more to gain politically than democracies from maintaining a positive image of science in the eyes of the public.

The preceding discussion suggests that democracies and nondemocracies may differ in terms of the government's willingness and capacity to act as an effective public advocate for science. Of note, state advocacy is unlikely to affect the attitudes of all citizens equally, however. In particular, we expect the attitudinal gap caused by differential effectiveness in state advocacy to be most pronounced among the less-educated, for several reasons. First, compared to the well-educated, many of whom have learned about the value of science and have been socialized to accept its authority during extended school experience, the less-educated are typically less exposed to science teaching at school and possess less

[47] Mauzy and Milne 2002.

[48] See Kili 1980. "Kemalist regime" here refers to the period from the 1923 founding of the Turkish Republic to the first competitive multiparty election in 1950. During this time, the Republican People's Party governed Turkey by following the ideology of its founding leader, Mustafa Kemal Atatürk, who emphasized modernization, secularism, and nationalism, among other things.

[49] Baum [1980] 2020; Dias and Serafim 2011; McFadden 1982. In Chile, Silva 2001, 96, notes that, in contrast to the antitechnocratic political discourse of the Pinochet regime's democratically elected predecessors (Eduardo Frei and Salvador Allende), Pinochet advocated for a rational, technocratic mode of decision-making aimed at convincing the public that party politics (and democracy) were useless for solving the country's problems. In China, the government often tries to schedule the beginning or end of important scientific exploration missions to coincide with the celebration of major political anniversaries so as to reinforce the perceived connection between scientific progress and state legitimacy; see Gan, Nectar, and James Griffiths. 2021. "China's Space Agency Just Gave the Communist Party a Big 100th Birthday Gift: A Rover on Mars." CNN. At https://www.cnn.com/2021/05/17/china/china-space-program-mic-intl-hk/index.html, accessed March 23, 2023.

systematic knowledge of related subjects.[50] This lack of knowledge implies that they may hold less stable attitudes toward science and depend more on external cues in forming their opinions.[51] In addition, that the less-educated disproportionately occupy the lower rungs of the socioeconomic ladder means that they are often more vulnerable to the various hazards and risks generated by modern technologies, such as workplace accidents, environmental pollution, and unemployment caused by automation.[52] These vulnerabilities may make them less favorably predisposed toward science and more susceptible to the influence of antiscience narratives or conspiracy theories.[53] Strong, credible public advocacy for countering skepticism and improving trust in science can thus be particularly consequential in these situations.

In sum, our central hypothesis, then, is:

> —Hypothesis: Because of a combination of two factors—citizens' stronger suspicion of government and the regime's reduced reliance on science as a source of legitimacy—the public in contemporary democracies may hold a more skeptical view of science than do its counterparts in nondemocracies, and we should see the difference in attitude more clearly among the less-educated majority than the well-educated minority.

In the following pages, we test this proposition empirically using a global survey of attitudes toward science.

Data and Measurement

Measuring Attitudes toward Science and Educational Attainment

The main data that we use in the empirical analysis come from the 2018 Wellcome Global Monitor (WGM), part of the Gallup World Poll. The

[50] A growing body of research argues that mass education is a crucial political institution through which states mold the values, preferences, and behaviors of future citizens; Darden and Grzymala-Busse 2006; Melton [1988] 2002; Paglayan 2021, 2022. An alternative explanation related to schooling experience is that systematic differences may exist between democracies and nondemocracies in the coverage of science-related subjects at lower grades. If science plays a more important role for political legitimacy in nondemocracies than it does in democracies, we may expect the former to include more science-related materials in school education than the latter, and the gap may be relatively larger at lower-level schools, which the state controls more tightly. However, a counterargument is that in most countries, the systematic teaching of science usually does not begin until lower secondary school or later; Taber and Akpan 2017. Hence, the regime-based difference in schooling experience may not be unique to, or most prominent at, the primary-school level. We investigate this possibility in our empirical analysis. Our findings suggest that precollege science literacy does not differ significantly across regime types (see tables A.17 and A.18 in the supplementary material), and that exposure to democracy during primary-school years (ages seven to thirteen) is not as strongly correlated with trust in science as is democratic exposure in later years (see Table A.8).

[51] Zaller 1992.

[52] Beck 1992; Eubanks 2018.

[53] Oliver and Wood 2014; Taverne 2006.

survey asked more than 140,000 individuals in 143 countries a range of questions about their attitudes toward science, including their overall trust in science, their views about the ability and integrity of the practitioners of science (scientists and doctors), and their assessment of the effects of scientific progress on society.[54] To our knowledge, the WGM survey provides the most comprehensive data to date for studying public opinion about science on a global scale.[55]

A potential concern with using survey questionnaires to measure trust in science is that attitudes expressed in social surveys may not always correspond perfectly with actual behaviors. Critics of the survey-based approach have rightfully noted that people who claim to be skeptical of science sometimes have no trouble taking advantage of modern technologies powered by scientific research.[56] Although limits certainly exist as to what survey questions can measure, our view is that answers to these questions nevertheless still contain valuable information about how individuals may choose and behave in the real world. In the context of the current pandemic, for example, Cristina Bicchieri and coauthors show that trust in science is positively associated with compliance with lockdown measures, and Patrick Sturgis, Ian Brunton-Smith, and Jonathan Jackson provide evidence that individuals' willingness to get vaccinated is a function of not only their own trust in science, but also the prevailing level of trust among their fellow citizens.[57] These findings suggest that meaningful behavioral differences do exist between individuals who report different levels of science-related trust in surveys.

Figure A.1 in the supplementary material presents the detailed wording of all thirteen science-related questions in the WGM and the cross-tabulations of the responses against a three-level variable for educational attainment (primary school or below, secondary school, and college or above). Overall, we note that although the majority of the respondents still express some degree of trust in science and scientists, the expressed trust is not as unequivocal as one might expect. For example, when responding to the relatively context-free question about trust in science,

[54] The Wellcome Global Monitor (WGM) 2018 survey was administered through either face-to-face or telephone interviews, with the latter used only in countries with at least 80 percent telephone coverage. Its implementation followed the same quality-control standards as in all other Gallup World Poll surveys: Interviewers received extensive training in survey administration and research ethics before going into the field. They conducted interviews in local languages and were instructed to maintain the confidentiality of respondents' identity. A substantial share of the interviews (more than 30 percent of face-to-face and 15 percent of phone-based) were validated.

[55] To ensure the WGM's representativeness, we compare the aggregate responses to its questions with responses to similarly worded questions in other reputable international surveys and find a strong positive correlation between them (see figures A.2 and A.3 in the supplementary material).

[56] Eyal 2019, 52–53.

[57] Bicchieri et al. 2021; Sturgis, Brunton-Smith, and Jackson 2021.

less than half (36.3 percent) of the respondents say they have "a lot of trust" and close to 20 percent say they have little to no trust ("not much" or "not at all"). The better-educated, unsurprisingly, show greater trust in science than the less-educated: a mere 7 percent of those with a college degree (about 18 percent of the sample) report little to no trust in science, but 26 percent of those with only primary-school education (about 31 percent of the sample) give that response. Responses to the more specific questions reveal a greater level of skepticism. About 28.5 percent of all respondents, and more than one-third of those with a primary-school education or less, think that scientists' work does not benefit people like them. When asked which to believe when the teachings of science and religion disagree, more than 55 percent of all respondents, and 73 percent of those with only primary-school education, choose religion over science. At minimum, the patterns seem to suggest that, as of 2018, a considerable share of the global population has reservations about science and the scientific community, and the authority of science is far from undisputed.

We also note that, within each respondent, answers to the survey questions exhibit strong internal coherence (Cronbach's $\alpha = 0.84$). To simplify the analysis, we estimate an item response theory (IRT) model on these questions to obtain a latent variable, *trust in science*, as the main dependent variable. As a robustness check, we report regression results in the supplementary material, using each of the component questions as the outcome variable (see Figure A.8 in the supplementary material).

Measuring Democracy

To study the effect of democracy on trust in science, we match the WGM survey with country-level data sets on political institutions. The main indicator that we use to measure democracy is the Polity2 variable (*polity score* hereafter) from the Polity project.[58] The polity score is one of the most widely used empirical measures of democracy in cross-country social science research. It has a twenty-one-point scale ranging from −10 (most autocratic) to +10 (most democratic) in one-point increments. A country is typically considered to be a democracy if its polity score is at or above 6. In the baseline analysis, we create a dichotomous indicator for democracy following this convention. About 62 percent of the countries in our sample are coded as democratic according to this criterion. As robustness checks, we replicate our analysis using the original continuous polity score and several other popular measures of regime types, including the electoral democracy index from the Varieties

[58] Marshall, Gurr, and Jaggers 2018.

of Democracy Project (V-Dem), the *Freedom House status* variable from Freedom House, and the dichotomous democracy measure by Carles Boix, Michael Miller, and Sebastian Rosato.[59] All these measures are highly correlated with one another and yield substantively similar results.

