

WHEN EXPERTS TALK, DOES ANYONE LISTEN?
ESSAYS ON THE LIMITS OF EXPERT INFLUENCE ON PUBLIC OPINION

by

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Abstract

There are large gaps in opinion between policy experts and the public on a wide variety of issues. Scholarly explanations for these observations largely focus on the tendency of citizens to selectively process information from experts in line with their ideology and values. These accounts are likely incomplete. This dissertation is comprised of three papers that examine other important limitations of expert influence on public opinion on topics featuring widespread expert agreement.

The first paper looks at the degree to which information on expert agreement is available in the information environment of the average citizen – the news media – and whether or not such information is clouded by media bias towards *balance* and *conflict*. An automated and manual content analysis was conducted on over 280,000 news stories on 10 issues featuring widespread expert agreement. The results show that discussion of expert agreement is extremely rare in news content. On occasions when such discussion is featured, it is typically found in the midst of claims and counter claims by polarizing political actors.

The second paper seeks to explain rising climate skepticism in the American public and related polarization of Democratic and Republican Party supporters on climate science. An automated content analysis was conducted on over 26,000 news stories to measure over time dynamics in polarizing information, such as party elite and ideological identity cues, messages from organized climate skeptics, and economic cost frames. Results show that the prevalence of party elite cues is strongly associated with aggregate levels of climate skepticism and polarization even after controlling for other possible factors.

The third paper explores the role of anti-intellectualism as a predisposition that governs persuasion by expert agreement and the possibility that anti-elite rhetoric may prime this predisposition in information processing. Findings from the General Social Survey and an original survey of over 3,600 American citizens show that anti-intellectualism is strongly associated with opposition to a variety of positions of expert agreement. Results of an embedded survey experiment demonstrate that anti-intellectuals are less persuaded by messages of expert agreement and that this is particularly true when primed with anti-elite rhetoric.

Lay Summary

This dissertation is composed of three papers that illustrate important limitations of policy expert influence on public opinion. The first paper evaluates media content to examine how often expert agreement is discussed in coverage of relevant topics and whether or not such information is clearly communicated. The results show that journalists rarely discuss expert agreement when appropriate and when they do it is typically in a polarizing political context. The second paper seeks to explain rising skepticism of climate science among Americans and political polarization on this topic. Findings suggest that a proliferation of political messages in news coverage may have played an important part in this process. The third paper explores anti-intellectualism's role in shaping citizen acceptance of expert agreement. Results indicate that this set of beliefs is strongly associated with opposition to expert positions, while anti-intellectuals are less persuaded by expert agreement messages in an experimental setting.

Preface

Paper I of this dissertation is completely comprised of my own research. I constructed the literature review, formulated the research questions, and collected and analyzed the data. A previous version of this paper has been presented at the annual meeting of the Canadian Political Science Association in 2018.

Paper II was co-authored with Dr. Dominik Stecula, a former Ph.D. student in the department of political science at UBC and now a postdoctoral fellow at the Annenberg School of Public Policy at the University of Pennsylvania. Dominik and I contributed equally to this paper. We both contributed to the development of the relevant research questions and downloaded media content for analyses. Dominik gathered the public opinion polls and constructed the aggregate public opinion measures. He also generated the graphics for this paper. I was responsible for the time series modelling. We both contributed equally to the writing of the paper. Dominik wrote the bulk of the literature review, introduction, and discussion, while I penned most of the data and methods section, and results.

A version of this work has been presented at the annual meeting of the American Political Science Association in 2015 and 2016, the annual meeting of the Pacific Northwest Political Science Association in 2016, and the Comparative-Canadian Workshop at UBC in the fall of 2015. Some of the data and materials from this paper has been recently featured in the peer-reviewed academic journal, *Science Communication*. The citation is:

Merkley, E., & Stecula, D. A. (2018). Party elites or manufactured doubt? The informational context of climate change polarization. *Science Communication*, 40(2), 258-274.

Paper III was constructed entirely by myself. I compiled the literature review, formulated the research questions, and collected and analyzed the data. The data collection for this paper was funded out of pocket by myself and Miriam Matejova – a fellow graduate student at UBC who had survey questions oriented towards her own dissertation. The survey and the experiment were approved by the UBC Behavioural Research Ethics Board (application # H18-01595). A version of this paper has been presented in 2019 at both the Annual Meeting of the Western Political Science Association and the Comparative-Canadian Workshop at UBC.

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In memory of my nono, Roman Pangos (1936-2019)

Vedno te bom imel rad

Introduction

On many central issues related to important policy areas there is widespread agreement among those who have relevant and specialized knowledge acquired through advanced levels of education and experience, such as scientists, medical professionals, economists, and policy experts. We know that the human production of greenhouse gases is causing our climate to warm and that vaccines are safe and have dramatically reduced the prevalence of harmful childhood diseases. Economists, both liberal and conservative, have drawn attention to the destructive impact of rent control and trade protectionism. They also agree on a wide range of other policy topics, particularly involving the freer movement of goods and people, and the ineffectiveness of government imposed limits on competition and subsidies for corporations (Caplan, 2002; Fuller & Guide-Stevenson, 2003, 2014; Gordon & Dahl, 2013; Whaples, 2009). These areas are often labeled those of *expert consensus* and will be the primary focus of this thesis.¹

Substantial research has shown that government policy is responsive to the broad contours public opinion on a host of issues (Erikson, Mackuen, & Stimson, 2002; Page, Shapiro, & Dempsey, 1987; Soroka & Wlezein, 2009). Consequently, the quality of the public's signal sent to policymakers should be of substantial interest. We would hope the public uses expert consensus where and when it exists to inform their policy evaluations of related topics. But there is substantial evidence that the public often diverges substantially from expert opinion. A Pew (2015) survey of U.S. adults and members of the American Academy for the Advancement of Science (AAAS) shows that there are large gaps in opinion between scientists and the U.S. public. For example, 88 percent of AAAS members believe it is safe to eat genetically modified foods, versus 37 percent of Americans, while 87 percent of AAAS accept the anthropomorphic global warming thesis, compared to only 50 percent of Americans.

If anything, the Pew survey understates the gap that exists between scientists and the public on these issues. AAAS membership is not solely composed of those that specialize in those topics. For example, meta-analysis of climate change research has shown that 97 percent of peer reviewed articles endorse the IPCC view that climate change is happening and mostly caused by human

¹ In reality there will always be dissenting experts that challenge the dominant view of their discipline. Dissent and disagreement are valuable in keeping experts honest in different policy domains. For the purposes of this thesis, however, these areas of agreement among a large majority in a discipline will be often termed a *consensus*.

activities, while similar meta-analyses have shown little-to-no disagreement among plant scientists on the safety of GMOs (e.g. Nicolia et al., 2014) or in the medical research community on the safety and efficacy of childhood vaccinations. The story is not any better on economic issues. If anything it is worse. Sapienza and Zingales (2013) compared a panel survey of economic experts conducted by the Initiative on Global Markets (IGM) at the University of Chicago with a representative sample of Americans. They found an average difference of 35 percentage points between the two groups across 18 issues. The largest differences existed on the topics where economists exhibited the largest agreement. Clearly, the public is often offside of expert opinion, particularly when the latter is in agreement. Why is this the case?

One possibility is that this phenomenon is just another demonstration of the public being largely ignorant about politics, both at the general (Berelson et al., 1954; Campbell et al., 1960; Converse, 1964; Delli Carpini & Keeter, 1996) and policy level (Kuklinski et al., 1982; Kuklinski et al., 1997; Gilens, 2001) because of insufficient motivation to become informed. However, it does not automatically follow that people fail to process information from experts to help them form policy evaluations. They can pick up cues from experts in the media, such as the existence of expert consensus, without having to understand the complex policy information undergirding expert opinion (Johnston & Ballard, 2016). We might expect, then, some congruence between expert and public opinion providing that the information environment provides them with these facts.

Another partial explanation is that people ultimately reject advice from experts when it contradicts their prior beliefs or values – known as motivated skepticism (Kahan et al., 2011; Johnston & Ballard, 2016). This perspective builds on the influential literature on motivated reasoning in cognitive psychology (Ditto & Lopez, 1992; Kunda, 1990; Lodge & Taber, 2014). Citizens interpret information in a superficial way oriented towards maintaining their own beliefs. This psychological process is symmetric – Republicans and conservatives only tend to be implicated because issues where they reject expertise are currently more salient (Lewandowsky & Oberauer, 2016). In other important areas Democratic supporters and liberals are more likely to reject expert opinion, such as on the safety of GMOs, pesticides, and nuclear power (Pew Research Center, 2015).

The tendency to reject counter-attitudinal expert opinion is particularly intense when issues are highly salient and have clear implications for the social and political identities of citizens. It is also more common among those with the strongest affective attachments to political objects – those that are politically sophisticated (Lodge & Taber, 2014). Motivated skepticism has likely played an

important part in why some citizens stubbornly resist the scientific consensus on climate change – particularly politically attentive Republicans (Kahan et al., 2012). It is also important to note that the media play an important role in facilitating the motivated rejection of expert opinion by carrying elite cues to the public from opposing partisan and ideological groups (Darmofal, 2006; Merkley & Stecula, 2016) and thus priming their directional motivation (Kunda, 1990).

Nevertheless, skepticism motivated by partisanship, ideology, or values cannot be the whole story. American opinion departs from that of experts on a wide range of issues, many of which cut across party and ideological lines. More importantly, most Americans simply do not possess consistent and constrained ideological predispositions that would prevent them from accepting expert advice on most issues (Achen & Bartels, 2016; Converse, 1964; Kinder & Kalmoe, 2017). Motivated skepticism driven by ideology and partisanship likely matters for a small subset of Americans who are very politically engaged, but it is not sufficient to explain this phenomenon more broadly.

This thesis identifies three other possible sources of the divergence between expert and public opinion that correspond to each of its papers. First, theories that focus on rational ignorance or motivated skepticism implicitly assume that the media environment contains information that can apprise citizens of expert consensus. For the former, citizens are simply not motivated enough to obtain and process this information, while for the latter their processing is biased by their ideology or values. Unlike other political issues, citizens are reliant on the mass media for information on expert consensus (Wilson, 1995). Policy specialists are not often found in their social circles. However, theories related to the production of media content in political communication give us plenty of grounds to be skeptical that this information will be regularly presented to viewers and readers in a way that is conducive to information processing. This is the starting point for the first paper in this thesis.

Widespread changes have been occurring in the media environment over the past 30 years. Competition between news outlets is sharper and, as a result, they are more responsive to consumer tastes than ever before (Bagdikian, 2004; Shoemaker & Reese, 2014). This process has been further magnified by the fragmentation of the media marketplace brought on by advances in communications technology (Bennett & Iyengar, 2009). In this context journalists select and frame stories to emphasize novelty (Wilkins & Patterson, 1991), drama, and personality (Bennett, 2007), making news coverage superficial and episodic (Iyengar, 1991). Coverage of expert agreement is not easily justified by this take on newsworthiness as practiced by editors and journalists. And, even

when important expert messages are covered, other newsroom practices may take the persuasive punch out of these messages. Journalistic norms of balance (Giannoulis et al., 2010; Schudson, 1978), when combined with the propensity of the news media to cover authority figures (Althaus et al., 1996) and drama (Bennett, 2007), may lead to coverage in which expert messages are highly contested by contrarian experts or polarizing political figures. The former may confuse citizens about the stance of the expert community on important questions, while the latter may prime motivated citizens to resist their messages.

To consumers of American news media, these points may seem obvious. However, much of the literature in political and science communication either assumes expert messages reach the public through the news media or underplay the possible existence of media bias by using highly stylized experiments featuring messages from experts that are divorced from how these messages are normally transmitted to citizens in the real world.

Here, I engage in an ambitious content analysis of over 280,000 news articles and transcripts from print, cable, broadcast, and newswire sources on 10 issues where there is meaningful agreement among experts on a central question related to each issue. Some of these issues, like vaccines and climate change, have been a substantial focus of the literature. Others, like nuclear power and GMOs, have not. I have also included economic issues like trade protectionism and road pricing because expert consensus need not be limited to the natural sciences. I use a combination of automated methods, such as dictionaries and supervised machine learning, and manual coding to identify how often experts communicate important messages of agreement in news content and the degree to which these messages are clouded by newsroom bias towards *balance* and *conflict*.

To the extent that the first paper identifies a bright spot in the media's treatment of expert consensus, it is to be found in climate change news content. The presence of expert messages and consensus cues are more frequent in this coverage. It more strongly emphasizes arguments supporting the position of the expert community, and it is characterized by less 'false balance.' This raises the question of why Americans have increasingly polarized on climate change despite the emergence of a scientific consensus that is conveyed to Americans reasonably well through the news media – at least compared to other areas of expert agreement.