As a preliminary exploration of the cross-national patterns, we plot in Figure 1 the average *trust in science* separately for the ten highest and ten lowest countries by education level (college or above versus primary

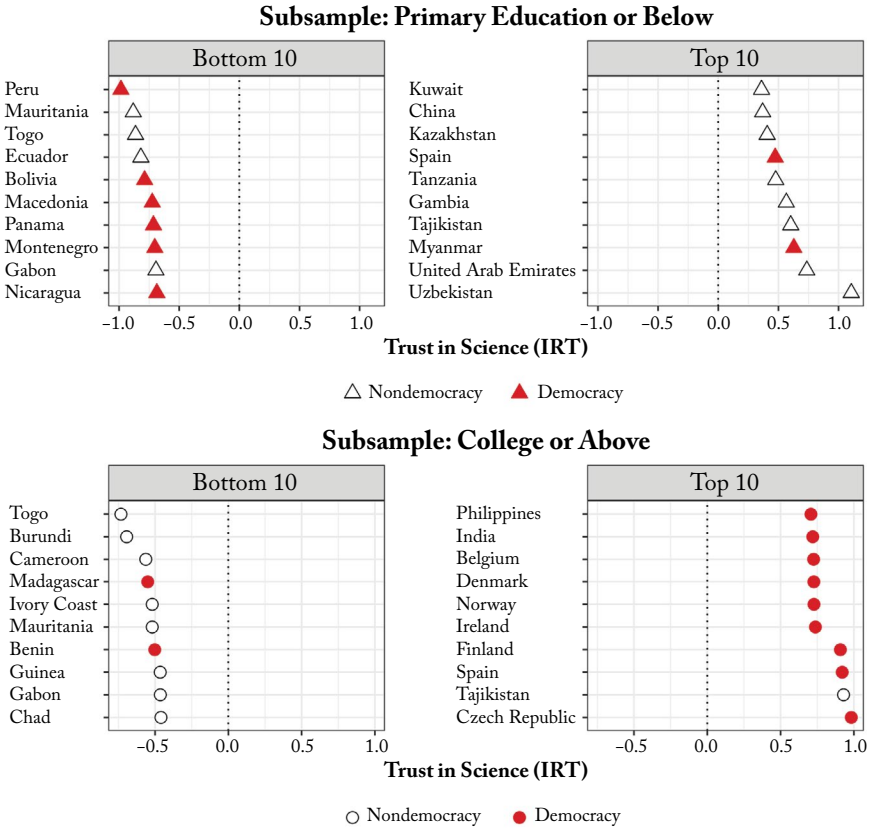

FIGURE 1
AVERAGE TRUST IN SCIENCE BY COUNTRY/REGION AND EDUCATION LEVEL[a]

[a] This figure displays countries/regions with the highest and lowest average trust in science by educational strata. The white (open) symbols denote nondemocracies; red (shaded) symbols denote democracies. In the WGM survey, 31 percent of respondents have a primary-school education or below, and 18 percent have a college education or above. Figures A.5 and A.6 in the supplementary material show full visualizations for all countries/regions.

[59] Boix, Miller, and Rosato 2013. For the Varieties of Democracy Project, see Coppedge et al. 2018.

school or below). Symbols for countries that were democratic in 2018 are colored red; nondemocracies are in white. Beginning with the less-educated (top panel), we see that among the ten countries in which the less-educated trust science the most, only two were democracies in 2018 (Spain and Myanmar). By contrast, six of the ten countries with the lowest mass trust in science were democracies. This pattern of regime distribution is reversed when we turn to the subsample of the college-educated. Here, major Western democracies seem to have a dominant presence among countries in which college graduates have the most trust in science, though this relationship may be confounded by those countries' higher levels of social and economic development. Overall, these visual patterns are broadly consistent with our hypothesis that although a democracy can provide a propitious environment for the well-educated to freely pursue their scientific curiosities, it may have a negative effect on how the less-educated perceive science.

Empirical Strategy

We use two empirical strategies to evaluate the effect of democracy on mass attitudes toward science, each leveraging a different kind of variation for causal identification. First, given the structure of our data, a natural approach is to examine how cross-country variations in democracy correspond with variations in science attitudes, controlling for a number of individual- and country-level covariates. This approach essentially compares the attitudes of individuals of similar socioeconomic background between democracies and nondemocracies that are otherwise comparable in terms of economic, demographic, and technological conditions. The estimation uses a cross-sectional model with the following specification:

$$\begin{aligned} Trust\ in\ Science_{icr} &= \delta^{L} Education_{ic}^{L} \times Democracy_{c} \\ &+ \beta^{L} Education_{ic}^{L} + \gamma Democracy_{c} + \mathbf{X}_{ic}\beta + \eta_{r} + \epsilon_{icr}, \end{aligned} \tag{1}$$

where i, c, r, and L index individual, country, region, and education level, respectively. The dependent variable is an individual's trust in science. The key independent variable, *education* × *democracy*, is an interaction term between a respondent's education level and the regime type of the respondent's country. In all regressions, we include fixed effects (η_r) for eighteen world regions as classified by the United Nations Statistics

Division to account for unobserved, region-specific confounders.[60] $\mathbf{X}$ is a vector of individual-level and country-level controls. At the individual level, we control for a respondent's birth year, gender, employment status, place of residence (urban versus rural), and income level.[61] At the country level, we use GDP per capita and population size to measure general socioeconomic conditions. To capture a country's actual state of scientific and technological development, we further control for (1) the total number of Nobel Prize winners in the sciences and medicine as of 2018 and (2) the number of universities on the QS World University Rankings top 500 list in 2018, both normalized by the size of the country's population (in millions).[62] In more extensive specifications, we include interactions between the individual-level controls and the democracy variable, and interactions between the country-level controls and the education variable, to allow the influence of these covariates to vary by regime type and educational stratum.

This cross-sectional approach, while simple and intuitive, nonetheless requires relatively strong assumptions for causal inference. Specifically, we need to assume that, conditional on the region fixed effects and the control covariates, that no other confounders exist that can affect both regime types and the masses' science attitudes. This assumption may be violated if political institutions and public opinion are jointly shaped by certain country-specific cultural or institutional factors that are difficult to measure directly. To remedy this problem, we adopt a second empirical strategy that leverages cross-cohort variation in *cumulative lifetime exposure to democracy*. The key idea behind this strategy is that an individual's attitude toward science is influenced not only by their country's current regime type, but also by their past exposure to political regimes. An extensive body of research has established that early-life socialization can have a persistent impact on an individual's values and ideological orientations. The formation of attitudes toward institutions, in particular, usually begins as early as the eighth or ninth

[60] The regions include: Eastern/Central/North/Southern/Western Africa, North/Central/South America, East/Southeast/South/Central Asia, Middle East, Eastern/Southern/Western/Northern Europe, and Australia and New Zealand.

[61] The control for birth year is in the form of fixed effects. Since the survey was fielded in one year, birth year is perfectly collinear with age. The income level in WGM is coded as a discrete variable based on national quintiles. We also treat missing values as a separate category.

[62] For data on Nobel Prize winners, see https://www.nobelprize.org/prizes/lists/all-nobel-prizes, accessed April 19, 2023. For the 2018 QS top 500 list, see https://www.topuniversities.com/university-rankings/world-university-rankings/2018, accessed April 19, 2023.

grade (age fourteen or fifteen) and continues through adulthood.[63] Several studies have exploited this cross-cohort variation in regime exposure as a source of identification for estimating the cumulative effects of democratic experience on individuals' political preferences.[64] Building on this line of work, we expect that individuals who grew up during a nondemocratic era may also have different attitudes toward science than those from the same country who spent their entire formative years under democracy.

Specifically, our second model uses a cross-cohort design with the following specification:

$$\begin{aligned} Trust\ in\ Science_{ihc} &= \delta^{L} Education^{L}_{ihc} \times Democratic\ exposure_{hc} \\ &+ \beta^{L} Education^{L}_{ihc} + \gamma Democratic\ exposure_{hc} \\ &+ \eta_{c} + \tau_{hL} + \epsilon_{ihc}, \end{aligned} \quad (2)$$

where i, h, c, and L represent individual, cohort, country, and education level, respectively. The key independent variable is the interaction term between education and democratic exposure, *education × democratic exposure*. Democratic exposure measures the percentage of one's life lived under a democracy (polity score ≥ 6) between age fourteen and the year 2018. This variable has the same value for all individuals belonging to the same birth cohort in a country, but may vary across birth cohorts. For example, the polity score for South Korea surpassed 6 in 1989. As of 2018, the 1960 cohort in South Korea had spent about 69 percent of their lives after age fourteen under democratic rule, whereas the same share for the 1970 cohort was about 89 percent.[65] The existence of such within-country variation enables us to include country fixed effects η_c in the cross-cohort model to account for all time-invariant, country-specific confounders that could not be adequately controlled for in a cross-sectional design. Moreover, to the extent that transition to democracy is a global phenomenon that happens in waves, important generational trends may exist in respondents' exposure to democracy. Those trends can be correlated with other time-varying factors that have differential effects across education levels—factors such as economic globalization, the spread of the Internet, and the diffusion of certain political or religious values. We thus include birth year–education fixed

[63] Merelman 1971; Miller and Sears 1986; Mishler and Rose 2007.

[64] Fuchs-Schündeln and Schündeln 2015; Mattes and Bratton 2007. For using a similar design to study nondemocracies, see Pop-Eleches and Tucker 2017.

[65] For a more systematic illustration, see Figure A.7 in the supplementary material.

effects τ_{bL} in the model to account flexibly for unobserved heterogeneity across different generations and education levels. Overall, this cross-cohort design uses a more restrictive set of variations for identification than the cross-sectional design does, but this reduction in the degrees of freedom comes with the benefit of (considerably) more credible causal inference.

Main Results

We begin by presenting the results from the cross-sectional design. Table 1 reports the estimated marginal effects of democracy on public trust in science separately for the three educational groups.[66] The first column uses the most parsimonious model, which only includes the interaction between a binary indicator of democracy and the education variable. The second column adds region and birth-cohort fixed effects, and the third column further adds individual- and country-level covariates as well as their interactions with democracy and education. In columns 4 to 6, we experiment with three other measures of democracy: the original (continuous) polity score, the electoral democracy index from V-Dem, and a continuous Freedom House status rating from the Freedom House data set.[67] Throughout these models, we see that democracy is consistently associated with lower trust in science among respondents who have primary-school education or less. Focusing on the first three models with dichotomous indicators, the coefficient estimates suggest that the least-educated respondents report on average about 20 percent of a standard deviation lower trust in science in a democracy than they do in a nondemocracy. To put this magnitude into perspective, we note that it is about the same as the average difference in trust between those with only primary-school education and those with a college degree (about 20 percent of a standard deviation). In other words, for the least-educated citizens, the reduced trust in science due to regime-specific factors may only be offset by an extended period of education (about ten years, or secondary school plus college).

As we move to other educational strata, the pattern becomes more mixed and we observe a clear gradation in the effect size. For those

[66] In all the tables, we present coefficients that sum the main effect of democracy and the interaction effect between democracy and education. Following the notation of equation 1, the effect of democracy on individuals with primary education or lower is γ (the benchmark); the effect on those with secondary education is $\gamma + \delta^{\text{Secondary}}$; and the effect on those with college education is $\gamma + \delta^{\text{College}}$.

[67] We compute the rating by running a principal component analysis on Freedom House's three seven-point component indices—political rights, civil liberty, and rule of law—and taking the first component.

Table 1
Results from Cross-Sectional Analysis: Contemporary Level of Democracy[a]

	DV = Trust in Science (IRT)					
	(1) Binary Polity	*(2) Binary Polity*	*(3) Binary Polity*	*(4) Continuous Polity*	*(5) Electoral Democracy (V-Dem)*	*(6) Freedom House Status*
Effect of democracy on:						
Primary school or below	−0.188*	−0.196*	−0.225*	−0.131*	−0.128*	−0.124*
	(0.081)	(0.077)	(0.091)	(0.052)	(0.052)	(0.054)
Secondary school	0.025	−0.042	−0.121+	−0.100*	−0.079+	−0.065
	(0.066)	(0.059)	(0.071)	(0.041)	(0.044)	(0.046)
College or above	0.153*	0.045	−0.033	−0.053	−0.040	−0.010
	(0.065)	(0.067)	(0.083)	(0.040)	(0.048)	(0.049)
Region and birth year FE		✓	✓	✓	✓	✓
Country-level controls × education			✓	✓	✓	✓
Democracy × individual controls			✓	✓	✓	✓
Adjusted R^2	0.02	0.06	0.09	0.09	0.09	0.09
Observations	144762	144159	139028	139028	141510	141510

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$ (two-tailed test)

[a] This table presents the results from cross-sectional regressions of democracy on trust in science. We standardized the coefficient estimates for continuous democracy measures (columns 4–6) to facilitate interpretation. Country-level controls include *log GDP per capita*, *log population*, *log number of Nobel Prize winners per capita (science and medicine)*, and *log number of QS 500 universities per capita*. Individual-level controls include *female*, *employment*, *urban residence*, and *income*. Standard errors clustered at country level are reported in parentheses.

with secondary-school education, for example, the estimated effect of democracy is negative in all columns except the first, but the effect size is about half of that for the least-educated group, and the difference between the two groups is statistically significant at 90 percent or above in all except models 4 and 5.[68] For individuals with a college degree, moreover, democracy appears to have a positive effect in the most parsimonious model (column 1), which is consistent with what we see in the bottom panel of Figure 1. However, the coefficient estimate shrinks

[68] See Table A.3 for a systematic comparison of effect sizes under the cross-sectional design.

considerably as we add region fixed effects and country-level socioeconomic controls to the model. This change seems to suggest that the greater trust in science that we observe for the well-educated in democracies may be partly confounded by special regional characteristics or by the higher levels of economic development in advanced democracies. Overall, this differential effect of democracy is broadly in line with our expectation: the less-educated group's views about science are more susceptible to the influence of external political and institutional factors than are the views of the well-educated.

As discussed in the previous section, one potential limitation of the cross-sectional design is that valid inference requires the (relatively strong) assumption that no unobserved, country-specific confounders exist. This assumption may not hold if countries that have embraced democratic institutions are different from those that have not in unobserved ways that could affect citizens' science-related attitudes. We address this problem using cross-cohort analyses that exploit within-country, cross-cohort variations in cumulative democratic exposure. Table 2 displays the regression results from the cross-cohort design. Consistent with the cross-sectional design, we see that the effect of democratic exposure on trust in science is negative and statistically significant for respondents with primary-school education or lower. Depending on which democracy measure we use to construct the exposure variable, a one standard deviation in life experience under democracy is associated with about 5.7 to 11.7 percent of a standard deviation decline in trust in science among the lowest educational strata. The coefficient estimates from the cross-cohort analyses are quite similar to those obtained from the cross-sectional design (comparing the coefficients in columns 4 to 6 between Table 1 and Table 2), even though the two designs use very different sources of variation for identification. This congruence in results increases our confidence in the validity of our findings. The estimated effects of democracy in science-related trust are also negative and significant for individuals with secondary education in models with more extensive controls (models 3 to 6), but the estimates are noticeably smaller than those from the primary education group.[69] Moreover, in line with the cross-sectional results, the trust-dampening effect of democracy does not extend to individuals with college degrees. The estimated coefficients for the college-educated are either positive or close to zero, and statistically

[69] The estimates for primary-school and secondary-school groups are statistically distinguishable from each other at the 90-percent level or above in all except model 6. For a detailed comparison of cross-cohort estimates between different education levels, see Table A.4 in the supplementary material.

Table 2
Results from Cross-Cohort Analysis: Lifetime Exposure to Democracy[a]

	DV = Trust in Science (IRT)					
	(1) Binary Polity, age 14 to present	*(2) Binary Polity, age 14 to present*	*(3) Binary Polity, age 14 to present*	*(4) Continuous Polity, age 14 to present*	*(5) Electoral democracy (V-Dem), age 14 to present*	*(6) Freedom House Status, age 14 to present*
Effect of lifetime exposure to democracy on:						
Primary school or below	−0.057*	−0.056*	−0.081**	−0.117**	−0.115**	−0.112**
	(0.022)	(0.026)	(0.028)	(0.030)	(0.033)	(0.036)
Secondary school	−0.000	0.004	−0.044+	−0.069**	−0.076*	−0.087**
	(0.019)	(0.023)	(0.024)	(0.026)	(0.031)	(0.029)
College or above	0.080**	0.084**	0.030	0.001	−0.002	−0.019
	(0.026)	(0.029)	(0.030)	(0.030)	(0.036)	(0.035)
Country FE	✓	✓	✓	✓	✓	✓
Birth year–education FE		✓	✓	✓	✓	✓
Country-level controls × education			✓	✓	✓	✓
Democracy × individual controls			✓	✓	✓	✓
Adjusted R^2	0.14	0.15	0.15	0.15	0.16	0.16
Observations	144792	144792	139661	139661	141510	141510

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$ (two-tailed test)

[a] This table presents the results from cross-cohort analysis. The independent variable is cumulative exposure to democracy during a respondent's lifetime (after age fourteen). We standardize the value of this variable to facilitate interpretation. Country-level controls include *log GDP per capita*, *log population*, *log number of Nobel Prize winners per capita (science and medicine)*, and *log number of QS 500 universities per capita*. Individual-level controls include *female*, *employment*, *urban residence*, and *income*. Standard errors clustered at country level are reported in parentheses.

different from both primary-school and secondary-school education groups in all models (at the 95-percent level or above).

Democracy is a relatively well-defined regime type, but nondemocracies encompass a diverse set of regimes with distinct institutional and ideological characteristics. To further unpack the main results, we decompose nondemocracies into four regime subtypes following the classification by Barbara Geddes, Joseph Wright, and Erica Frantz: personalist, single/dominant party, military, and monarchy.[70] These subtypes differ not only in their internal organization but also in how they project political legitimacy to the masses. In particular, researchers have noted that compared to the other types, party- and military-based regimes are relatively more "modern" and "rational" forms of autocracies that tend to justify their rule by their ability to deliver economic, social, and technological modernization.[71] We thus expect that the need to maintain a high level of mass support for science is greater in these regimes than in personalist regimes or monarchies, which rely more on other forms of legitimacy such as individual charisma or tradition.

To test this conjecture, we rerun both the cross-sectional and cross-cohort regressions with additional exposure variables for autocratic regime subtypes and their interactions with education.[72] Figure 2 shows the results. We see that democracies' trust deficit is indeed more pronounced when we compare democracies with single-party regimes and military regimes, but much less pronounced when comparing democracies with personalist regimes or monarchies.[73] Overall, these within-autocracy patterns seem to provide additional evidence for our theoretical argument that public support for science is higher in regimes that are more dependent on science as a source of political legitimacy.

[70] Geddes, Wright, and Frantz 2018.

[71] According to Huntington 1970, 4, single-party regimes are "the principal modern form of authoritarian government," emerging from the convulsive process of social, economic, and political change in the twentieth century. Pye 1962, 74, regards armies as "consistently among the most modernized institutions" in underdeveloped societies.

[72] Our analysis uses the binary (and mutually exclusive) regime subtype indicators provided in the original data set. For the rules of simplifying mixed regime types, see Geddes, Wright, and Frantz 2016, 12.

[73] The effect of military regimes is not as precisely estimated as that for party-based regimes. This may be due to the relatively small sample size for military regimes (only 12 percent of the country-year spells in the full autocratic regime data set) or the presence of significant heterogeneity within them. For the heterogeneous effect of military rule on modernization, see Bienen 1983; Jackman 1976.

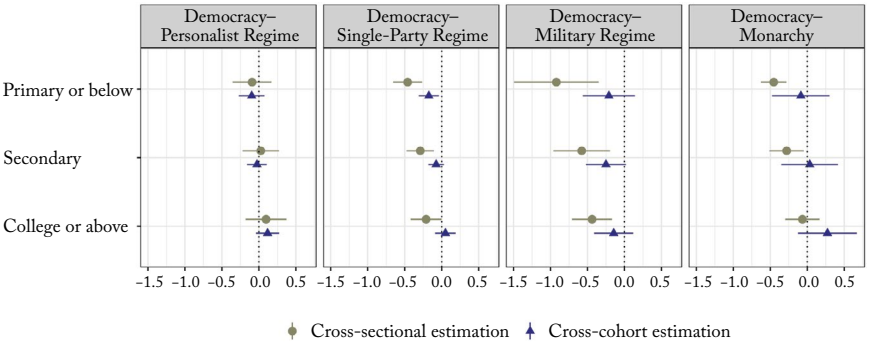

Figure 2
Unpacking Nondemocratic Regime Types[a]

[a] This figure displays the estimated effects of democracy on science attitudes using different nondemocratic regime types as the benchmark. Nondemocratic regime types are personalist regimes, single/dominant party regimes, military regimes, and monarchies (Geddes, Wright, and Frantz 2018). We base the cross-sectional and cross-cohort models on column 4 of tables 1 and 2, respectively. The circles/triangles denote point estimates; horizontal bars represent 95-percent confidence intervals.