This is the starting point for the second paper in this thesis, co-authored with former graduate school colleague Dominik Stecula. The dominant explanation for the polarization of Americans on climate change has been advanced by scholars focused on motivated skepticism. For these scholars, Republican skepticism of climate science is a reflection of ideology-driven motivated reasoning

(Kahan et al., 2012). The policy implications of dealing with climate change are not congenial to conservative or free-market ideology as policy responses typically involve higher taxes and the imposition of government regulation (Campbell & Kay, 2014; Oreskes & Conway, 2010). Republican identifiers are then expected to counter-argue and reject the messages of scientists to support their identities and values. However, this approach does not easily address the fact Republicans once believed in climate change at equal rates to Democrats (Krosnick et al., 2000).

So what then caused the polarization of the American public on climate change? We argue that rising climate skepticism and polarization between Republican and Democratic supporters can be explained by a cue-taking process from party elites. As previously noted above, most Americans do not adhere to highly constrained ideologies. They have to learn which policy positions are compatible with their identities. Political science literature has shown party cues to be a powerful influence on opinion formation, both observationally and experimentally (Berinsky, 2009; Cohen, 2003; Kam, 2005; Nicholson, 2012; Zaller, 1992). We contend that Americans took their cues from party elites as climate change morphed from an issue strictly about science, to one with dramatic policy implications much more robustly covered in the news media.

We conduct a media content analysis of over 26,000 print, cable, broadcast, and newswire stories on climate change from the early 1980s to 2014 in order to construct time series measures of possible sources of polarization dynamics, such as party elite and ideological identity cues, messages from organized climate skeptics, and frames related to the economic costs of climate change mitigation. We shed light on whether or not there are any important trends in the use of these classes of polarizing information and if their presence in the news is related to the overall salience of climate change or the type of news outlet providing the coverage. Most importantly, we construct novel, aggregate measures of public attitudes towards climate science. Armed with this data, we can show whether or not there is an association between party elite cues and other polarizing information, and climate skepticism and partisan polarization, after controlling for other factors we know are important from relevant literature.

The third paper in this thesis advances the argument that more scholarly focus is needed on the concept of anti-intellectualism in order to explain why citizen and expert opinion diverges. The issue of climate change has dominated literature that seeks to explain why citizens often reject advice from mainstream communities of experts for good reason. It is one of the most pressing issues of our time and one in which appropriate policy action has been hard to come by. Focus on this issue, however, may give us a misleading impression of the role ideology plays in other areas of expert and

scientific consensus where partisan and ideological lines are much less clear. On these issues anti-intellectualism is likely to be more important in conditioning the persuasiveness of expert agreement. Following Hofstadter (1962) and others (Brewer, 2016; Kazin, 1995; Motta, 2017; Rigney, 1991), I conceptualize anti-intellectualism as a generalized mistrust in experts and intellectuals resulting from a disdain for intellectual and scholarly pursuits. This predisposition can be rooted in several different sources, one of which is the primary focus of this paper – populism.

I use the General Social Survey (GSS) and an original survey of over 3,600 Americans to explore whether or not there is an association between anti-intellectualism and the rejection of scientific consensus on climate change, nuclear power, GMOs, and water fluoridation even after controlling for partisanship and ideology. I experimentally manipulate the exposure of respondents to an expert agreement cue on each issue to show whether or not the persuasiveness of this cue is conditioned by levels of anti-intellectualism. Further, I examine a possible association between populism and anti-intellectualism using my survey results and those from the GSS. I argue that because these concepts are closely intertwined, anti-elite rhetoric may activate anti-intellectualism in moderating the persuasiveness of expert agreement cues. I randomly assign respondents to anti-elite rhetoric embedded in mock newspaper article to test this contention.

Together, these three papers point out further avenues for research beyond the ideology-driven motivated reasoning paradigm. The pursuit of evidence-based policy can be furthered by supportive public opinion. Science communicators will need greater attentiveness to the challenges outlined here moving forward.

Paper I

Are experts (news)worthy? Balance, conflict and mass media coverage of expert agreement

1 Introduction

The role of experts in shaping public opinion has been of increasing interest, driven, in part, by continued confusion over the degree of scientific consensus on anthropogenic climate change among a sizable portion of the American public. Of particular concern is understanding what explains often substantial gulfs in opinion between the public and experts on a wide range of issues (Pew Research, 2015; Sapienza & Zingales, 2013). A growing experimental literature has shown that experts, when in consensus, can be persuasive on highly technical issues (Johnston & Ballard, 2016; Lewandowsky et al. 2012; van der Linden et al., 2016), but processes of motivated reasoning often prevent citizens' assimilation of counter attitudinal signals from experts on other highly charged issues (Kahan et al., 2011; Lewandowsky & Oberauer, 2016). We also know that features of media coverage, such as fragmentation and episodic framing, may limit people's exposure to information about expert consensus and that providing a balance of arguments among sources may instill confusion among readers about the state of expert opinion. There is some evidence that this form of reporting once guided climate change coverage (Boykoff & Boykoff, 2004; Zehr, 2000).

However, little scholarly effort has been made to systematically examine the media environment to learn whether information about expert consensus is readily available across a wide range of issues and if it is presented in a way that is conducive to influencing public attitudes. This study will present an automated and manual content analysis of over 280,000 newspaper articles, and broadcast and cable transcripts, on 10 issues where there important areas of agreement among scientists and economists. The results suggest that journalists generally craft news content that emphasize arguments aligned with positions of expert agreement rather than providing strictly balanced coverage and they do not typically balance the perspective of the expert community with those of contrarian expert sources. More problematic is the tendency of journalists to situate messages from experts amidst claims and counterclaims by polarizing political actors – even on low salience issues – which may prime citizens to resist messages signaling expert agreement.

The most troubling finding presented below, however, is that messages from experts relevant to important areas of agreement are not common in media content even when such content is

directly relevant to the area of agreement. Clear cues signaling the existence of agreement or consensus among experts are rarer still. If citizens are learning about expert agreement, it is likely not through the news media.

2 Media bias and the presentation of expert opinion

Experts and scientists are in agreement on a wide range of topics. Ideally, citizens should be informed of these important areas of agreement so they can take them into account when forming opinions on relevant issues. It is here where the news media play a critical role – citizens rely on signals or cues sent from relevant communities of experts carried in news coverage as they rarely encounter policy experts in their social circles (Wilson, 1995). These cues are particularly valuable if they communicate the existence of expert agreement or consensus (Johnston & Ballard, 2016; Lewandowsky et al., 2012; van der Linden et al., 2016). However, much of the literature on the influence of source cues on public opinion, such as from experts, fails to examine the cueing environment in the media (see Gilens & Murkawa, 2002 for a broader discussion). These studies implicitly assume that messages or cues from experts are readily available in the information environment of the average citizen and that they are presented in a way that is easy for them to process.

However, there are strong theoretical grounds to suspect that the mass media routinely fails on both counts. We know that the mass media exist amidst a complex network of institutions whose members often seek to use the media to disseminate their message to influence public opinion and policy (Shoemaker & Reese, 2014). As a result, media sources have a direct influence on media content, particularly those with considerable institutional power. In newsroom practice, this means journalists often rely on official sources (Bennett, 2007). This practice also extends to the political allies of these sources, such as interest groups and think tanks, so elites can be seen as having a cascading effect on media content that extends well beyond their direct influence (Entman, 2003). This reliance on official sources has the effect of “indexing” political debate to reflect the spectrum of opinion among elites and to the exclusion of minority voices (Althaus et al., 1996; Bennett, 1990). In part, this is due to institutional pressure for the media to disseminate elite opinion, but it is also a low-cost way of generating news content with a high degree of accuracy (Shoemaker & Reese, 2014).

Organization-level factors also have powerful influences on news content. Technological changes through the 20th and early 21st centuries have magnified the competition that exists between media organizations for consumers and advertisers (Bennett & Iyengar, 2009). The media

marketplace has fragmented and outlets are struggling to make profits. This pressure has directly influenced decision making. Economic considerations are increasingly important (Bagdikian, 2004). As Shoemaker and Reese (2014) note “media personnel are now more likely to evaluate each news item in terms of how it will affect circulation and/or ratings” (p.140). The economic viability of an organization is tied to advertising revenue and subscription fees, which are linked to the consumer reach of an outlet. The new economic reality – combined with the rise of corporate ownership (Bagdikian, 2004) – means that media outlets are more risk-averse and increasingly responsive to the tastes of news consumers.

It is in this context that perceptions of newsworthiness are being shaped. An increasing need to be responsive to consumer demand has magnified several important regularities in news coverage that have been identified by scholars. First, coverage is likely to be *dramatized* by emphasizing lines of conflict. News coverage of events tend to feature dueling quotes of personalities for or against various propositions (Bennett, 2007; Boykoff & Boykoff, 2007). Second, journalists will tend to *personalize* coverage (Bennett, 2007). Finally, there will be a focus on *novelty* (Wilkins & Patterson, 1991). The drama of a story is lessened if it is covered with a similar angle repeatedly, such as the growing threat of global warming (Boykoff & Boykoff, 2007; Hilgartner & Bosk, 1988). The combination of the drama, personalization, and novelty lead to the framing of political issues in ways that are superficial and episodic. As Bennett (2007) notes, news stories give “preference to the individual actors and the human interest angles in events while downplaying institutional and political considerations that establish the social context of events” (p. 26). News content will typically eschew linkages between stories and continuity in coverage in favour of covering controversial events and personalities (Iyengar, 1991).

There are clear links between journalistic routines, perceptions of newsworthiness, and coverage of expert agreement. A reliance on official sources provides one avenue for experts to be covered (McManus, 2000). Some will serve in an official capacity, others may be employed in allied interest groups and ideological think tanks and press to have their organizational positions reflected in media content. More impartial experts from universities and non-partisan think tanks may be less likely to deliberately seek out media attention, but journalists may cite them for the purpose of objectivity and to bolster the credibility of the narrative chosen by the journalist (Steel, 1990).

On the other hand, experts often provide institutional and social context to certain issues, which may not be easily incorporated into episodic, drama-laden news coverage. One essential piece of context to a policy discussion is the existence of expert agreement on questions central to that

debate. This is likely to be less prominent in coverage for a couple reasons. First, consensus, by its very nature, leaves little room for drama and novelty. Second, and more importantly, discussion of central questions of public policy, like whether trade protectionism is generally welfare-enhancing or reducing, is unlikely to find its way into media coverage that is episodic and fragmented rather than thematic and context-rich (Iyengar, 1991). The degree to which experts are cited in coverage to provide support for positions of consensus is ultimately an empirical question. This motivates the first research question in this paper:

Research Question 1 (RQ1): How often do news media use experts as sources to support positions on central questions of policy that have broad expert agreement? Do journalists use clear cues to signal the existence of expert agreement or consensus when appropriate?

Separate from concerns about whether or not experts are present in coverage and conveying information about important areas of agreement is the possibility that such information might not be presented in a clear and persuasive manner. One issue is that the journalistic norm of objectivity is likely to lead to coverage that presents information from both sides of a policy debate equally – often labeled *balance*. In part, this norm exists because both journalistic and societal beliefs value news for being covered in an even handed manner (Giannoulis et al., 2010; Schudson, 1978). But it is also a mechanism to protect journalists from attacks that might undermine their credibility (Hallin, 1986; Shoemaker & Reese, 2014). As a result, journalists tend to provide both sides of a political dispute and weigh them relatively equally in coverage (Dunwoody, 1999). This also furthers their need for personalized and dramatized coverage (Stocking, 1999; Zehr, 2000).

Balance as form of journalistic bias means that experts in line with the mainstream consensus will often be featured in coverage alongside those that are not representative of the broader expert community – often labeled *false balance* by media critics. The resulting dueling quotes in coverage serve to dramatize and personalize coverage. Conflict between experts as portrayed in the media may increase public perceptions of uncertainty in expert findings, thus leading to divergence between public and expert opinion on key issues (Koehler, 2016). A number of experiments have tried to determine the extent of the problem and possible remedies. Some of these works have found that exposure to dueling experts increased perceptions of disagreement among experts (Clarke et al., 2015; Dixon & Clark, 2013; Dixon et al., 2015; Koehler, 2016). Other studies have had

more mixed results (Corbett & Durfee, 2004; Jensen & Hurley, 2012). Nevertheless, there is strong reason to suspect such falsely balanced coverage of expert consensus may, at times, engender confusion among citizens about the state of expert knowledge.

A number of scholars have argued that false balance was common in media coverage of climate change in the United States where journalists pitted the IPCC consensus against dissenting scientists that often had ties to conservative groups and the fossil fuel industry (Boykoff & Boykoff, 2004; Zehr, 2000; though for a more skeptical account see Merkley & Stecula, 2018). This has also been observed in other areas of science-based policy (Dearing, 1995; Dunwoody, 1999; Stocking, 1999). Most work on this topic has not examined the prevalence of balanced coverage outside the issue of climate change. This discussion leads to the second research question pursued here:

Research Question 2 (RQ2): To what degree does news coverage provide a balance of perspectives on areas of expert agreement? How often are contrarian experts presented in coverage alongside those who are in line with the mainstream of the expert community?

A second common feature of news coverage that could limit the persuasiveness of expert messages is closely tied to concerns about balance. The tendency of journalists to dramatize the news means that coverage of a policy area will be laced with *conflict*. Taken together with the journalistic norm of balance, this means consensus information from experts will often be contested in coverage by polarizing political actors (Bennett, 1990; Merkley & Stecula, 2018; Trumbo, 1995, 1996). We know that citizens often form opinions on political issues by following cues from party elites, ideological organizations, and interest groups (Cohen, 2003; Lupia, 1994; Mondak, 1993). Scholars have debated whether the use of these cues by citizens comes from a rational need to make decisions in line with their interests with little information (Lupia & McCubbins, 1998) or unconscious and automatic responses to information driven by affect (Lodge & Taber, 2014). Whatever the cause, the presence of these actors in political coverage may limit the persuasiveness of experts by priming citizens to resist their messages.

Relatedly, journalists may also cite polarizing sources that *support* the expert position in the context of a political debate. For example, journalists may carry supportive messages of climate science from Democratic elites or of GMOs by Monsanto representatives. Because out-group cues

have been shown to be as persuasive as in-group cues (Berinsky, 2009; Nicholson, 2012), these messages may undermine support for expert positions among segments of the public predisposed to disliking or distrusting those sources (Hart & Nisbet, 2012; Merkley & Stecula, 2018).

Research Question 3 (RQ3): How often do news media present influential and polarizing information sources that *oppose* or *support* the stated position of the expert community such as parties, interest groups, or ideological organizations?

These three questions motivate much of what follows. However, journalistic practices may also vary across issues, media format, and outlet ideology. For example, broadcast and cable formats are more conducive to episodic coverage compared to print (Shoemaker & Reese, 2014). Coverage of relevant expert messages should be less frequent in these media. We know that cable news typically caters to politically engaged audiences (Levendusky, 2013; Prior, 2013) and focus more attention on conflict (Feldman et al., 2012; Sobieraj & Berry, 2011). They might be more likely to situate expert messages in the context of political conflict. The television news format may be more conducive to providing balance (Bennett, 2007), so broadcast and cable may score higher on these dimensions.

There are also likely to be partisan and ideological differences between outlets. Scholars have shown that conservative media are more prone to elevating the messages of climate skeptics (Dunlap & McCright, 2011). This may apply across a broader assortment of issues. Journalists may selectively cite experts or opponents of the expert community to bolster narratives that align with the partisan leanings of an outlet. Citizens are exposed to a broad assortment of news media and increasingly have the ability to select into different news formats that suit their tastes. Examining how coverage of experts varies across outlets is thus of great importance.

3 Data and methods

We cannot possibly analyze media coverage of all areas of expert agreement that attract media attention, nor do we know what the population of such issues looks like. The best we can do is select issues across a number of different dimensions we may think are important. Some of these are issues of natural science. Here, the media turns to scientists, doctors, physicists, ecologists, and a whole host of other disciplines. Other matters are related to the anticipation of the economic benefits or costs of a policy for society writ large. Here, economists tend to dominate, in addition to

specialists for particular policy areas. Issues may also vary in their partisan or ideological implications.

With these considerations in mind, I selected nine issues that varied in whether they are related to the natural sciences or economics and in the direction of elite cues. The tenth issue is climate change, which has been a dominant focus of the science communication literature. The issues are shown below in Table 1.1. Climate change is the most widely recognized example of expert consensus. Over 97 percent of published articles on climate change endorse the main elements of the consensus identified by the Intergovernmental Panel on Climate Change – that it is happening, man-made, and a serious threat (Anderegg et al., 2010). Surveys indicate that anywhere from 80 to 95 percent of scientists agree with this perspective (Bray & von Storch 2008; Doran & Zimmerman, 2009).

Similar levels of expert agreement exist in other areas as they relate to the safety of scientific interventions. Scientific research has repeatedly demonstrated the relative safety of nuclear power compared to alternative forms of energy production. Meta analyses have shown no link between thyroid cancer incidents and the proximity of nuclear reactors (Kim et al., 2016), and recent research has estimated that nuclear power has saved over 1 million lives by displacing fossil fuel production, which is orders of magnitudes more harmful (Kharecha & Hansen, 2013). The Centers for Disease Control and Prevention and the American Academy of Pediatrics both endorse the safety of childhood vaccinations, and a wide range of literature has debunked supposed associations between vaccinations or its recommended schedule and autism or other neurological problems.² An exhaustive meta-analysis of 1,700 research papers on GMO safety since 2002 found no meaningful hazards connected with the use of GMOs (Nicoli et al., 2014), and a consensus document by the National Academy of Sciences (2016) could find no evidence that the risk of GMOs outweighed those of conventional alternatives, but recommended continued study on the matter.

The economics profession is not as adept at conducting meta-analyses and compiling consensus reports, but several works have used surveys of economists to illustrate a number of important areas of agreement (Fuller & Geide-Stevenson, 2003; Whaples, 2006, 2009). And, a long-running panel survey of economists run by the Booth School of Business at the University of

² More information can be found on the CDC's website:
<https://www.cdc.gov/vaccinesafety/research/index.html>

Chicago (hereby referred to as the IGM panel) has facilitated greater awareness of areas where economists are in agreement or otherwise.³ For example:

- Surveys of economists have shown over 90% reject the use of tariffs in trade policy (Fuller & Geide-Stevenson, 2003; Whaples, 2006, 2009). No economist surveyed on the IGM panel disagreed with statements indicating that past trade deals benefitted most Americans; that NAFTA has been beneficial on balance for citizens; that freer trade improves productive efficiency and consumer choice that provide long-run gains that exceed any employment costs; and, most notably, that trade with China makes most Americans better off.
- Surveys of economists have shown that only 16% believe immigration levels in the U.S. are too high (Whaples, 2006). 94% of IGM panelists agreed with the statement that expanding U.S. immigration to hire those with more advanced degrees would increase per capita income. In the European variant of the IGM panel, 99% of respondents believed the free movement of people in the European Union made the average Western European citizen better off. Only 24% believed free movement negatively affected low-skilled workers compared to the 55% that rejected that notion.
- Surveys of economists have shown that upwards of 83% of economists favour the complete elimination of farm subsidies (Whaples, 2006).
- 98% of the IGM panel agreed with a statement that using congestion pricing to lower taxes would make Americans better off.
- 90% of IGM panel respondents disagreed with a bill that would have forced the Federal Reserve to submit a monetary policy rule to Congress that would be enforced by Congress. 80% disagreed with a Senate bill to subject Federal Reserve decisions to an audit, while no panelist agreed with either proposition outright.
- 95% of the IGM panel disagreed with a statement that local ordinances that limited rent increases for some rental units had a positive impact on the quality and amount of affordable rental housing.

³ The complete set of questions posed to the panelists can be found here: <http://www.igmchicago.org/igm-economic-experts-panel>.

In short, these issues offer compelling areas of expert agreement on questions central to those policy domains. More information on the nature of the expert consensus on each issue can be found in Appendix A.

	Democrats against experts	Mixed/none	Republicans against experts
<i>Natural Sciences</i>	Nuclear power safety; GMO safety	Vaccine safety and efficacy	Climate change
<i>Economics</i>	Rent control	Trade protectionism; farm support	Immigration economics; Federal Reserve independence; road pricing

Table 1.1 Issue selection

Each of these issues vary in the direction of elite cues on the topic. This dimension was chosen to rule out bias in press coverage of experts that could be driven by partisanship. Democrats and liberal advocacy groups tend to be supportive of rent control and skeptical of the safety of GMOs and nuclear power. These are termed *Democratic-resist* issues for the remainder of this paper. Republicans and conservatives lean towards skepticism of Federal Reserve independence, road pricing, and immigration. These are labeled *GOP-resist* issues for the remainder of the analyses. This does not mean all elites fit this description, and in some cases partisan dynamics change over time. For example, skepticism of the Federal Reserve was found mainly in Democratic ranks in the 1980s because of aversion to the Federal Reserve's inflation fighting stance under Chairman Paul Volcker. There are also some issues with no clear direction of party cues. There is generally strong cross-partisan support for childhood vaccinations. Backing for farm support programs cut across farm state lines, while Democratic presidents and Republican lawmakers have advanced an agenda of free trade in lockstep. Together, these ten issues feature critical areas of expert agreement that economists and science advocates have emphasized in the hopes of influencing public policy.

I gathered media coverage from the *Lexis* and *LexisNexis Academic* services using keywords and subject tags (found in Appendix B) selected for coverage rather than precision in order to draw in all possible news coverage that relates to my issues of interest. The keywords and phrases also carefully avoided reference to experts so that I did not select on stories with these references. I selected sources to cover the primary news media (newspaper, newswire, broadcast, and cable), and, where feasible, the ideological spectrum. I chose liberal-leaning outlets like the *New York Times* and *CNN*

alongside editorially conservative outlets like the *San Diego Union-Tribune* and *Fox News*.⁴ The sources used in this analysis and their start dates are shown in Table 1.2. Table B.1 in the Appendix provides the total number of articles or transcripts across issues. This is by no means a complete picture of the coverage of these issues, but it is a significant and ideologically balanced slice of the media environment that covers how the vast majority of Americans receive their news.

Newspapers	Conservative newspapers	Cable	Broadcast	Newswire
New York Times (1980)	San Diego Union-Tribune (1983)	CNN (1990)	ABC (1980)	Associated Press (1980)
Washington Post (1980)	Houston Chronicle (1991)	FOX (1997)	CBS (1990)	
USA Today (1989)	Dallas Morning News (1992)	MSNBC (1999)	NBC (1997)	

Table 1.2 Source selection

In total, I collected nearly 300,000 articles and transcripts. Each of these articles is related in some way to one of the ten issues I am studying. But not all of these articles are especially relevant, in the sense that not all of them spoke to the specific area on which experts agree. For example, most immigration stories likely do not focus on the economic effects of immigration, but rather the politics of illegal immigration or refugee flows. Similarly, some climate change coverage may cover the politics of climate mitigation or industry development of alternative energy sources, rather than climate science or climate impacts. I needed to distinguish these especially relevant articles from the others. However, there are far too many articles for me to manually code, so I trained software to do the coding for me.

Specifically, I made use of *RTextTools* – an R package that allows me to train an ensemble of predictive algorithms on a limited sample of manually coded articles. These algorithms learn how to classify articles from my own coding. I can then use these trained algorithms to classify my entire corpus of almost 300,000 articles and transcripts. Supervised machine learning techniques are

⁴ The *Dallas Morning News* and the *San Diego Union-Tribune* both endorsed Republican presidential candidates in every cycle from 1980 to 2012. The *Houston Chronicle* endorsed the Republican Party 8 of 9 presidential election cycles from 1980 to 2012. In contrast, the *New York Times* and *Washington Post* endorsed Democratic candidates in every cycle in that period, with the only exception in 1988 when the *Washington Post* did not endorse a candidate. Newspaper endorsement histories can be found here: <https://noahveltman.com/endorsements/>.

increasingly used by scholars to study large volumes of text, including news content (Grimmer & Stewart, 2013; Lacey et al., 2015; Young & Soroka, 2012).

In order to train the software I manually coded 500 articles for each issue as “1” if they contained discussion related to the area of expert agreement for a given issue, and “0” if otherwise (750 articles were coded for immigration for a total of 5250 articles). I refer to this classification as *topic relevance*. The general coding rules are shown in Table 1.3 and more detail on coding criteria can be found in Appendix C. I used a random sample of 400 of these manually coded articles on each issue to train four categorization algorithms in the *RTextTools* package: SVM, Boosting, Random Forest, and Maximum Entropy.⁵ The machine classifies articles as “1” if a consensus of 3 of the 4 algorithms agreed it was relevant. I then tested the trained algorithms on the remaining 100 manually coded articles for each issue to evaluate the reliability of the machine coding. Accuracy and precision scores were calculated for this evaluation, which are shown in Appendix D.⁶

Overall accuracy of the algorithm consensus ranges from 80% on trade protectionism to 92% for Federal Reserve and farm support coverage with an average of 88% across all issues. Even more impressive are the precision scores given the low baseline of relevance for some issues. It ranges from 0.8 for trade protectionism and the Federal Reserve to 1.00 for road pricing with an average of 0.9. In other words, a best estimate for the rate of false positives is 10% across all issues. After training the algorithms, they were used to predict the topic relevance of the full corpus of nearly 300,000 news stories.

Rates of topic relevance varied considerably across issues, from a low of 2% for immigration to a high of 58% of GMOs. The rates of topic relevance for each issue are shown in Table 1.3. This variance is to be expected. An area on which there is some element of expert agreement is only one part of a broader debate on any given issue. The economic dimension is a very small part of immigration coverage, whereas GMO safety concerns are at the heart of media attention to that issue. Also expected are differences across media. Cable and broadcast content was less likely to be

⁵ Computer memory constraints limited my ability to use the other algorithms. Algorithms were trained on a random sample of articles from the newswire and newspaper sources. Random Forest was removed from the ensemble on road pricing, farm support, rent control, and the Federal Reserve. A consensus for these issues is the agreement of relevance between 2 of the 3 algorithms.