Robustness Checks

We conduct a range of additional tests to ensure the robustness of our findings. In the interest of space, we summarize only the key results here, leaving a more detailed discussion to Section B in the supplementary material.

alternative measures

First, we evaluate whether our results are sensitive to the specific ways in which we measure democracy or science-related attitudes. We modify our measure of democracy by using: (1) the average level of democracy in the previous five years (2014–2018), (2) dichotomous democracy indicators from two other major data sets, and (3) cumulative democratic exposure variables that start at different ages.[74] The results obtained from these alternative measures are similar to those in the original analyses.[75] For scientific attitudes, we rerun our regressions on each of the individual questions used in the IRT model. The basic pattern of our finding holds for all except one or two questions.[76]

[74] The dichotomous democracy indicators that we use are from Boix, Miller, and Rosato 2013; and Cheibub, Gandhi, and Vreeland 2010.
[75] See tables A.5 and A.6 in the supplementary material.
[76] See Figure A.8 in the supplementary material.

PLACEBO ANALYSIS

We also conduct a placebo analysis to address the possibility that our democratic exposure variable might be correlated with other unobserved changes that happened around the same time that a country was transitioning to democracy. We compute three placebo *democratic exposure* variables based on the average polity scores during respondents' preschool years (ages zero to six), early school years (ages seven to thirteen), and over the five-year period before their birth, and then substitute those variables for the original exposure variable in the cross-cohort regressions. We find that the estimated coefficients for the placebo variables are much smaller than the original estimates (and sometimes even of the opposite sign), and none attain the conventional level of statistical significance.[77] This finding suggests that the effect we observe with the original democratic exposure variable is highly specific to respondents' experience with democracy during and after their formative years.

ACCOUNTING FOR POLITICAL IDEOLOGY

Studies show that self-identified conservatives in the United States and Europe tend to hold less trust in science.[78] To the extent that low education may be a stronger predictor of conservative ideology in democracies than in nondemocracies, another potential concern with our findings is that education's effect may be confounded by respondents' political ideology. While the WGM does not have a direct measure of ideology, we address this concern by constructing a proxy variable based on the average political ideology reported by those respondents in World Values Surveys (WVS) who are from the same country, in the same birth cohort, and at the same education level as each WGM respondent. We find that controlling for this group-based proxy for ideology does not significantly alter our results.[79]

SUBSAMPLE ANALYSES

We conduct several subsample analyses to check whether a special subset of regions or countries might be driving our findings. We show that our results still hold after excluding observations from (1) developed Western countries, (2) former and current communist countries, and (3) countries

[77] See Table A.8 in the supplementary material.
[78] Gauchat 2012.
[79] See Table A.9 in the supplementary material.

currently governed by political leaders who have manifested strong populist tendencies.[80]

ADDRESSING PREFERENCE FALSIFICATION

An important alternative interpretation of our results is that the regime-based difference in the science-related attitudes of less-educated citizens may simply be due to political desirability bias: if science is used to legitimize nondemocratic rule, then citizens in nondemocracies may be incentivized to overstate their trust in science for fear that doing otherwise might appear as criticizing the regime. We note, however, that the existing evidence on preference falsification suggests that such behavior tends to be more prevalent among the better-educated than the less-educated.[81] To address this concern systematically, we leverage the cross-cohort design to conduct estimation on the subsample of countries that were democracies in 2018. Respondents in this subsample should face little political pressure to falsify their preferences, as they were all living in democracies when the survey took place, yet they might have different depths of experience with democracy depending on their birth year and the year of their country's transition. The results from this subsample still show that longer exposure to democracy is associated with significantly lower trust in science among less-educated citizens, suggesting that this pattern cannot be explained merely by preference falsification.[82]

REPLICATION WITH WORLD VALUES SURVEY

To further assess the generalizability of our findings, we replicate our analysis using data from the WVS. Compared to the WGM, the WVS has fewer science-related questions and is limited in its country coverage. But it has a distinct advantage in that it is longitudinal, meaning that we can observe members of the same country-cohort multiple times over their lifespan, which allows us to disentangle the effect of age from the effect of being born into a specific cohort. Table A.13 in the supplementary material shows that the results from the replication are substantively similar to what we find from the WGM: less-educated citizens hold more negative views of science in democracies than in nondemocracies.

[80] See Table A.10 in the supplementary material.
[81] Jiang and Yang 2016; Kalinin 2016.
[82] See Table A.12 in the supplementary material.

Evaluating Possible Mechanisms

Having shown that a discernible gap exists between democracies and nondemocracies in terms of the less-educated masses' trust in science, we next explore several possible mechanisms that may explain that gap.

Religious Freedom

The most obvious explanation that mass trust in science may be lower in democracies is related to religion. Many observers believe that religion offers a different, and potentially less rational, type of worldview that may conflict with the teachings of science.[83] To the extent that democracies are typically more tolerant of religious activities, the influence of certain religious beliefs could account for the more negative view of science among the less-educated. A potential challenge to this explanation, however, is that not all religious beliefs are antiscience. The early development of science, for instance, was inextricably linked to religious authorities, and sometimes supported by them.[84] Recent studies show that being a believer is compatible with a diverse range of views on science.[85]

To evaluate this religion-based mechanism, we construct several measures for individual- and country-level religiosity. For individual-level religiosity, we create a binary variable, *believe in religion*, from a survey question that asks respondents whether they believe in any religion. For the country level, we create several variables that measure the percentage of believers in major religions in a country's population. We draw the statistics on national population of believers from the World Christian Database.[86] We also use two variables from the V-Dem database, *religious freedom* and *repression of religion*, to measure the extent to which a country tolerates religious activities. We include these variables and their interactions with education in regression models, and examine how their inclusion affects the estimate (δ) for the main interaction term (education × democratic exposure).[87] A sizable reduction in the magnitude of δ would suggest that the included variables play a significant mediating role.

[83] Hofstadter 1963, 47.
[84] Brooke 1991.
[85] O'Brien and Noy 2015.
[86] Johnson and Zurlo 2023.
[87] In this part of the analysis, we simplified the regression models by converting the three-level education variable into a binary indicator, *no college education*.

We show the mediation results for religion variables in Table 3. The first column presents the baseline result (with no mediator) and the second column includes respondents' self-reported religiosity as the mediating variable. We can see that adding individual-level religiosity to the regression barely moves the estimate of δ, suggesting that democracy's negative impact on the less-educated group's trust in science may not work through increasing that group's religiosity. The next two columns evaluate the mediating role of a country's religious population for democracy. Here we see somewhat larger mediation effects, particularly with respect to the percentage of Christians in the population (column 3). But the absolute share of the total effect being mediated is still quite

Table 3
Alternative Explanation: Democracy Is More Tolerant of Religion[a]

	Trust in Science (IRT)			
	(1)	*(2)*	*(3)*	*(4)*
No college × Democratic exposure (after age 14)	−0.169**	−0.169**	−0.155**	−0.167**
	(0.046)	(0.046)	(0.054)	(0.062)
Believe in religion		0.018		
		(0.018)		
No college × % Christians			−0.135*	
			(0.066)	
No college × % Muslims			−0.078	
			(0.073)	
No college × Religious freedom (V-Dem)				0.021
				(0.031)
No college × Repression of religion (V-Dem)				−0.020
				(0.033)
Mediation effect as % of δ		−0.01	8.38	0.93
Country and birth year–education FE	✓	✓	✓	✓
Country-level controls × education	✓	✓	✓	✓
Democracy × individual controls	✓	✓	✓	✓
Adjusted R^2	0.16	0.16	0.16	0.16
Observations	129100	129100	129100	129100

$^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$ (two-tailed test)

[a] This table presents the regression results controlling for indicators of individual- and country-level religiosity. To simplify presentation, we transform the three-level education variable into a binary indicator for whether a respondent has a college degree. The variables that constitute the interaction terms are included in the regressions. The specification is otherwise the same as the cross-cohort models reported in column 4 of Table 1. Standard errors clustered at country level are reported in parentheses.

limited (about 8 percent).[88] Overall, these results suggest that although the spread of religion may play some role in explaining democracies' lower mass trust in science, religion is unlikely to be the most important mechanism.

Science Literacy

Another possible explanation for this gap is that the apparent difference in the masses' attitudes toward science may be rooted in the difference in their actual knowledge about science. The literature on public understanding of science has long argued that greater science literacy contributes to a more positive view of science.[89] Researchers note that in some nondemocracies, especially in communist countries, school curricula strongly emphasize the natural sciences and mathematics.[90] Therefore, earlier and more intense exposure to these subjects may explain why the less-educated in nondemocracies develop more trust in science than their counterparts in democracies.

We evaluate this possibility in several ways. First, we examine questions in the WGM survey that ask respondents to provide a subjective assessment of their knowledge about science. We fail to find any significant difference between the less-educated in democracies and nondemocracies in terms of self-reported scientific knowledge.[91] Second, we collect and analyze additional data on students' performance in science and mathematics from the Programme for International Student Assessment and on the number of medalists in the International Mathematical Olympiad.[92] We find no evidence that precollege students in democracies perform systematically worse in science and mathematics than those in nondemocracies.[93] These findings suggest that lower levels of mass science literacy may not be what drives greater mass skepticism of science in democracies.