⁶ Accuracy tells us how often the algorithm got it right ($[\text{True Positives} + \text{True Negatives}]/\text{Total}$). But, the purpose of this analysis is to hone in on a sample of articles for manual coding. As such the more important measure of performance is how many true positives we have relative to all articles that were coded as relevant. This is what the precision score gets us ($\text{True Positives}/[\text{True Positives} + \text{False Positives}]$).

coded as relevant, likely because such media are less disposed to providing the context essential for a story to be classified as such.

Issue	N	Coding criteria	% Relevant
Climate change	48,924	Coded '1' if... discussion of climate science or climate change impacts	27
Immigration economics	100,033	Coded '1' if... discussion of the economic benefits/costs of immigration	2
Trade protectionism	73,672	Coded '1' if... discussion of the economic benefits/costs of liberalized trade or protectionism	37
Nuclear power	30,704	Coded '1' if... discussion related to the safety of nuclear reactors	20
Road pricing	9,791	Coded '1' if... discussion of the advantages/disadvantages of road pricing/tolls	11
Childhood vaccines	11,891	Coded '1' if... discussion of benefits/costs of vaccines and vaccine safety	28
GMOs	1,703	Coded '1' if... discussion of benefits/costs of GMOs and GMO safety	58
Federal Reserve independence	600	Coded '1' if... discussion of merits/drawbacks of Federal Reserve independence	23
Farm support	6,180	Coded '1' if... discussion of benefits/costs of subsidies/farm supports	17
Rent control	2,835	Coded '1' if... discussion of benefits/costs of rent control	30

Table 1.3 Topic relevance manual coding criteria and share of stories that are topic relevant

Next, I built dictionaries of keywords and phrases for each issue to be used in conjunction with the R package *Quanteda*. This allowed me to count the number of references to experts in news coverage and construct a measure that captures the share of coverage with these references, referred to as *expert citations* throughout this paper. On economic issues, the dictionary contains categories for economists and policy analysts, along with a category to capture generic references to experts, featuring words such as analyst, expert, specialist, and professor. On natural science issues, the generic category was maintained, along with the addition of categories specific to each issue. These dictionaries, which can be found in Appendix E, aim for coverage rather than precision, and in doing so set an upper limit on the share of coverage that may contain discussion of the state of expert knowledge on these issues. In reality, many experts portrayed in the media may be anything but. Genuine experts may also be used to shed light on information unrelated to the topics of expert agreement that are the focus of this paper.

The result of my automated analysis is that I am able to identify stories with content relevant to the expert consensus central to each issue – or *topic relevance* – and whether or not there are *expert citations* in any given article. However, this information does not tell us a lot about whether or not expert agreement on an important dimension of a policy issue is being clearly conveyed to readers and viewers. So, for example, are these expert citations conveying information related to the expert consensus of interest? Are there clear cues conveying the level of expert agreement? Are expert voices contested by political interests or contrarian experts? These are more nuanced questions that deserve more delicate treatment.

In order to answer these questions I manually coded a stratified random sample of articles and transcripts that were classified as relevant *and* as having an expert citation according to my automated analysis. My aim was to code 100 articles for each relevant subset of sources on each issue. So I coded 100 randomly selected articles each for Republican-leaning newspapers, broadcast sources, liberal cable outlets, and so on. For most issues, particularly those of lower salience, there were not 100 articles or transcripts for a relevant media subset. This was primarily true for cable and broadcast sources. In these cases, I coded all the articles within that subset. Coding criteria can be found in Appendix F.

I manually coded the resulting sample of 3,147 articles and transcripts in ways related to my three research questions. First, I coded features of articles related to the presentation of expert messages to examine whether messages conveying the position of the expert community are present and whether journalists clearly signal there is agreement within the community. At the most superficial level my automated analysis can tell us whether or not there is an *expert citation* in the text of an article. Of articles with these citations only some of them will contain a message from, or attributed to, an expert that is related to the area of expert agreement for a given issue. Experts could also be used to describe the state of the world or how certain policies work. Or, they may be asked to make predictions about the future. The important point is that they can do all of this without fundamentally speaking to the area of expert agreement on each issue *even when there is some content in the article that is related to that question*. So I code my articles for whether or not any expert citation in the story is linked to a message from an expert related to the area of expert agreement for that issue (Present/Absent). I call these *expert messages*.

Expert messages related to consensus can provide compelling insight into a particular question for the average reader of a news article. On their own, however, they may lead some citizens to wonder if the stance attributed to the expert reflects their personal view alone or is representative of

the broader expert community. After all, there are plenty of areas on which experts are in disagreement. So I code for whether the journalist or expert uses a cue that signals to readers or viewers that the expert message is related to some broader agreement in the expert community (Present/Absent). This cue could range in its concreteness from crystal clear statements that indicate there is an expert consensus on the question, to vaguer statements like “experts agree that...” I refer to the subset of expert messages that contain such signals *agreement cues*.

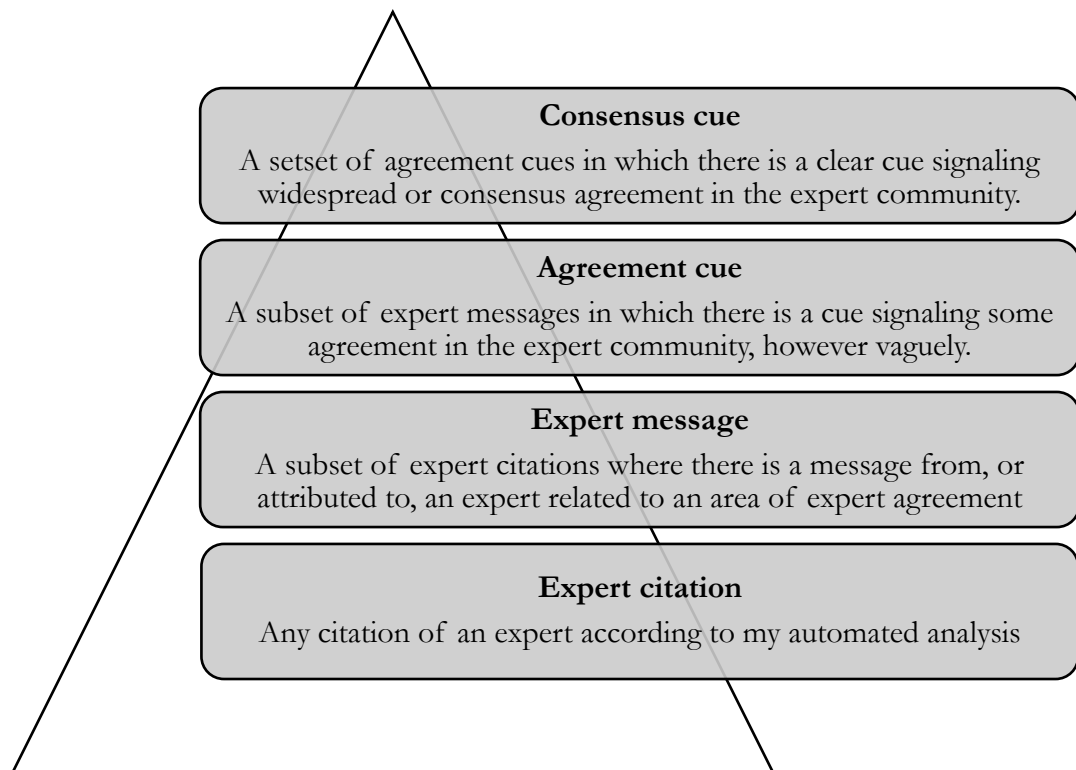


Figure 1.1 Relationship between different classes of expert information

I further parse the agreement cue category. Many of these cues are imprecise in their presentation of the balance of opinion in the broader expert community. A statement like “many experts believe...” or “scientists say...” is not sending a clear and unambiguous statement that there is supermajority or consensus agreement within the expert community on a pertinent question. So, I code agreement cues for whether or not there is such an unambiguous signal (Present/Absent). Statements like “most experts say...”, “a large majority of economists believe...”, or “there is a scientific consensus that...” all qualify as a *consensus cue*. Armed with this coding, I can demonstrate the prevalence of each type of expert signal in relevant and total news content on my 10 issues,

where each finer grained distinction provides more informative value to citizens on the state of expert knowledge. The relationship between these classifications is shown in Figure 1.1.

Second, I coded several features related to the entire article that might limit the persuasiveness of expert messages – *balance* and *conflict*.

- *Balance* (-1 to 1): The overall balance of arguments in an article related to positions of expert agreement.
 - A score of 1 means that the relevant information contained in the article was entirely aligned with the position of the mainstream expert community, while -1 was entirely against that position.
 - Scores of 0.5 and -0.5 were assigned if there was a notable emphasis in the article for perspectives in either direction, but there is still some evidence of a balancing of perspectives by the journalist.
 - A score of 0 indicated that both perspectives were evenly balanced. Both sides were treated relatively equally in the content of the article.
 - Scores of -1 and 1 were given to articles that took a clear stance against or in favour of the expert position even if alternative perspectives were mentioned simply to discredit them. It was also insufficient to simply note alternative perspectives exist on an issue – the journalist had to spend some space paraphrasing their argument or quoting a source in support. If not, scores of -1 or 1 were assigned.

The final three classes of codes only applied to articles in which an expert was cited to communicate a position on an area on which there is substantial expert agreement (i.e. an expert message).

- *False Balance* (Present/Absent): Contrarian experts were cited by journalists to balance the perspective of expert sources who relayed stances aligned with the expert community.
- *Polarizing opponent* (Present/Absent): Parties, advocacy organizations, or interest groups were cited in opposition to the position of expert sources that are aligned with the broader expert community.
- *Polarizing ally* (Present/Absent): Parties, advocacy organizations, or interest groups were cited in support of the position of expert sources that are aligned with the broader expert community.

All told, the manual coding gives us a clear picture of how often experts appear in coverage to relay important messages of agreement, and how frequently balance and conflict bias in news content muddy communication from experts.

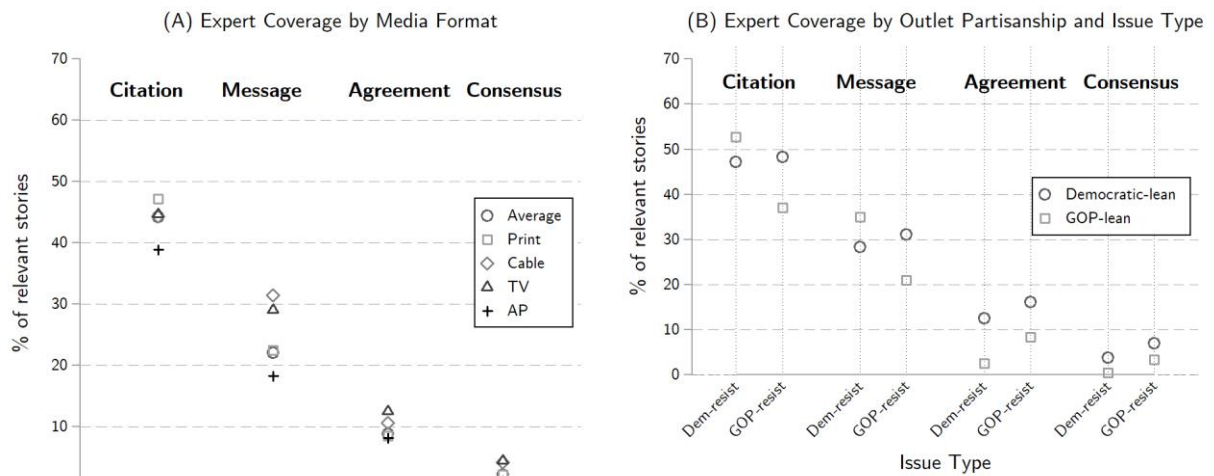


Figure 1.2 Share of relevant coverage with expert citations, messages, and cues. (A) Comparisons across media format for all issues. Average across media types represented by the circle; (B) Comparisons across outlet partisanship for Democratic and GOP-resist issues. Note: All results expressed as a share of relevant news coverage (i.e. coded “1” by the trained classification algorithms).

4 Results

First, I discuss patterns of expert messages and consensus cues across media format, outlet partisanship, and issues. Second, I present the results of the manual coding that dig deeper into the presentation of expert information with a focus on balance and polarizing conflict in news coverage.

4.1 The frequency of experts messages in news coverage

Panel A of Figure 1.2 presents the share of expert citations, messages, and cues across different media formats for all issues combined. The results are expressed as a share of content that the machine classified as relevant to an area of expert agreement. The preliminary automated analysis showed that 44% of relevant coverage cites an expert, averaged across media format and all of the issues used here. This number is slightly lower in AP coverage (38%), and is, on average, higher for science-based news, averaged across media format (64%, not pictured). Not all of these citations reflect information provided by experts about areas of consensus. The share of relevant

coverage with expert messages on an area of agreement as indicated by my manual coding drops to 22%, averaged across media format and all issues. This number is modestly higher in cable (31%) and broadcast news (29%), but it is worth noting that these formats contained far less content relevant to areas of expert agreement at the outset. Cues that signal expert agreement are even less common, as they are present in only 9% of relevant coverage, averaged across media format and all issues. This number is modestly higher in science-based coverage, averaged across media format (17%, not pictured). Clear cues of consensus, for their part, are exceptionally rare – occurring in only 2% of relevant coverage. Again, the number is slightly higher for science-based news (5%, not pictured), averaged across media format, but the result is still far from impressive. Messages from experts signaling information related to an area of agreement are not particularly common, and cues indicating the existence of expert agreement or consensus are rarer still.

There is some evidence of partisan bias in the signaling of messages from experts. Panel B of Figure 1.2 displays the share of relevant news content with expert citations, messages, and cues across outlet partisanship for Democratic and GOP-resist issues, respectively. Republican-leaning outlets (represented by the square symbol in the figures that follow) are less likely to cite an expert when their elites typically stand opposed to the area of expert agreement (37%) compared to Democratic-leaning outlets (48%, represented by the circle), whereas they are more likely to cite an expert than their Democratic-leaning counterparts when their elites tend to be supportive of the expert position (53% vs. 47%). This same pattern holds when looking at messages from experts relaying information about an important area of agreement. Democratic-leaning outlets are more likely to carry agreement and consensus cues than Republican-leaning outlets regardless of issue type. There appears to be some partisan bias across outlets in their citation of experts, but this does not extend to agreement or consensus cues.

There is notable variation across issues in the presentation of expert messages, but this does not take away from the main finding that these cues are not common in news content. Panel A of Figure 1.3 presents the number of expert citations, messages, and cues expressed as a share of relevant news coverage across each of the issues in this study. As noted above, a minority of relevant news stories have an expert citation captured by the automated dictionary analysis (44%), while only half of these have a clear message related to an area of expert agreement based on my hand coding (22%). Only a fraction of these cues have a signal of agreement within the expert community (9%), and far fewer explicitly state there is majority or consensus agreement (2%). The story is modestly better in vaccine (87%, 65%, 19%, and 6%) and climate change coverage (71%, 61%, 39%, and

13%). However, agreement cues only exceed 10% of coverage on these two issues and GMOs (13%). Agreement and consensus cues are only robustly used in climate change coverage.

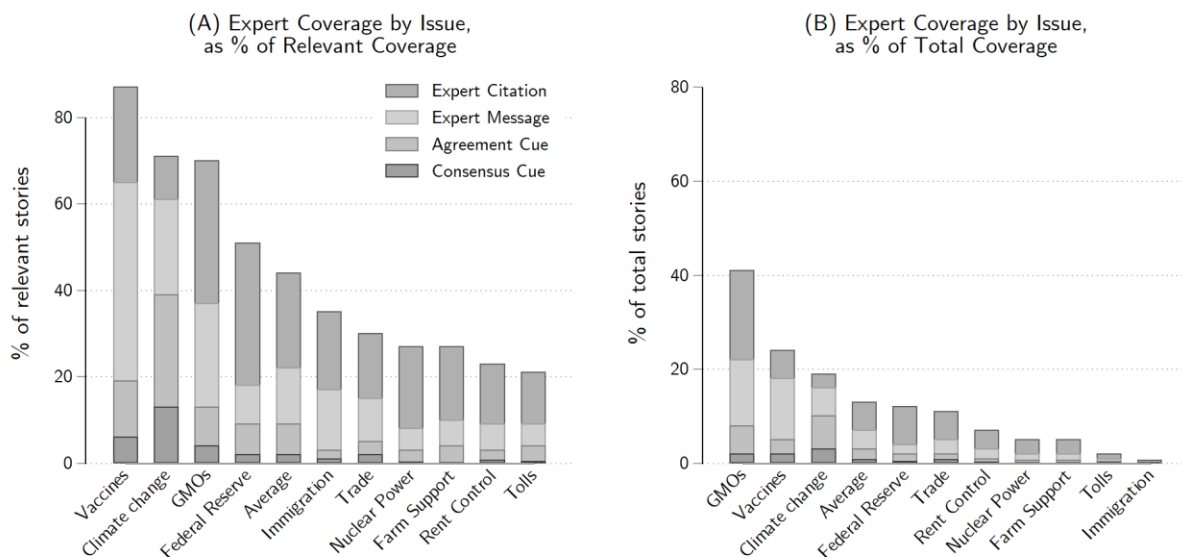


Figure 1.3 Prevalence of expert citations, messages, and cues in news coverage. (A) As a share of relevant coverage (i.e. coded “1” by the trained classification algorithms). (B) As a share of total coverage downloaded from *Lexis* and *LexisNexis Academic* using keywords and subject tags. Note: Expert citation means the automated dictionary picked up a reference to an expert in a news story, while expert message means the hand coding revealed a message in an article by an expert that was relevant to a position of expert agreement.

The story is even worse when accounting for the fact that news coverage on these issues does not usually contain content relevant to an important area of expert consensus. Panel B of Figure 1.3 displays the prevalence of expert citations, messages, and cues, expressed as a share of the total volume of coverage gathered from *Lexis* and *LexisNexis Academic* using a variety of keywords and subjects tags indicating relevance for a policy area. Only a minority of stories contain both an expert citation and content relevant to the consensus in the expert community (13% of the total). Of these, only half contain messages from experts that speak to the area of agreement (6.5% of the total), only a fifth have a cue that signals expert agreement (3% of the total), and 1 in 20 have a clear consensus cue (0.6% of the total). Again, there is variation across issues. The media does the best job on these metrics in its coverage of climate change (27%, 19%, 16%, 10%, and 3%) and vaccines (28%, 24%, 18%, 5%, and 2%) and the worst in its coverage of immigration (20%, 1%, 0.47%, 0.09%, and

0.04%) and nuclear power (31%, 5%, 2%, 0.6%, and 0.45%). Cues that signal the existence of expert agreement are simply not that common, even when coverage is relevant to this position (RQ1).

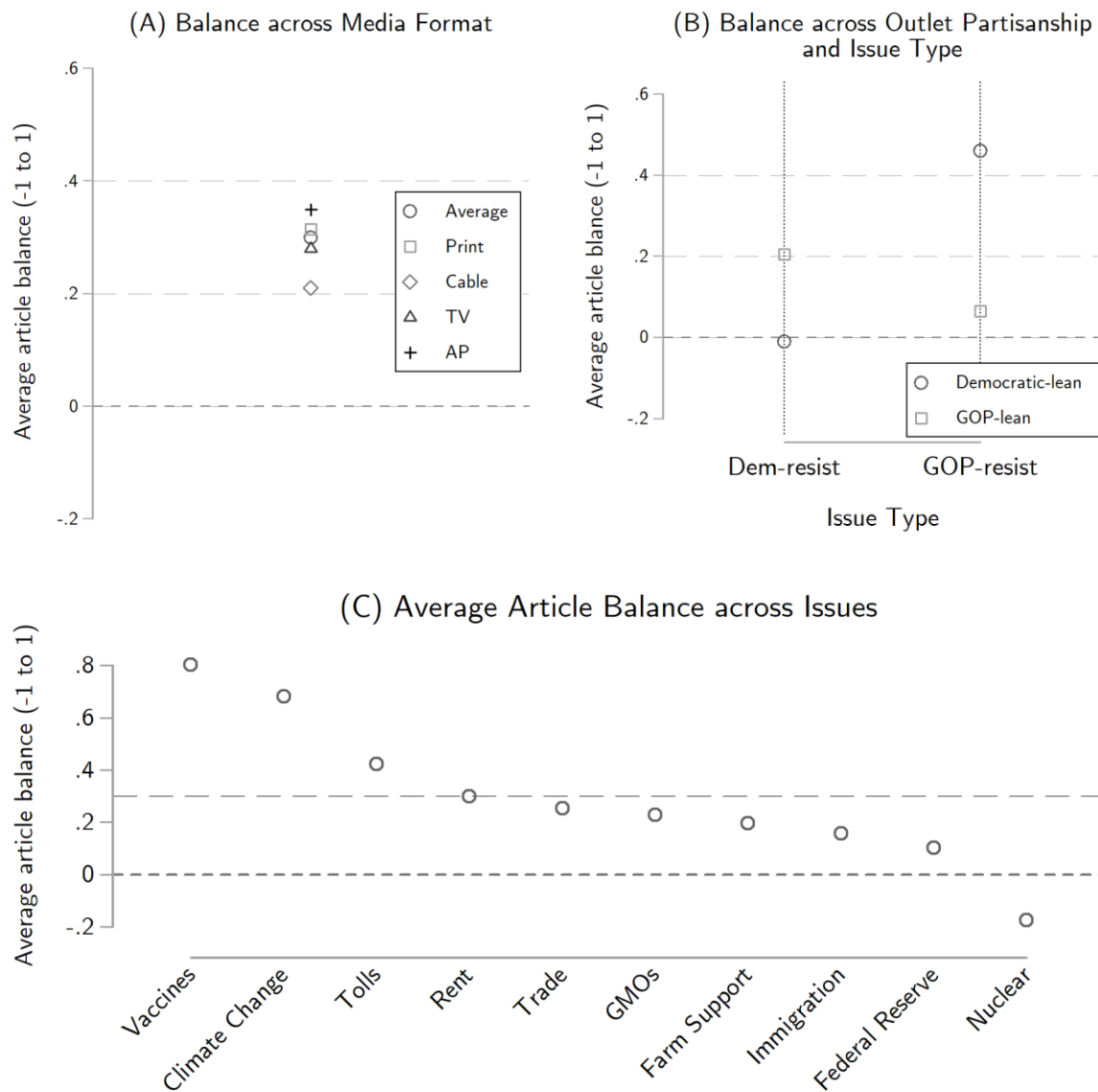


Figure 1.4 Average article balance in relevant news content with expert references. (A) Comparisons across media format for all issues. Average of all media types represented by the circle. Solid line at 0 represents balanced coverage, on average. (B) Comparisons across outlet partisanship for Democratic and GOP-resist issues. Solid line at 0 represents balanced coverage, on average. (C) Comparisons across issues. Dashed line represents the average across all issues. Note: Scale runs from -1, where all arguments in the news story reject the expert position, to 1, where all arguments support the expert position. 0 represents a relatively equal balance of perspectives.

4.2 Balance and polarizing conflict in news coverage of experts

So far the story presented has been rather bleak. The media does not often carry messages from experts, and it is rarer still that they convey information about expert consensus (RQ1). This is true even when coverage is directly relevant to the consensus at hand. Scholarship seeking to explain why experts and the public are often offside need to account for this important deficiency in the information environment, rather than attributing it almost entirely to the motivational deficiencies of average citizens.

However, there is one area where the media at least partially defy pessimistic expectations: balance (RQ2). To be sure, most articles displayed some balance of perspectives in favour and opposed to the stance of the expert community, but emphasis in either direction could be detected in around 80% of news stories. Only 21% of articles were effectively balanced in their presentation of positions in favor and opposed to the stance of the expert community. Journalists typically orient coverage in favor of the position of the mainstream expert community. 56% of articles emphasize arguments that support the expert position compared to 23% that emphasize arguments opposed to areas of expert agreement across the issues used here.

Panel A of Figure 1.4 presents the average balance score for news stories across different types of media format for all issues combined. This score ranges from -1, where all arguments used in the news story reject the expert position, to 1, where all arguments support the expert position. 0 means that, on average, coverage is effectively balanced between positions in support of and opposed to the expert position. The media scored 0.3 on this measure, averaged across format and all issues, indicating a modest orientation towards the expert position in news coverage. Balance is more common in cable news, as we would expect, averaged across issues (0.2). Articles are also somewhat more reflective of the expert position on natural science issues, averaged across media format (0.37, not pictured), but as we will see, this number varies substantially by issue.

Balance also varies across outlet partisanship, but not in ways that diminish the main finding that the news media generally orients the tenor of coverage towards expert positions. Panel B of Figure 1.4 presents the average balance score for news stories across Democratic and Republican-leaning outlets for issues where expert messages are resisted by Democratic and Republican elites, respectively. On issues where Democratic and liberal elites are more likely to resist experts, Democratic-leaning outlets average much closer to balance (-0.01) than their GOP-leaning counterparts (0.20). On issues where Republican and conservative elites are more likely to resist experts, GOP-leaning outlets average much closer to balance (0.07) than their Democratic-leaning

counterparts (0.43). In sum, the media does emphasize arguments supported by experts compared to those they oppose (RQ2), but there are subtle differences across outlet partisanship and format.