State Advocacy

Our preferred explanation for why less-educated citizens in democracies hold stronger distrust of science centers on the capacity and incentive of

[88] In Table A.16, we show that the mediation effect remains limited even when we include interaction terms between individual religiosity and aggregate shares of religious populations.
[89] E.g., Bauer, Durant, and Evans 1994; Withey 1959.
[90] McFadden 1982; Ross 1960.
[91] See Figure A.9 in the supplementary material.
[92] International Mathematical Olympiad 2022; OECD 2022.
[93] See tables A.17 and A.18 in the supplementary material.

the state to effectively advocate for science. We provide several pieces of evidence for this mechanism. First, the argument regarding capacity suggests that reduced trust in political authority is a key factor limiting governments' ability to influence mass opinions about science in democracies. To evaluate this mechanism, we conduct another mediation analysis, using respondents' *trust in government* as the mediating variable. This variable is based on the survey question, "How much do you trust the national government?" Possible answers are (1) "not at all," (2) "not much," (3) "some," and (4) "a lot."[94] We show the results in Table 4. We see that trust in government is strongly and positively correlated with trust in science, and that it mediates about 30 to 37 percent of the interaction effect of education × democracy on trust in science. The magnitude of the mediation effect size, of course, needs to be interpreted with caution, as causal identification in mediation analysis typically requires much stronger assumptions than it does in standard linear models.[95] That said, the general patterns of the estimates are still informative: at least a non-negligible share of the mass distrust of science in democracies appears to be attributable to the relatively low level of trust in government in those countries.

Next, we test whether democratic states indeed have weaker incentives than nondemocratic states to advocate for science because science is not as crucial a resource for legitimation. To accurately assess a state's basis of legitimacy is challenging, but we can draw clues from two unique data sources. The first is a data set of constitutions. As documents of foundational political importance, constitutions provide the ruling political elites a place to articulate what they regard as their key political missions and the basis upon which their government's legitimacy rests.[96] Our data set draws information from the Comparative Constitution

[94] We recognize that the level of expressed political trust may vary systematically across countries. The cross-cohort model that we use for estimation thus incorporates country fixed effects to account for unobserved, country-level heterogeneity in the political, cultural, and institutional environment, and derives estimates exclusively from cross-cohort variation in cumulative exposure to democracy within each country. The WGM survey has refrained from asking the question about trust in government in a number of countries where it might be deemed politically sensitive, such as Cambodia, China, Egypt, Kuwait, Laos, Saudi Arabia, Tajikistan, Turkmenistan, the United Arab Emirates, and Vietnam.

[95] One important assumption here is sequential ignorability, which requires there to be no unobservable confounders affecting both the outcome and the mediator conditional on treatment status and covariates; Imai, Keele, and Yamamoto 2010. In our case, this assumption might be violated if one's trust in government and trust in science are both influenced by a common propensity to trust other individuals or groups—that is, generalized trust. To address this possibility, we conduct additional mediation analyses using several variables that measure respondents' trust in individuals or entities other than the government. We learn that these nonpolitical trust variables mediate a much smaller share of the total interactive effect than does the political trust variable (see Table A.19 in the supplementary material).

[96] Maddox 1982.

TABLE 4
MEDIATION EFFECT OF POLITICAL TRUST[a]

	Trust in Science (IRT)					
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
No college × democratic exposure (measure A)	−0.142**	−0.100*				
	(0.049)	(0.040)				
No college × democratic exposure (measure B)			−0.012**	−0.008*		
			(0.004)	(0.003)		
No college × democratic exposure (measure C)					−0.241*	−0.151+
					(0.104)	(0.085)
Mediator: trust in government		0.328**		0.327**		0.325**
		(0.010)		(0.010)		(0.010)
Mediation effect as % of δ		29.67		30.93		37.43
Country and birth year–education FE	✓	✓	✓	✓	✓	✓
Country-level controls × education	✓	✓	✓	✓	✓	✓
Democracy × individual controls	✓	✓	✓	✓	✓	✓
Adjusted R^2	0.15	0.27	0.15	0.27	0.16	0.27
Observations	120723	120723	120723	120723	122507	122507

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$ (two-tailed test)

[a] This table presents the results of the mediation effect of political trust on the relationship between democracy and trust in science. The first two columns use a democratic exposure variable constructed from the binary polity measure (measure A); columns 3 and 4 switch to the continuous polity score (measure B); and columns 5 and 6 use the electoral democracy index from V-Dem (measure C). The specification is otherwise the same as the cross-cohort models reported in column 4 of Table 1. Standard errors clustered at country level are reported in parentheses.

Project, which provides the full text of the most recent constitutions of more than 150 countries, along with standardized labels to denote sections of constitutions that discuss certain topics, such as motives, national motto, and references to solidarity/art/science/religion.[97] We focus specifically on the "reference to science" label, and examine how its frequency in constitutions varies by regime type.[98]

The second data source that we use is an original data set of national honors and decorations that governments award to domestic and foreign civilians. Apart from being a nonmonetary reward for individuals' extraordinary public services, national honors are also an important means for a state to create public role models and signal to citizens the

[97] Elkins, Ginsburg, and Melton 2009.
[98] For examples of texts with this label, see Section B.1 in the supplementary material.

kinds of work and professions that it values.[99] We construct an extensive list of (nonmilitary) high-level government honors and their recipients using Wikidata, an online database that gathers structured information from Wikipedia.[100] The list contains 541 different orders, decorations, and honorary titles from eighty countries. Between 1970 and 2018, a total of 26,221 individuals received these awards; of that number, 16 percent were scientists or worked in science-related professions.[101] We aggregate the information into a panel data set that records the percentage of national honors given to scientists in each country-year spell.

Table 5 presents the results from our analyses of constitutional texts and national honors.[102] The first column reports the bivariate relationship between a binary indicator of regime type and the frequency of constitutional references to science (per thousand words). The second column controls for a country's economic and population sizes. We also include region and promulgation-year fixed effects to account for unobserved region- and time-specific heterogeneity in constitutional content. Columns 3 and 4 switch to two alternative measures of democracy: a continuous measure from V-Dem and a three-level discrete measure from the Freedom House rating. Results from the four models consistently show that democracies are less likely to refer to science in their constitutions than are nondemocracies. The estimated difference is substantial: the average constitution makes about 0.14 references to science per thousand words; the reduction in frequency under democracy is thus about 56 to 65 percent of the sample mean.

In columns 5 to 8, we repeat the same analysis using the share of national honors to scientists as the dependent variable. Consistent with what we find in constitutions, we see that scientists also make up a smaller

[99] Frey 2007.

[100] Vrandečić and Krötzsch 2014. Wikidata organizes information based on two basic concepts: "item," which represents topics, concepts, or objects; and "property," which represents the connection type between two items. We located all items whose property is "award" and manually went through them to identify awards granted to civilians by national governments (national honors). We then queried Wikidata to obtain information about every individual who was awarded national honors. For more details, see the Concept section at https://en.wikipedia.org/wiki/Wikidata.

[101] We define *scientists* as individuals who conduct research in natural sciences, medicine, or engineering. The coding is based on information from each individual's Wikidata occupation property (property code: P106).

[102] These results provide evidence on how democracy affects indicators of states' willingness to publicly advocate for science. Technically, a full-fledged mediation analysis would also need to show the effect of state advocacy on the public's trust in science. However, the second step is challenging with our current design because (1) some indicators of state advocacy have limited sample coverage, and (2) precisely pinning down each cohort's exposure to advocacy outcomes—that is, constitutions and national honors—is difficult. In Table A.21 in the supplementary material, we provide suggestive evidence that a country's overall public trust in science is positively correlated with the cumulative share of scientist recipients in national honors.

Table 5
Analysis of Constitutional Texts and National Honors[a]

	DV: Constitutional References to Science per 1,000 Words				*DV: Percent of National Honors to Scientists*			
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
Democracy (Polity ≥ 6)	−0.076**	−0.088**			−0.064**	−0.102*		
	(0.026)	(0.027)			(0.023)	(0.043)		
Electoral democracy (V-Dem)			−0.184**				−0.161*	
			(0.057)				(0.069)	
Freedom House status								
(Reference category: Not free)								
Partially free				−0.075*				−0.090
				(0.032)				(0.059)
Free				−0.113**				−0.104*
				(0.036)				(0.051)
Year FE		✓	✓	✓		✓	✓	✓
Region FE		✓	✓	✓				
Country FE						✓	✓	✓
Control variables		✓	✓	✓		✓	✓	✓
Adjusted R^2	0.05	0.40	0.41	0.39	0.01	0.10	0.10	0.09
Observations	154	147	159	159	1304	1234	1283	1075

$^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$ (two-tailed test)

[a] This table presents the relationship between regime type and two indicators of states' propensity to use science for legitimation: (1) the number of references to science in constitutions and (2) the percentage of national honors given to scientists annually. The coding of the constitution is based on the text of the most recent version (as provided in the Comparative Constitution Project). Control variables for columns 1 through 4 are *log GDP per capita* and *log total words in constitution*. Control variables for columns 5 through 8 are *log GDP per capita* and *log total number of state honors granted*. Robust standard errors clustered at country level are reported in parentheses.

percentage of national honor recipients in democracies than in nondemocracies. The difference amounts to about 45 to 70 percent of the sample average, which is similar to the estimated gap in constitutional references. Moreover, as columns 4 and 8 make clear, both "free" and "partially free" systems put less effort into publicly honoring scientists than do systems labeled as "not free." One interpretation of this pattern is that both democracies and hybrid regimes subscribe to similar procedural principles of political legitimacy that rely on holding elections, whereas closed regimes may more often have to resort to the rational authority of science for legitimacy because electoral input is absent.[103] Overall, these results help to confirm a crucial aspect of our argument that democratic states are less keen than nondemocratic states to publicize science as a means of legitimation.