There is also variance across issues. Panel C of Figure 1.4 displays the average balance score for news stories across issues, where the dashed line indicates the average across all of these issues (0.3). Climate change and vaccine coverage appear to be the most reflective of mainstream expert positions (0.61 and 0.80), and the climate change score rises to 0.87 when excluding *Fox News*, whose coverage of climate change is unsurprisingly oriented against the expert consensus (-0.17). In contrast, nuclear power coverage leans modestly against the position of the expert community (-0.18). This illustrates that there is no clear dividing line between issues of natural science and economics. The safety of GMOs and nuclear power are far more contested in news coverage than the reality of climate change or the safety and efficacy of vaccines.

How likely are journalists to engage in much maligned *false balance* by citing contrarian expert sources (RQ2)? It turns out that it is not as common as we might expect. Panel A of Figure 1.5 plots the share of coverage with expert messages characterized by false balance across different media formats for all issues. False balance only occurs in 22% of coverage where expert messages are featured, averaged across media format and all issues. The prevalence of false balance is relatively consistent across media format with the exception of being markedly higher in cable news (36%).

As was the case with the overall article balance scores, there is some evidence of partisan bias. Panel B of Figure 1.5 displays the share of coverage with expert messages that is characterized by false balance across the partisan lean of outlets for issues where Democratic or Republican elites resist expert messages, respectively. Democratic-leaning outlets are much more likely to engage in false balance when Democratic elites resist expert messages (44%) compared to issues where Republicans are resistant (20%). Republican-leaning outlets cite contrarian experts at relatively equal rates across both types of issues. There is also variation across issues. Panel C of Figure 1.5 shows the prevalence of false balance for each of the issues used here. False balance is notably higher than the average on three issues: GMOs (40%), nuclear safety (38%), and immigration (33%), while rates of false balance in climate change and vaccine coverage are below the average of 22% represented by the dashed line in the figure. The contrast between the relatively high rates of false balance in GMO coverage and low rates in climate change (19%) and vaccine coverage (13%) are striking given the fact that most scholarly attention has focused on the latter two issues.

Journalists may not often provide coverage of expert agreement or consensus (RQ1), but when they do, they typically orient such coverage towards the position of the expert community and

resist the use of contrarian expert sources – a tendency which is overwhelming in climate change and vaccine coverage (RQ2). Differences in opinion between experts and the public may well, in part, be explained by inadequacies in news coverage, but norms of balance likely play second fiddle to the overwhelming tendency of the news media to ignore expert agreement.

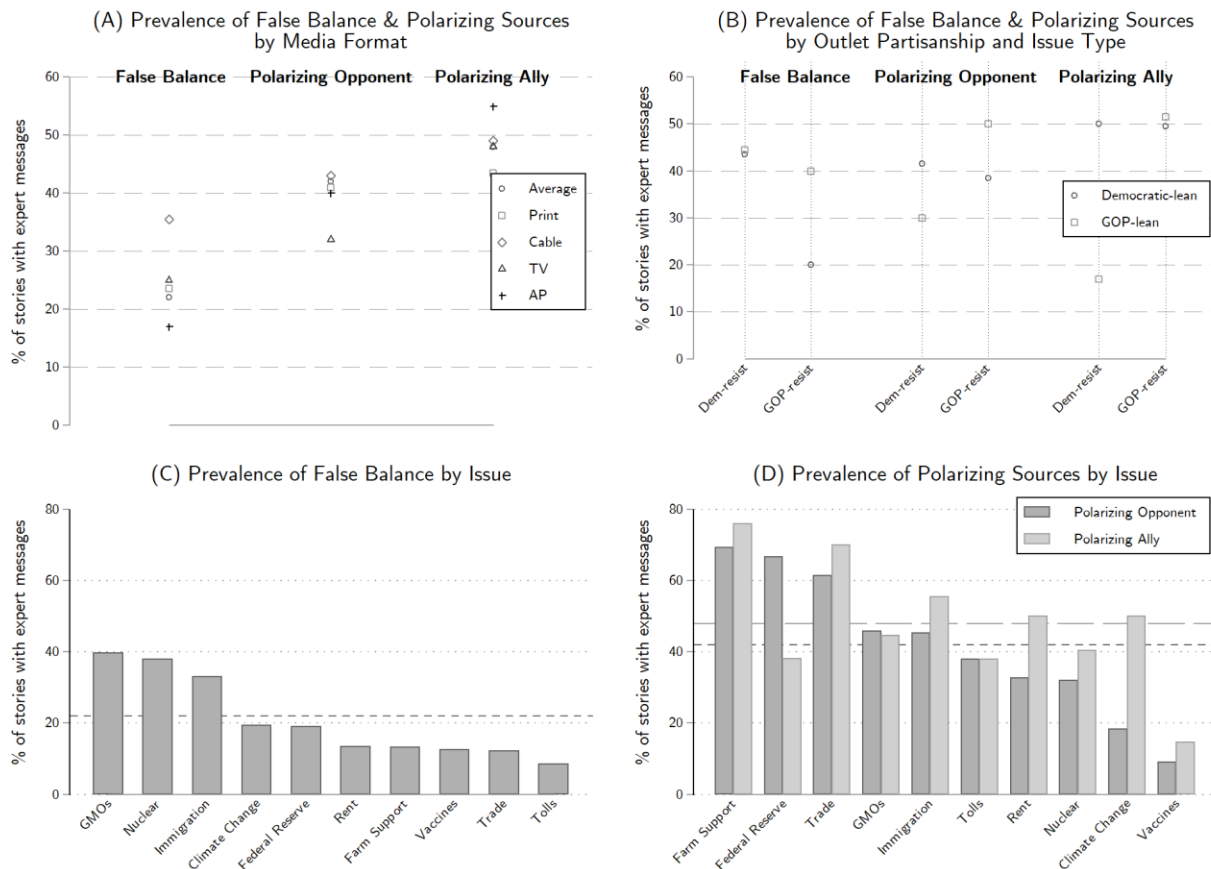


Figure 1.5 False balance and polarizing political sources in relevant news content with expert messages. (A) Comparisons across media format for all issues combined. Average across media types represented by the circle. (B) Comparisons across outlet partisanship for Democratic and GOP-resist issues. (C) Prevalence of false balance across issues. Dashed line represents the average. (D) Prevalence of polarizing sources across issues. Dashed line represents average for polarizing opponent. Dotted line represents average for polarizing ally. Note: All results expressed as a share of coverage with a message from an expert related to an area of expert consensus.

It is comparatively more common for journalists to satisfy their norm of balance by citing political actors opposed to the expert position (RQ3). Panel A of Figure 1.5 displays the share of coverage with expert messages that feature polarizing political opponents across different media formats. 42% of news stories with expert messages also have polarizing opponents, averaged across

media format and all issues. This number is comparatively higher in cable news, averaged across issues (49%). Coverage of science-based issues is also less likely to feature polarizing opponents (31%, not pictured). Panel B of Figure 1.5 plots the same share across outlet partisanship for issues that Democratic or Republican elites resist expert messages, respectively. Democratic-leaning outlets are more likely to cite a polarizing political opponent when Democratic elites resist expert messages (42%) compared to Republicans-leaning outlets (30%). The reverse is true on issues when Republican elites oppose the expert position (38% vs. 50%). Panel D of Figure 1.5 plots the substantial variation that exists across issues on this dimension with the average indicated by the dashed line (42%). The citation of polarizing opponents is typically more common for economic issues like farm support (69%), Federal Reserve independence (67%), and trade (62%), while it is less common in articles about climate change (18%) and vaccines (9%). There is a clear divide between economic and science issues, with the former more frequently citing polarizing opponents.

The tendency of the media to anchor news in political conflict goes both ways. In many cases the views of sympathetic party elites, interest groups, and advocacy organizations are also mentioned alongside experts (RQ3). Panel A of Figure 1.5 plots the share of relevant coverage containing expert messages across media format that feature a polarizing ally for all issues. Almost half of news stories with expert messages contain signals from supporting political actors, averaged across media format and all issues used here (48%). This is consistent across media format, though it is somewhat lower for science-based issues (37%, not pictured). Panel C of Figure 1.5 displays the considerable variation that exists across issues on this dimension with the average indicated by the long dashed line. Typically issues with heavy citation of polarizing opponents also use polarizing allies as sources with one important exception: climate change. On this issue polarizing allies are far more likely to be covered by journalists than opponents (50% vs 18%). This sets it apart from vaccine coverage, which is, on the whole, non-politicized. Whether or not supporting political cues may undermine the persuasiveness of expert messages is a topic that has not been addressed in experimental research. It deserves further inquiry as it is a common feature of news coverage.

5 Discussion

There is little doubt that aggregate public opinion can often be at odds with expert opinion on a wide variety of important issues. Most research that has tackled this problem views it primarily as one of information processing. Segments of the public are often motivated to resist messages from experts for reasons of ideology and partisanship. Motivated skepticism is, to be sure, part of the

problem, particularly on highly salient issues like climate change. But neglected in this narrative is the information environment. Lacking policy specialists in their social circles, most citizens learn about complex political issues from the mass media, which is typically resistant to covering relevant context that lacks drama and conflict – much like the existence of expert agreement.

Further, the media may be predisposed to providing balance in news content by citing contrarian experts or by presenting expert opinion as one of many perspectives in a charged political conflict. The former may confuse readers and viewers as to the true position of the expert community, while the latter may prime citizens to resist messages from experts at odds with the elites they support and their partisan and ideological identities. The lack of congruence between experts and the public may, in part, be an information problem on many policy issues. The public simply is not being informed about important areas of expert agreement in many policy domains or at least not in ways that are conducive to unbiased information processing.

Perhaps the most significant finding in the data presented above is how unusual it is for media to present relevant information from experts when they are in agreement. This paper represents the first effort to systematically examine news coverage of a wide range of issues with substantial expert agreement from a large variety of outlets. Out of all stories about issues like climate change, immigration, and international trade, only a minority have expert citations (38%) and even fewer contain both an expert citation and content relevant to the consensus in the expert community (13%). Of these, only half contain messages from experts that speak to the area of agreement (6.5%), and only a fifth have a cue that signals expert agreement (3%). Expert cues are relatively more common in vaccine and climate change coverage, with agreement and consensus cues appearing primarily in the former, but even still the overall numbers are not that impressive. If we were to read 100 stories on a policy issue, on average we would only encounter an expert message related to an important area of expert agreement seven times, and a clear signal that there is agreement among experts three times. Clear signals of expert consensus that could allow citizens to update their policy opinions are rare indeed.

It may well be true that cognitive failures of citizens explain part of the gap that exists between expert and public opinion – either by not having enough motivation to pay attention or by having too much directional motivation whereby they reject expert information they are given. But it is also likely true that deficiencies in the information environment play an important role as well – citizens simply won't often encounter information about expert consensus in the venue where most of them learn about politics and policy (RQ1).

When journalists do cover experts, their signal is not clouded by balance as much as we may think (RQ2). On the whole, the press place considerable emphasis on arguments supportive of the expert perspective (0.30 on the -1 to 1 scale of balance), with over half of stories exhibiting some emphasis on perspectives related to positions of expert agreement on the issues used here. There is no doubt that a norm of balance operates to a degree, as most articles provide some effort to illustrate arguments for and against positions of expert agreement, but it would be a mistake to then assume that most articles contain an equal balance of perspectives. Only a minority of stories have an approximation of balance on these issues (20%). Again, there is some meaningful variance across issues. In particular, coverage of climate change (0.84, Fox excluded) and childhood vaccinations (0.80) stand out for having coverage that strongly emphasizes positions of expert agreement and that largely ignores critics. Balanced coverage of climate change is primarily confined to the conservative media echo chamber – represented here by Fox News (-0.13). It is ultimately beyond this scope of this research to judge whether or not news coverage on this dimension is sufficient. Technocrats may think any effort at balance is misguided and those attached to norms of balanced coverage may believe any emphasis on certain perspectives is problematic. What can be said is that any impression that the media provides truly balanced coverage on issues involving agreement among expert communities is misguided and this is especially true for climate change and vaccines.

And what actors are cited in opposition to mainstream, expert communities? Surprisingly, instances of dreaded “false balance” between experts and contrarian specialists are relatively uncommon (RQ2, 22%), at least compared to the citation of opposing polarizing actors (RQ3; 42%). The former number is higher for science-based issues, but this is driven primarily by higher levels of false balance in coverage of the safety of GMOs (40%) and nuclear power (38%), compared to climate change (19%, Fox included) and vaccines (13%). Although most scholarly work on false balance has emphasized its prevalence in climate change coverage, it appears that this issue is much more salient on other issues like GMOs. More often than not, however, the media balance expert perspectives against those of political actors (RQ3) rather than other experts (RQ2).

The results above are reasonably consistent across outlet format. However, there is some modest evidence of partisan or ideological bias. First, Republican-leaning outlets are more likely than their Democratic-leaning counterparts to use expert messages when Democratic elites are aligned with the expert community. The reverse is true on issues where Republican elites are in line with expert opinion. Second, outlets are more likely to provide balanced coverage, on average, on issues where they are ideologically predisposed to resisting expert messages. In this sense, balance should

not only be seen not as the result of an important norm in journalism, but rather a manifestation of outlet bias. The differences are substantive, but do not take away from the general tendency of the media to orient coverage in favour of positions with expert agreement – a pattern that is overwhelming in the case of climate change and vaccines.