Conclusion

In many democracies, the COVID-19 pandemic has turned out to be a struggle not only between humans and the virus, but also between science and its skeptics. The widespread public distrust of science that we observe under major contemporary democracies is puzzling in light of the public's long-held belief in the close and natural connection between scientific reason and open society. We address this puzzle by arguing that democratic governments may face certain comparative disadvantages in helping science to maintain a positive public image. These disadvantages stem both from greater public suspicion toward political authorities themselves and from states' relatively weaker dependence on science as a source of political legitimacy. Our empirical analysis of a global survey confirms that less-educated citizens in democracies are significantly more skeptical of science than are their counterparts in nondemocracies. We also provide suggestive evidence that certain changes in the basis of legitimacy for the state and in public perceptions of government credibility are more central in explaining this increase in skepticism than other plausible explanations, such as preference falsification, the spread of religion, or differences in scientific literacy.

An important qualification to our findings, of course, is that greater trust in science does not always mean a better understanding of it. This qualification is especially relevant for the less-educated citizens in

[103] Levitsky and Way 2010.

nondemocracies, whose favorable opinions of science are often formed on the basis of information and cues supplied by the state or its associated organizations. The lack of critical reflection means that this group may be misled into believing false narratives or pseudo-scientific theories that purport to follow scientific principles. One example of such blind trust in science is China's Qigong fever in the 1980s, when folk magic and claims of supernatural abilities gained wide popularity among the masses after the government publicly endorsed their "scientific values."[104]

This caveat aside, our finding that mass skepticism of science is greater in more democratic polities is still a cause for grave concern. Even relatively uncritical trust in science could sometimes be useful for coordinating public responses in times of emergency. For instance, many lives might have been saved at the start of the COVID-19 pandemic if more citizens in major democracies had chosen to trust, rather than challenge, public health guidelines about social distancing and mask-wearing. On a more worrying note, the masses' deteriorating trust in science may also threaten the long-term vitality of both science and democracy. A public hostile to science might demand the withdrawal of public funding for basic research, or support government policies that lack scientific merit. The growing influence of antiscience superstition and conspiracy theories, furthermore, could make it difficult to carry out reasoned, fact-based debates about public affairs, which are essential to the health of a democracy.

What can be done to address the masses' trust deficit with science in contemporary democracies? When state advocacy is inadequate, nonstate actors, such as academic institutions, NGOs, and scientists themselves, could become more active in reaching out to the public and more skillful in crafting their messages. But private initiatives, however useful and important, can only get us so far. To the extent that few private institutions can match the state in its scope of authority and the resources that it commands, a fundamental solution would still require the state itself to first regain the public's trust, and then be willing to play a more significant role than it currently does in steering and maintaining public consensus on basic facts and core values. The scientific potential of a liberal society may be better fulfilled when individual-level skepticism can be somewhat balanced out by a strong collective ethos that recognizes and respects the value of science.

[104] Palmer 2007.

Supplementary Material

Supplementary material for this article can be found at http://muse.jhu.edu/resolve/206.

Data

Replication files for this article can be found at https://doi.org/10.7910/DVN/RG0OCG.

References

Allum, Nick, Patrick Sturgis, Dimitra Tabourazi, and Ian Brunton-Smith. 2008. "Science Knowledge and Attitudes across Cultures: A Meta-Analysis." *Public Understanding of Science* 17, no. 1: 35–54. At https://doi.org/10.1177/0963662506070159.

Almond, Gabriel A., and G. Bingham Powell, Jr. 1966. *Comparative Politics: A Developmental Approach*. Boston, Mass.: Little, Brown & Co.

Almond, Gabriel A., and Sidney Verba. [1963] 2016. *The Civic Culture: Political Attitudes and Democracy in Five Nations*. Princeton, N.J.: Princeton University Press.

Baker, Joseph O., Samuel L. Perry, and Andrew L. Whitehead. 2020. "Crusading for Moral Authority: Christian Nationalism and Opposition to Science." *Sociological Forum* 35, no. 3: 587–607. At https://doi.org/10.1111/socf.12619.

Bauer, Martin, John Durant, and Geoffrey Evans. 1994. "European Public Perceptions of Science." *International Journal of Public Opinion Research* 6, no. 2: 163–86. At https://doi.org/10.1093/ijpor/6.2.163.

Baum, Richard, ed. [1980] 2020. *China's Four Modernizations: The New Technological Revolution.* New York, N.Y.: Routledge.

Beck, Ulrich. 1992. *Risk Society: Towards a New Modernity*. Trans. Mark Ritter. Thousand Oaks, Calif.: SAGE Publications.

Bicchieri, Cristina, Enrique Fatas, Abraham Aldama, Andrés Casas, Ishwari Deshpande, Mariagiulia Lauro, Cristina Parilli, Max Spohn, Paula Pereira, and Ruiling Wen. 2021. "In Science We (Should) Trust: Expectations and Compliance across Nine Countries during the COVID-19 Pandemic." *PLOS ONE* 16, no. 6: e0252892. At https://doi.org/10.1371/journal.pone.0252892.

Bienen, Henry. 1983. "Armed Forces and National Modernization: Continuing the Debate." *Comparative Politics* 16, no. 1: 1–16. At https://doi.org/10.2307/421592.

Boix, Carles, Michael Miller, and Sebastian Rosato. 2013. "A Complete Data Set of Political Regimes, 1800–2007." *Comparative Political Studies* 46, no. 12: 1523–54. At https://doi.org/10.1177/0010414012463905.

Brooke, John Hedley. 1991. *Science and Religion: Some Historical Perspectives*. New York, N.Y.: Cambridge University Press.

Burnham, John C. 1987. *How Superstition Won and Science Lost: Popularizing Science and Health in the United States*. New Brunswick, N.J.: Rutgers University Press.

Castelfranchi, Yurij. 2018. "Decades of Change—Brazilian Perceptions of Science 1987–2015." In Martin W. Bauer, Petra Pansegrau, and Rajesh Shukla, eds.,

The Cultural Authority of Science: Comparing across Europe, Asia, Africa and the Americas. New York, N.Y.: Routledge.

Cepaluni, Gabriel, Michael T. Dorsch, and Réka Branyiczki. 2022. "Political Regimes and Deaths in the Early Stages of the COVID-19 Pandemic." *Journal of Public Finance and Public Choice* 37, no. 1: 27–53. At https://doi.org/10.1332/251569121X16268740317724.

Cheibub, José Antonio, Jennifer Gandhi, and James Raymond Vreeland. 2010. "Democracy and Dictatorship Revisited." *Public Choice* 143: 67–101. At https://doi.org/10.1007/s11127-009-9491-2.

Cheibub, José Antonio, Ji Yeon Jean Hong, and Adam Przeworski. 2020. "Rights and Deaths: Government Reactions to the Pandemic." At https://doi.org/10.2139/ssrn.3645410.

Cologna, Viktoria, and Michael Siegrist. 2020. "The Role of Trust for Climate Change Mitigation and Adaptation Behaviour: A Meta-Analysis." *Journal of Environmental Psychology* 69: 101428. At https://doi.org/10.1016/j.jenvp.2020.101428.

Coppedge, Michael, John Gerring, Carl Henrik Knutsen, Staffan I. Lindberg, and Jan Teorell. 2018. *V-Dem Dataset v8*. Gothenburg, Sweden. At https://www.v-dem.net/data/dataset-archive/country-year-v-dem-core-v8/, accessed March 20, 2023.

Crozier, Michel J., Samuel P. Huntington, and Joji Watanuki. 1975. *The Crisis of Democracy: Report on the Governability of Democracies to the Trilateral Commission*. New York, N.Y.: New York University Press.

Dahl, Robert A. 1956. *A Preface to Democratic Theory*. Chicago, Ill. University of Chicago Press.

Dalton, Russell J. 2004. *Democratic Challenges, Democratic Choices: The Erosion of Political Support in Advanced Industrial Democracies.* New York, N.Y.: Oxford University Press.

Dalton, Russell J., and Doh Chull Shin. 2014. "Reassessing the *Civic Culture* Model." In Russell J. Dalton and Christian Welzel, eds., *The Civic Culture Transformed: From Allegiant to Assertive Citizens*. New York, N.Y.: Cambridge University Press.

Dalton, Russell J., and Christian Welzel, eds. 2014. *The Civic Culture Transformed: From Allegiant to Assertive Citizens.* New York, N.Y.: Cambridge University Press.

Darden, Keith, and Anna Grzymala-Busse. 2006. "The Great Divide: Literacy, Nationalism, and the Communist Collapse." *World Politics* 59, no. 1 (October): 83–115. At https://doi.org/10.1353/wp.2007.0015.

Deutsch, Franziska, and Christian Welzel. 2016. "The Diffusion of Values among Democracies and Autocracies." *Global Policy* 7, no. 4: 563–70. At https://doi.org/10.1111/1758-5899.12388.

Dias, Rafael, and Milena Serafim. 2011. "Science and Technology Policy in Brazil: An Analysis of the Recent Period." Paper presented at the 2011 Conference on Science and Innovation Policy, Atlanta. At https://doi.org/10.1109/ACSIP.2011.6064468.

Dorsch, Michael T., and Paul Maarek. 2019. "Democratization and the Conditional Dynamics of Income Distribution." *American Political Science Review* 113, no. 2: 385–404. At https://doi.org/10.1017/S0003055418000825.

Elkins, Zachary, Tom Ginsburg, and James Melton. 2009. *The Endurance of National Constitutions*. New York, N.Y.: Cambridge University Press.
Eubanks, Virginia. 2018. *Automating Inequality: How High-Tech Tools Profile, Police, and Punish the Poor*. New York, N.Y.: St. Martin's Press.
Evans, Geoffrey, and John Durant. 1995. "The Relationship between Knowledge and Attitudes in the Public Understanding of Science in Britain." *Public Understanding of Science* 4, no. 1: 57–74. At https://doi.org/10.1088/0963-6625/4/1/004.
Evans, John H., and Michael S. Evans. 2008. "Religion and Science: Beyond the Epistemological Conflict Narrative." *Annual Review of Sociology* 34: 87–105. At https://doi.org/10.1146/annurev.soc.34.040507.134702.
Eyal, Gil. 2019. *The Crisis of Expertise*. Medford, Mass.: Polity Press.
Ezrahi, Yaron. 1990. *The Descent of Icarus: Science and the Transformation of Contemporary Democracy*. Cambridge, Mass.: Harvard University Press.
Ezrahi, Yaron. 2004. "Science and the Political Imagination in Contemporary Democracies." In Sheila Jasanoff, ed., *States of Knowledge: The Co-Production of Science and the Social Order*. New York, N.Y.: Routledge: 254–73.
Frey, Bruno S. 2007. "Awards As Compensation." *European Management Review* 4, no. 1: 6–14. At https://doi.org/10.1057/palgrave.emr.1500068.
Fuchs-Schündeln, Nicola, and Matthias Schündeln. 2015. "On the Endogeneity of Political Preferences: Evidence from Individual Experience with Democracy." *Science* 347, no. 6226: 1145–48. At https://doi.org/10.1126/science.aaa0880.
Fukuyama, Francis. 1992. *The End of the History and the Last Man*. New York, N.Y.: Free Press.
Galison, Peter, and Bruce Hevly, eds. 1992. *Big Science: The Growth of Large-Scale Research*. Stanford, Calif.: Stanford University Press.
Gauchat, Gordon. 2012. "Politicization of Science in the Public Sphere: A Study of Public Trust in the United States, 1974 to 2010." *American Sociological Review* 77, no. 2: 167–87. At https://doi.org/10.1177/0003122412438225.
Gaukroger, Stephen. 2006. *The Emergence of a Scientific Culture: Science and the Shaping of Modernity 1210–1685*. New York, N.Y.: Oxford University Press.
Geddes, Barbara, Joseph Wright, and Erica Frantz. 2016. *Autocratic Regimes Code Book,* Version 1.2. At https://bpb-us-e1.wpmucdn.com/sites.psu.edu/dist/0/12570/files/2016/05/GWF-Codebook.pdf, accessed April 20, 2023.
Geddes, Barbara, Joseph Wright, and Erica Frantz. 2018. *How Dictatorships Work: Power, Personalization, and Collapse*. New York, N.Y.: Cambridge University Press.
Giddens, Anthony. 1991. *Modernity and Self-Identity: Self and Society in the Late Modern Age*. Stanford, Calif.: Stanford University Press.
Gimpelson, Vladimir, and Daniel Treisman. 2018. "Misperceiving Inequality." *Economics & Politics* 30, no. 1: 27–54. At https://doi.org/10.1111/ecpo.12103.
Gleditsch, Kristian Skrede, and Michael D. Ward. 2008. "Diffusion and the Spread of Democratic Institutions." In Beth A. Simmons, Frank Dobbin, and Geoffrey Garrett, eds., *The Global Diffusion of Markets and Democracy*. New York, N.Y.: Cambridge University Press: 261–302.
Guston, David. 1993. "The Essential Tension in Science and Democracy." *Social Epistemology* 7, no. 1: 3–23. At https://doi.org/10.1080/02691729308578676.
Hilgartner, Stephen, J. Benjamin Hurlbut, and Sheila Jasanoff. 2021. "Was 'Science' on the Ballot? Labeling Dissent as 'Anti-Science' is Bad Social Science

and Bad Politics." *Science* 371, no. 6532: 893–94. At https://doi.org/10.1126/science.abf8762.
Hofstadter, Richard. 1963. *Anti-Intellectualism in American Life*. New York, N.Y.: Knopf Books.
Holton, Gerald. 1993. *Science and Anti-Science*. Cambridge, Mass: Harvard University Press.
Huntington, Samuel P. 1970. "Social and Institutional Dynamics of One-Party Systems." In Samuel P. Huntington and Clement H. Moore, eds., *Authoritarian Politics in Modern Society: The Dynamics of Established One-Party Systems*. New York, N.Y.: Basic Books.
Huntington, Samuel P., and Clement H. Moore, eds. 1970. *Authoritarian Politics in Modern Society: The Dynamics of Established One-Party Systems*. New York, N.Y.: Basic Books.
Imai, Kosuke, Luke Keele, and Teppei Yamamoto. 2010. "Identification, Inference and Sensitivity Analysis for Causal Mediation Effects." *Statistical Science* 25, no. 1: 51–71. At https://doi.org/10.1214/10-STS321.
Inglehart, Ronald. 1977. *The Silent Revolution: Changing Values and Political Styles among Western Publics*. Princeton, N.J.: Princeton University Press.
Inglehart, Ronald, and Christian Welzel. 2005. *Modernization, Cultural Change, and Democracy: The Human Development Sequence*. New York, N.Y.: Cambridge University Press.
International Mathematical Olympiad. 2022. "International Mathematical Olympiad Results." At https://www.imo-official.org/results.aspx, accessed April 20, 2023.
Irwin, Alan, and Brian Wynne, eds. 1996. *Misunderstanding Science? The Public Reconstruction of Science and Technology*. New York, N.Y.: Cambridge University Press.
Israel, Jonathan. 2009. *A Revolution of the Mind: Radical Enlightenment and the Intellectual Origins of Modern Democracy*. Princeton, N.J.: Princeton University Press.
Jackman, Robert W. 1976. "Politicians in Uniform: Military Governments and Social Change in the Third World." *American Political Science Review* 70, no. 4: 1078–97. At https://doi.org/10.2307/1959375.
Jiang, Junyan, and Kinman Wan. 2023. "Replication Data for: Democracy and Mass Skepticism of Science." Harvard Dataverse, V1. At https://doi.org/10.7910/DVN/RG0OCG.
Jiang, Junyan, and Dali L. Yang. 2016. "Lying or Believing? Measuring Preference Falsification from a Political Purge in China." *Comparative Political Studies* 49, no. 5: 600–34. At https://doi.org/10.1177/0010414015626450.
Johnson, Todd M., and Gina A. Zurlo, eds. 2023. "World Christian Database." Leiden, Netherlands, and Boston, Mass.: Brill. At https://www.worldchristiandatabase.org, accessed December 24, 2020.
Johnston, Robert D. 2006. *The Radical Middle Class: Populist Democracy and the Question of Capitalism in Progressive Era Portland, Oregon*. Princeton, N.J.: Princeton University Press.
Kalinin, Kirill. 2016. "The Social Desirability Bias in Autocrat's Electoral Ratings: Evidence from the 2012 Russian Presidential Elections." *Journal of Elections,*

Public Opinion and Parties 26, no. 2: 191–211. At https://doi.org/10.1080/17457289.2016.1150284.
Kamens, David H., and Aaron Benavot. 1991. "Elite Knowledge for the Masses: The Origins and Spread of Mathematics and Science Education in National Curricula." *American Journal of Education* 99, no. 2: 137–80. At https://doi.org/10.1086/443977.
Kili, Suna. 1980. "Kemalism in Contemporary Turkey." *International Political Science Review* 1, no. 3: 381–404. At https://doi.org/10.1177/019251218000100308.
Kitcher, Philip. 2001. *Science, Truth, and Democracy*. New York, N.Y.: Oxford University Press.
Layton, David. 1973. *Science for the People: The Origins of the School Science Curriculum in England*. London, UK: Allen & Unwin.
Levitsky, Steven, and Lucan A. Way. 2010. *Competitive Authoritarianism: Hybrid Regimes after the Cold War*. New York, N.Y.: Cambridge University Press.
Lipscy, Phillip Y. 2018. "Democracy and Financial Crisis." *International Organization* 72, no. 4: 937–68. At https://doi.org/10.1017/S0020818318000279.
Macleod, Roy. 1997. "Science and Democracy: Historical Reflections on Present Discontents." *Minerva* 35: 369–84. At https://doi.org/10.1023/A:1004362816974.
Maddox, Graham. 1982. "A Note on the Meaning of 'Constitution.'" *American Political Science Review* 76, no. 4: 805–09. At https://doi.org/10.2307/1962972.
Marshall, Monty G., Ted Robert Gurr, and Keith Jaggers. 2018. *Polity IV Project: Political Regime Characteristics and Transitions, 1800–2017*. Vienna, Va.: Center for Systemic Peace.
Mattes, Robert, and Michael Bratton. 2007. "Learning about Democracy in Africa: Awareness, Performance, and Experience." *American Journal of Political Science* 51, no. 1: 192–217. At https://doi.org/10.1111/j.1540-5907.2007.00245.x.
Maurer, Eva, Julia Richers, Monica Rüthers, and Carmen Scheide, eds. 2011. *Soviet Space Culture: Cosmic Enthusiasm in Socialist Societies*. New York, N.Y.: Palgrave Macmillan.
Mauzy, Diane K., and R. S. Milne. 2002. *Singapore Politics under the People's Action Party*. New York, N.Y.: Routledge.
McFadden, Charles P. 1982. "Science Education in the USSR." *Science Education* 66, no. 1: 123–37. At https://doi.org/10.1002/sce.3730660114.
Melton, James Van Horn. [1988] 2002. *Absolutism and the Eighteenth-Century Origins of Compulsory Schooling in Prussia and Austria*. New York, N.Y.: Cambridge University Press.
Merelman, Richard M. 1971. "The Development of Policy Thinking in Adolescence." *American Political Science Review* 65, no. 4: 1033–47. At https://doi.org/10.2307/1953496.
Merton, Robert K. 1973. *The Sociology of Science: Theoretical and Empirical Investigations.* Chicago, Ill.: University of Chicago Press.
Miller, Jon D. 1983. *The American People and Science Policy: The Role of Public Attitudes in the Policy Process*. New York, N.Y.: Pergamon Press.
Miller, Steven D., and David O. Sears. 1986. "Stability and Change in Social Tolerance: A Test of the Persistence Hypothesis." *American Journal of Political Science* 30, no. 1: 214–36. At https://doi.org/10.2307/2111302.

Mishler, William, and Richard Rose. 2007. "Generation, Age, and Time: The Dynamics of Political Learning during Russia's Transformation." *American Journal of Political Science* 51, no. 4: 822–34. At https://doi.org/10.1111/j.1540-5907.2007.00283.x.