This work provides a necessary corrective to studies that have examined the link between experts and public opinion. The findings should warn us away from putting too much focus on oft touted notions of false balance. Rather, the dominant problem in media coverage of issues with expert consensus is a stunning lack of coverage of pertinent expert agreement. This should not completely shock us, however. Scholars have long cautioned us that the news media often lack the willingness to provide important context in its coverage of political issues and policy debates. These findings should also warn us away from stylized experiments where subjects are exposed to an even balance between experts and their contrarian counterparts. This is almost never how citizens encounter expert information in the news. These designs lack a critical component of external validity that make it difficult to draw links between findings and real world opinion formation.

At the same time, the results can point us in some interesting directions for future experiments that examine the public's processing of expert information. Experiments can be built with stimuli that reflect the patterns in the data presented here. This would enable scholars to answer questions such as the following: Does the endorsement of polarizing political actors of expert consensus undermine the effectiveness of expert messages? Does an endorsement of GMOs by Monsanto, or climate change by Democratic elites weaken the power of consensus information for those mistrusting of those actors? For another, does the citation of polarizing opponents dilute the effectiveness of consensus information similar to the practice of false balance? Future experiments should account for the fact that expert information is often presented in the context of a political debate between competing interest groups and parties. It is not presented in isolation.

There are often large, problematic gaps between expert and public opinion across a range of issues. In order to fully understand why they exist, scholars need to take the information environment seriously and design treatments rooted in such analyses. Only then can journalists, educators, science communicators, analysts, and policymakers advance an agenda that can effectively address the problem.

Paper II

Party cues in the news: Explaining the dynamics of climate change skepticism

with Dominik A. Stecula

1 Introduction

Political communication scholars have long drawn our attention to well-known regularities that exist in the news media's coverage of political issues. Journalists will heighten the lines of conflict in stories to service the tastes of news consumers in order to sell newspapers and garner 'clicks' (Bagdikian 2004; Shoemaker 1996). Prominently featured in such coverage are official sources and their allies that journalists come to depend on for content – party elites, ideological groups and think tanks – who compete to frame political debates on their terms (Althaus et al., 1996; Bennett, 1990; Entmann, 2003). In short, citizens are exposed to *polarizing* political discourse. And, because many citizens learn about politics through their exposure to news content, we might expect polarization in their attitudes as a consequence.

Against this backdrop is a puzzle that has perplexed scholars and science communicators – the polarization of American public opinion on climate change. Surveys continue to show that an overwhelming majority of Democrats believe climate change is happening, while less than 50 percent of Republicans concur. This number is even lower among the most conservative supporters of the GOP.⁷ It was not always this way. A Gallup poll from 1997 shows that 44% of Republicans believed that scientists thought of global warming as a serious threat, slightly higher than the percentage of Democrats sharing the view (39%).⁸ That year, the gap between strong partisans on whether they believed global warming was real was only 5 percent, with 73% of Democrats and 68% of Republicans believing that global warming had been happening (Krosnick et al., 2000). What exactly happened in the United States that promoted the polarization on climate change and the embrace of climate skepticism by a sizable segment of the public?

We argue that the news media plays a role in this process by communicating polarizing information to the American public on climate change. Scholars have identified a number of

⁷ See, for example [here](#) or [here](#).

⁸ In this paper, we use the terms global warming and climate change interchangeably.

possible factors that may undermine popular acceptance of the scientific consensus on climate change: ideological conflict (Campbell & Kay, 2014; Oreskes & Conway, 2010); organized climate skeptics and their messages of scientific uncertainty (Dunlap & Jacques, 2013; Dunlap & McCright, 2011; Farrell 2016a, 2016b; Jacques, Dunlap, & Freeman, 2008); and frames emphasizing the cost of mitigation often put forth by Republican elites and their allies (Davis, 1995; Nisbet, 2009; Vries et al., 2016). More recently, analysts have highlighted the possible importance of party elite cues (Carmichael & Brulle, 2017; Merkley & Stecula, 2018; Tesler, 2017). We know that each of these factors has the potential to undermine popular support for the climate change consensus due to a growing body of important experimental research. However, little work has systematically examined media content to evaluate the degree to which each of these influences are accessible to Americans in their information environment and how that may have changed over time.

In this paper, we provide evidence that party elite cueing through the news media may help us understand the dynamics of polarization of global warming attitudes among Americans. We begin by outlining several of the predominant theories in science communication that have sought to explain climate skepticism and polarization between Republicans and Democrats. We introduce our alternative explanation – opinion formation via the influence of party elite cues, and set out a number of research questions that guide the work that follows, among them: 1) how often does polarizing information appear in climate change news coverage? 2) Is such information trending over time, or 3) associated with the salience of climate change? 4) Are there any notable differences across media format and ideological slant? And 5) are over time dynamics in aggregate climate change skepticism and polarization associated with the dynamics of any of our classes polarizing information after controlling for other factors?

After this set up, we introduce our corpus of news articles on climate change and outline our measurement strategy to capture polarizing information in news content using dictionary methods and supervised machine learning. We illustrate the prevalence of each class of polarizing information and patterns in their emphasis in news content over time. We also use time series cross-sectional panel methods to illustrate whether there are any significant differences in the use of polarizing information over time and across different types of news outlets. We supplement our automated analyses with the manual coding of messages from polarizing sources like parties and organized climate skeptics. Taken together, these results suggest party elite cues are the most readily available polarizing influence in the news media environment. Their presence has increased over time and tracks with variation in the salience of climate change. This is particularly true for cues from

Democratic elites, which, unlike those from Republicans, uniformly take a consistent stand on climate change.

Finally, we outline five different aggregate measures of public opinion on climate change constructed with James Stimson's approach of aggregating public opinion polling on policy questions. We show, using time series modeling, that party elite cues – particularly those from Democrats – are consistently associated with aggregate skepticism of climate change, Republican perceptions of climate change threat, and partisan polarization, after controlling for other factors. Analyses based on vector autoregression suggest that, at least for Republican identifiers, elite cues lead rather than follow attitudes towards climate change. These results, when combined with observational evidence that polarization is strongest among those most attentive to the news and experimental work that shows elite cues can move public opinion on climate change (Tesler, 2017), provide compelling evidence of a powerful role of party elites in shaping American attitudes towards climate change.

2 Mass media and the determinants of climate change attitudes

Many explanations of climate change polarization and Republican skepticism of climate science are rooted in the nature of media coverage of the issue. There is a vast literature on the role that the media play in shaping public opinion. Its importance lies in the fact that the mass media have a virtual monopoly on the presentation of many kinds of information, especially for non-salient and specialized policy areas where the public may lack in-depth knowledge (Kahlor & Rosenthal, 2009; Jang, 2014; Ho et al., 2008; Lee & Scheufele, 2006; Nisbet & Myers, 2007; Zhao et al., 2011).

There are strong theoretical reasons to believe the media may convey information that polarizes Americans. News content is moulded by newsroom realities. For one, scholars have noted that the sources of journalists play an important role in shaping the news (Shoemaker & Reese, 2011), and this is particularly true for official sources (Althaus et al., 1996; Bennett, 1990) and their allies among interest groups and think tanks (Entmann, 2003). For another, technological change has fragmented the media marketplace (Bennett & Iyengar, 2008) and sharpened competition between outlets, making journalists and editors increasingly responsive to the tastes of consumers (Bagdikian, 2004) who privilege drama and negative information (Shoemaker, 1996; Soroka, 2014). Journalists also prize a norm of objectivity (Giannoulis et al., 2010; Schudson, 1978), which serves as

a mechanism to protect journalists' credibility, preserve access to sources (Hallin, 1986; Shoemaker & Reese, 2014), and heighten the drama of coverage (Boykoff & Boykoff, 2007).

Theories of news content lead us to expect prominent coverage of polarizing information. Here we identify four possible polarizing factors that have distinct literatures in climate change communication.

2.1 Party cues

First, we have a strong expectation that climate coverage increasingly contains cues from party elites. Politicians are important official sources for journalists and they add drama and conflict to any given story. Further, climate change has morphed over time from a story strictly about science to one featuring policy debate, necessitating the citation of policy makers. An increasing availability of these cues, however, could have substantial consequences.

Citizens learn from party elites. Many people use party elite cues as cognitive short cuts to make decisions in a low information context (Berinsky, 2009; Cohen, 2003; Conover & Feldman, 1989; Kam, 2005; Lupia, 1994; Lupia & McCubbins, 1998; Nicholson, 2012; Popkin, 1991). And their strong affect-oriented attachments to parties guide their information processing (Iyengar et al., 2012; Lodge & Taber, 2014). They are instinctively persuaded by elites they trust and dissuaded from those they do not, which is why both in-group and out-group party elites have been shown to have tremendous persuasive power (Berinsky, 2009; Cohen, 2003; Nicholson, 2012). It is the news media that communicates these signals when it indexes elite debate (Althaus et al., 1996; Bennett, 1990; Dalton et al., 1998).

There are some signs that partisan cueing may play an important role in polarizing Americans on climate change specifically. First, surveys have shown that the gap between Democrats and Republicans beliefs in the seriousness of the climate change threat is highest among politically attentive respondents (Guber, 2013) and those that consume the most news (Tesler, 2017). We would expect partisan cueing to be more influential among politically attentive citizens because they are the most attuned to signals from elites (Berinsky, 2009; Zaller, 1992). Second, research has found that concern about climate change varies based on legislative activity like congressional roll call votes and committee hearings – behavior that is covered by the media to some degree (Carmichael & Brulle, 2017). Finally, there is some experimental evidence that softening Republican elite positions

on climate change has the potential to change Republican attitudes towards climate science (Tesler, 2017).

2.2 Ideological identity cues

We should also expect a rise of ideological group cues in climate coverage, in addition to those of from party elites. Situating climate change in the context of ideological conflict serves the media's need for drama-laden coverage. A proliferation of ideological cues would also be anticipated given the shift in the elite debate towards policy solutions with ideological implications and due to the rising salience of ideological conflict in American politics more broadly. Ideology has been a dominant focus of climate change communication literature. The policy implications of climate change are not easily compatible with free market orthodoxy (Campbell & Kay, 2014; Oreskes & Conway, 2010). As a result, citizens interpret certain facts, like the existence of expert consensus, through the lens of their ideological preferences and social group membership (Kahan, 2013). They may even seek out information from contrarian sources to bolster their prior attitudes (Kahan et al., 2011).

However, these theories do not get us very far in explaining dynamics – or why conservatives became increasingly hostile to climate science over time. Republicans were as likely as Democrats to see climate change as a serious problem as late as 1997 (Krosnick et al., 2000), while economists and some conservative intellectuals champion market-friendly ways of reducing greenhouse gas emissions. Citizens learned to connect their conservative values to resistance to climate action. The media may play a role in this process by disseminating cues related to ideological identities from elites that allow people to link climate change to their underlying worldviews. Prior work has not examined the prevalence of ideological identity cueing in climate change coverage.

2.3 Organized climate skeptics

Perhaps the influence on climate change polarization that has captured the most attention from science communicators has been the campaign of an interconnected web of fossil fuel industry-supported advocacy groups and think tanks to cast doubt on climate science – the infamous “Merchants of Doubt” (Oreskes & Conway, 2010). In this account, a well-financed network of conservative groups allied with the fossil fuel sector to support the research of contrarian scientists

and frame climate policy in the news in terms of scientific uncertainty (Dunlap & McCright, 2011; Dunlap & Jacques, 2013; Farrell, 2016a, 2016b; Jacques et al., 2008).

There are strong theoretical reasons to expect the messages of these actors to appear readily in climate coverage. Citing these sources allow journalists to adhere to their professional norm of balance, which allows them to avoid charges of bias (Boykoff, 2007; Boykoff & Boykoff, 2004, 2007). It also serves their tendency to frame issues in terms of conflict by pitting scientists against contrarian experts supported by industry (Antilla, 2005; Bennett, 2007; Ward, 2008; Zehr, 2000). Whatever the cause, this practice allows voices not aligned with the scientific consensus to be heard disproportionate to their influence in their own disciplines. This creates an impression in the public that scientific opinion on climate change is more divided or unsettled than it really is (Antilla, 2005; Koehler, 2016; Ward, 2008). That being said, little in the way of systematic evidence has been gathered to assess how successful these actors have been in getting their message reflected in news media content.

2.4 Economic cost framing

Finally, the media are likely to carry frames in its news coverage that emphasize the economic cost of policy action on climate change. Scholars have shown that the public's willingness to tackle the problem is limited by both poor economic conditions and the cost of climate mitigation (Brulle et al., 2012; Carmichael & Brulle, 2017; Elliott et al., 1997; Guber, 2013, Scruggs & Benegal, 2012; for a contrary take see Mildenberger & Leiserowitz, 2017). Framing – the emphasis in news content or rhetoric on certain dimensions of a policy debate at the expense of others – has been shown to be an important influence on public attitudes on a wide variety of issues (see Busby et al., 2018, and Scheufele & Iyengar, 2014 for reviews). There is also some evidence that this applies in the environmental policy context (Davis, 1995; Vries et al., 2016). As a result, political actors and interest groups hoping to undermine support for climate change are likely do so by emphasizing the cost of climate mitigation policy in their rhetoric. These messages get communicated to the public as the media typically index elite debate (Althaus et al., 1996; Nisbet, 2009). Economic cost frames

communicated through the media may play its own role in polarizing the public independent of actual economic conditions.