Moore, Andrew S., ed. 2021. *Evangelicals and Presidential Politics: From Jimmy Carter to Donald Trump.* Baton Rouge, La.: Louisiana State University Press.

Nevitte, Neil. 2014. "The Decline of Deference Revisited: Evidence after Twenty-Five Years." In Russell J. Dalton and Christian Welzel, eds., *The Civic Culture Transformed: From Allegiant to Assertive Citizens*. New York, N.Y.: Cambridge University Press: 35–58.

Nichols, Tom. 2017. *The Death of Expertise: The Campaign against Established Knowledge and Why It Matter*s. New York, N.Y.: Oxford University Press Inc.

Norris, Pippa, ed. 1999. *Critical Citizens: Global Support for Democratic Government*. New York, N.Y.: Oxford University Press.

Norris, Pippa. 2011. *Democratic Deficit: Critical Citizens Revisited*. New York, N.Y.: Cambridge University Press.

North, Douglass C., and Barry R. Weingast. 1989. "Constitutions and Commitment: The Evolution of Institutions Governing Public Choice in Seventeenth-Century England." *Journal of Economic History* 49, no. 4: 803–32. At https://doi.org/10.1017/S0022050700009451.

Nye, Joseph S. Jr., Philip D. Zelikow, and David C. King, eds. 1997. *Why People Don't Trust Government*. Cambridge, Mass.: Harvard University Press.

O'Brien, Timothy L., and Shiri Noy. 2015. "Traditional, Modern, and Post-Secular Perspectives on Science and Religion in the United States." *American Sociological Review* 80, no. 1: 92–115. At https://doi.org/10.1177/0003122414558919.

Oliver, J. Eric, and Thomas J. Wood. 2014. "Conspiracy Theories and the Paranoid Style(s) of Mass Opinion." *American Journal of Political Science* 58, no. 4: 952–66. At https://doi.org/10.1111/ajps.12084.

Olson, Mancur. 1993. "Dictatorship, Democracy, and Development." *American Political Science Review* 87, no. 3: 567–76. At https://doi.org/10.2307/2938736.

Organisation for Economic Co-operation and Development (OECD). 2022. *Programme for International Student Assessment, Data*. Paris, France: OECD. At https://www.oecd.org/pisa/data/, accessed April 20, 2023.

Otto, Shawn. 2016. *The War on Science: Who's Waging It, Why It Matters, What We Can Do About It*. Minneapolis, Minn.: Milkweed Editions.

Paglayan, Agustina S. 2021. "The Non-Democratic Roots of Mass Education: Evidence from 200 Years." *American Political Science Review* 115, no. 1: 179–98. At https://doi.org/10.1017/S0003055420000647.

Paglayan, Agustina S. 2022. "Education or Indoctrination? The Violent Origins of Public School Systems in an Era of State-Building." *American Political Science Review* 116, no. 4: 1242–57. At https://doi.org/10.1017/S0003055422000247.

Palamenghi, Lorenzo, Serena Barello, Stefania Boccia, and Guendalina Graffigna. 2020. "Mistrust in Biomedical Research and Vaccine Hesitancy: The Forefront Challenge in the Battle against COVID-19 in Italy." *European Journal of Epidemiology* 35, no. 8: 785–88. At https://doi.org/10.1007/s10654-020-00675-8.

Palmer, David A. 2007. *Qigong Fever: Body, Science, and Utopia in China*. New York, N.Y.: Columbia University Press.

Patterson, Thomas E. 1994. *Out of Order: An Incisive and Boldly Original Critique of the News Media's Domination of America's Political Process*. New York, N.Y.: Vintage Books.
Piketty, Thomas. 2020. *Capital and Ideology*. Trans. Arthur Goldhammer. Cambridge, Mass.: Harvard University Press.
Polanyi, Michael. 1962. "The Republic of Science: Its Political and Economic Theory." *Minerva* 1: 54–73. At https://doi.org/10.1007/BF01101453.
Pop-Eleches, Grigore, and Joshua A. Tucker. 2017. *Communism's Shadow: Historical Legacies and Contemporary Political Attitudes*. Princeton, N.J.: Princeton University Press.
Popper, Karl. [1945] 1966. *The Open Society and Its Enemies*. Vol. 1 & 2. London, UK: Routledge & K. Paul.
Price, John. 2014. *Everyday Heroism: Victorian Constructions of the Heroic Civilian*. London, UK: Bloomsbury Academic.
Pye, Lucian W. 1962. "Armies in the Process of Political Modernization." In John J. Johnson, ed., *The Role of the Military in Underdeveloped Countries*. Princeton, N.J.: Princeton University Press.
Raza, Gauhar. 2018. "Scientific Temper and Cultural Authority of Science in India." In Martin W. Bauer, Petra Pansegrau, and Rajesh Shukla, eds., *The Cultural Authority of Science: Comparing across Europe, Asia, Africa and the Americas*. New York, N.Y.: Routledge.
Ross, Leslie W. 1960. "Some Aspects of Soviet Education." *Journal of Teacher Education* 11, no. 4: 539–52. At https://doi.org/10.1177/002248716001100420.
Ross, Michael. 2006. "Is Democracy Good for the Poor?" *American Journal of Political Science* 50, no. 4: 860–74. At https://doi.org/10.1111/j.1540-5907.2006.00220.x.
Schultz, Kenneth A., and Barry R. Weingast. 2003. "The Democratic Advantage: Institutional Foundations of Financial Power in International Competition." *International Organization* 57, no. 1: 3–42. At https://doi.org/10.1017/S0020818303571065.
Schwarcz, Vera. 1986. *The Chinese Enlightenment: Intellectuals and the Legacy of the May Fourth Movement of 1919*. Berkeley, Calif.: University of California Press.
Shapin, Steven. 2007. "Science and the Modern World." In Edward J. Hackett, Olga Amsterdamska, Michael E. Lynch, and Judy Wajcman, eds., *The Handbook of Science and Technology Studies*, 3rd ed. Cambridge, Mass.: MIT Press.
Silva, Patricio. 2001. "Forging Military-Technocratic Alliances: The Ibáñez and Pinochet Regimes in Chile." In Patricio Silvo, ed., *The Soldier and the State in South America: Essays in Civil-Military Relations.* New York, N.Y.: Palgrave Macmillan.
Sturgis, Patrick, and Nick Allum. 2004. "Science in Society: Re-Evaluating the Deficit Model of Public Attitudes." *Public Understanding of Science* 13, no. 1: 55–74. At https://doi.org/10.1177/0963662504042690.
Sturgis, Patrick, Ian Brunton-Smith, and Jonathan Jackson. 2021. "Trust in Science, Social Consensus and Vaccine Confidence." *Nature Human Behaviour* 5: 1528–534. At https://doi.org/10.1038/s41562-021-01115-7.
Taber, Keith S., and Ben Akpan, eds. 2017. *Science Education: An International Course Companion*. Rotterdam, Netherlands: Sense Publisher.

Taverne, Dick. 2006. *The March of Unreason: Science, Democracy, and the New Fundamentalism*. New York, N.Y.: Oxford University Press.
Trench, Brian, and Massimiano Bucchi. 2021. "Global Spread of Science Communication: Institutions and Practices across Continents." In Massimiano Bucchi and Brian Trench, eds., *Routledge Handbook of Public Communication of Science and Technology*, 3rd ed. New York, N.Y.: Routledge.
van der Meer, Tom W. G. 2017. "Political Trust and the 'Crisis of Democracy.'" In *Oxford Research Encyclopedias*. At https://doi.org/10.1093/acrefore/9780190228637.013.77.
Vrandečić, Denny, and Markus Krötzsch. 2014. "Wikidata: A Free Collaborative Knowledgebase." *Communications of the ACM* 57, no. 10: 78–85. At https://doi.org/10.1145/2629489.
Wei, Chunjuan Nancy, and Darryl E. Brock, eds. 2012. *Mr. Science and Chairman Mao's Cultural Revolution: Science and Technology in Modern China.* Lanham, Md.: Lexington Books.
Wellcome Global Monitor. 2018. "Wellcome Global Monitor: How Does the World Feel about Science and Health?" London, UK: Wellcome Global Monitor. At https://wellcome.org/sites/default/files/wellcome-global-monitor-2018.pdf, accessed March 23, 2023.
Welzel, Christian, and Russell J. Dalton. 2014. "From Allegiant to Assertive Citizens." In Russell J. Dalton and Christian Welzel, eds., *The Civic Culture Transformed: From Allegiant to Assertive Citizens*. New York, N.Y.: Cambridge University Press: 282–306.
Welzel, Christian, and Russell Dalton. 2016. "Cultural Change in Asia and Beyond: From Allegiant to Assertive Citizens." *Asian Journal of Comparative Politics* 2, no. 2: 112–32. At https://doi.org/10.1177/2057891116675978.
Withey, Stephen B. 1959. "Public Opinion about Science and Scientists." *Public Opinion Quarterly* 23, no. 3: 382–88. At https://doi.org/10.1086/266890.
Zaller, John R. 1992. *The Nature and Origins of Mass Opinion*. New York, N.Y.: Cambridge University Press.

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Acknowledgments

For their valuable feedback, we thank Chris Anderson, Yongshun Cai, Xi Chen, Jean Cohen, Gil Eyal, John Huber, Lianjiang Li, Zhaotian Luo, Xiao Ma, Tianguang Meng, Ka-U Ng, Emerson Niou, Peng Peng, Steve Utych, Tianyang Xi,

Wuyue You, Yu Zeng, Vivian Zhan, Kaiping Zhang, and participants at the Computational Social Science Workshop at Tsinghua University. Weiye Deng, Xinting Du, Dancheng Li, Yucheng Qiu, Xiaoqi Sun, Meng Tang, Lixian Wang, Hanying Wei, Haojun Xie, and Sile Yan provided excellent research assistance.

Key Words

science, democracy, public opinion, anti-intellectualism, institution, legitimacy, constitution