2.5 Research questions

There has been very little work examining the prevalence of our four potential polarizing factors in news media coverage in the form of source cues and frames. This omission is problematic because the news media are the primary avenue for information for most citizens on abstract and complex policy topics, such as climate change. This fuels three of our major research questions for the remainder of paper:

RQ1: How prevalent in news coverage are our four classes of potentially polarizing information? Important influences on climate polarization should be reflected in a reasonable degree of climate coverage. At a minimum they need to be readily available for news consumers to be influential.

RQ2: How has frequency of coverage of polarizing information changed over time? Important influences on climate polarization have likely increased over time. This is a weak expectation because overall salience has not been constant across time.

RQ3: Is there an association between these classes of polarizing information and climate change salience? Public opinion crystallizes in periods of high salience because members of the public are exposed to a higher volume of news content about a subject. Important influences on climate polarization are likely associated with higher levels of issue salience.

There is also likely to be considerable variance in the availability of polarizing information across media that is worth exploring. We have some expectation of important differences across media format and outlet ideology. First, scholars have shown that cable news tends to cater to partisan and politically engaged audiences (Levendusky, 2013; Prior, 2013). Thus, these sources are probably more likely to carry partisan and ideological group cues. Second, cable news is more orientated towards conflict, and so may be inclined to cite opposing climate skeptics (Feldman et al., 2012; Sobieraj & Berry, 2011). The television format may also be more conducive to providing

balanced coverage (Bennett, 2007), so broadcast news may similarly feature more climate skeptics. Third, scholars have emphasized the role of conservative media in the climate change countermovement (Dunlap & McCright, 2011), and thus they may be more likely to cover climate skeptics and denialists. Finally, we know that economic frames are prevalent in climate change discourse, and opposing actors have used discussion of costs to stir opposition to mitigation policy (Nisbet, 2009). Conservative media may be more likely to carry such themes in their coverage. This discussion leads us to our fourth major research question:

RQ4: Are there differences in the prevalence of polarizing information across media format and outlet ideology? We expect that cable news will more readily carry potentially polarizing information due to the medium's emphasis on conflict. Conservative media should also be more likely to carry polarizing information clearly geared towards undermining climate science, like cues from organized skeptics and frames that emphasize economic costs of climate mitigation.

After identifying possible sources of climate change polarization we can put possible causal claims to a stronger test. We might expect the prominence of each of our potential "polarizers" to be associated with climate skepticism in the aggregate over time after controlling for other possible influences.

RQ5: Is there an association between the dynamics of our classes of polarizing information and aggregate climate skepticism after controlling for other factors?

The dynamics in polarizing information should be associated with climate skepticism over time if they are a significant influence in the polarization of aggregate public opinion.

These five questions guide the analyses that follow. We start by introducing our media sample and examining changes in the volume of coverage over time. We then introduce our measures of four potential polarizing influences in media coverage and explore their prevalence across media and over time. Finally, we use time series models to show a strong association between party cues and different measures of climate skepticism after controlling for other factors we think may be

important. Our analysis of the media environment point to an important role of party elites in polarizing the American public on climate science.

	Start date	Ideology	Circulation (March 2013)	# of articles
New York Times	1980	Left	1,613,865	4,190
Washington Post	1980	Left	462,228	3,488
San Diego Union-Tribune	1983	Right	250,678	1,068
Los Angeles Times	1985	Left	641,369	2,653
Chicago Tribune	1986	Right	411,960	1,767
Houston Chronicle	1991	Right	325,814	1,461
Wall Street Journal	1991	Right	2,293,798	1,200
USA Today	1989	N/A	1,713,833	1,009
Dallas Morning News	1992	Right	410,130	590
Detroit Free Press	1994	Left	215,401	543
CNN	1990	Left		868
Fox News	1997	Right		661
MSNBC	2000	Left		166
ABC	1986	N/A		599
CBS	1990	N/A		461
NBC	1997	N/A		504
Associated Press	1980	N/A		5,385
Total				26,613

Table 2.1 News media sources. Note: newspaper circulation numbers gathered from a report from the Alliance of Audited Media. Newspaper ideology categorized based on Gentzkow and Shapiro (2010) slant scores.

3 Climate change coverage in the news media

We believe an examination of the climate change media environment is essential in understanding American climate change polarization, so we gathered all stories from the sources listed in Table 2.1 that referenced climate change or global warming in the *LexisNexis* subject tags and in the body of the text. In an effort to examine a broad slice of the media environment, we focus not only on major daily newspapers, but also the *Associated Press* (AP), the largest newswire service in the U.S., several high-circulation regional papers, and network television and cable news transcripts. We ensured that all the articles and transcripts were relevant (i.e. were explicitly focused on climate change) through a combination of manual coding and machine learning using *RTextTools*. Since many cable transcripts in *LexisNexis* were of entire broadcasts, not just segments dedicated to

climate change, we developed a *Python* script to trim each transcript to contain only relevant parts.⁹ The resulting dataset included 1,564 broadcast transcripts, 1,695 cable transcripts, and 23,354 newspaper and newswire articles. Though we certainly have not covered the media environment in its entirety, these 17 sources are popular and highly influential. They also represent a mix of conservative and non-conservative media. In all, we cover a substantially larger portion of the media landscape than any previous examination of the topic.

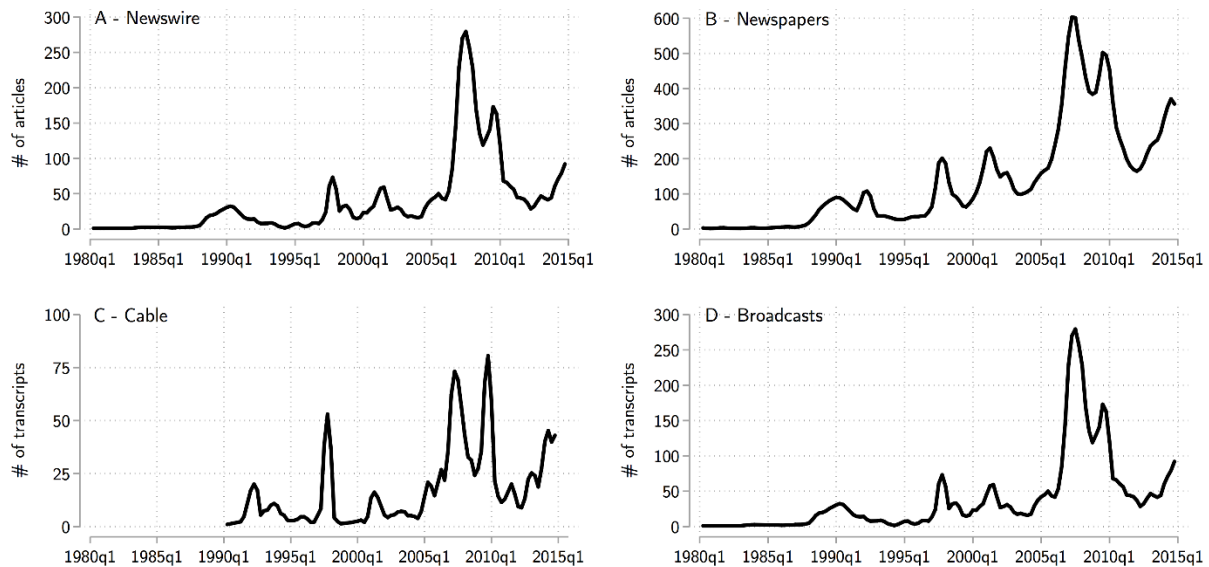


Figure 2.1 Total climate change coverage. A) Associated Press; B) Print; C) Cable; D) Broadcast television. Note: All series lowess smoothed at a 0.05 bandwidth.

Figure 2.1 paints a detailed picture of the annual coverage of climate change in both television news as well as in the high circulation daily newspapers. Coverage of the topic was trivial until the late 1980s. It was at this time that NASA climatologist James Hansen testified before Congress to warn of the reality and dangers of a warming climate. Controversy arose when the White House Office of Management and Budget secretly edited his testimony to weaken his conclusions. The White House held a conference on climate change in 1990 and agreed to sign on to the Framework Convention on Climate Change, which was signed in Rio in 1992. Coverage dropped until conferences, like Kyoto in 1997 and Bonn in 2001, drew the media's attention. The biggest increase in coverage came in the midst of two relatively simultaneous events: the release and promotion of

⁹ Each transcript was trimmed to exclude any content three sentences before the first reference to global warming or climate change and three sentences after the last reference to global warming or climate change and related keywords.

An Inconvenient Truth and the Democratic takeover of Congress in the 2006 midterm elections. These events massively increased the salience of climate change. Coverage remained high as a unified Democratic government, ultimately unsuccessfully, tried to pass a cap-and-trade program in 2010. Coverage then fell as the Republicans took over the House, but rebounded in the last years of Obama's presidency as he opted to bypass Congress and use regulations through the Clean Air Act to combat climate change.

The patterns in coverage are similar across news medium, with two notable exceptions. First, the AP newswire and broadcast television producers at *ABC*, *NBC* and *CBS* showed little interest in covering the topic in the early 1990s, unlike newspapers and cable (at this point consisting solely of *CNN*), which devoted considerable attention to the issue. Climate change captured the interest of network TV journalists only on the eve of the Kyoto conference. Secondly, the peak attention to the issue has lasted considerably longer on cable and in newspapers than in broadcast news and newswire, where it was largely limited to an explosion of coverage in 2007 and 2009.

4 The (potential) polarizers

A number of explanations for climate change polarization have been advanced by scholars. We generated measures that capture these influences in news coverage – the venue that most Americans will use to learn about climate change. First, our primary focus is on the role of party elites. Our definition of a party cue in this context is an *explicit or implicit stance on climate change science or related policy attributed to elites of either the Democratic or Republican Party*. We measure these cues using the automated content analysis software *Lexicoder* in conjunction with a dictionary of key terms, such as party names, office titles and party leaders. These leadership positions include presidents, presidential nominees, vice presidents, Speakers of the House, and Senate and House majority and minority leaders. We classify articles for whether or not they have reference to either the Democratic or Republican Party or the names of their high-profile elites in the White House or in congressional leadership. Of course, not all articles with party references contain cues signaling elite positions on climate change, but the overwhelming majority of them do. We manually coded a random sample of 700 articles that had a reference to either party in the text to validate our automated measure. Approximately 80% of these articles contained what could be considered a party cue on climate change by our definition.

Second, our definition of an ideological identity cue is similar to that of party elites: an *explicit or implicit stance on climate change science or related policy attributed liberals or conservatives*. We measure this

with a dictionary constructed with terms related to ideological identities such as liberal, progressive, conservative, and right-wing. Third, we built dictionaries of organizations linked to climate change skepticism and over 500 contrarian scientists based on lists previously compiled by scholars (Anderegg et al. 2010; Farrell 2016b).¹⁰ We further subdivided this list into its component parts: industry groups, conservative movement think tanks and advocacy associations, organizations dedicated to climate denial, and contrarian scientists. For our purposes we will be focusing on the combined measure, and the core of the climate denial movement – organizations explicitly dedicated to casting doubt on climate change and contrarian scientists – hereafter termed *denialists*. Again, we classify articles for whether or not they have references to either ideological groups or organized skeptics, respectively, in the body of the article. All of our dictionaries can be found in Appendix G.

Finally, we identify stories containing economic cost frames with supervised machine learning. We hand coded 1,500 articles stratified by three time periods to identify such frames in coverage.¹¹ Articles and transcripts were coded as “1” if they had any discussion of the cost of climate change mitigation, including the following: higher energy prices and taxes, a weaker economy, fewer jobs, declining competitiveness against developing countries, and general costs of regulatory compliance. We used the maximum entropy classification algorithm to generate predictions for our sample of articles. Our algorithm was trained, tested and used to predict articles for each time period independently to ensure adequate performance across our entire time period. Our recall and precision scores range from 0.74 to 0.76, and 0.78 to 0.80 respectively, across our three periods indicating reasonable reliability.

4.1 Availability of polarizing information

The share of coverage with each class of polarizing information is shown in Figure 2.2, which addresses our first research question (RQ1). Party elites are featured in a substantial amount of coverage (53%), of which Democrats tend to be more common (31%) compared to Republicans (23%). Economic cost frames are perhaps not as common as we might expect given the salience of economic concerns to policy discussion of climate change (26%). Ideological cuing and messages from organized climate skeptics are very uncommon. References to conservatives are only found in 8% of coverage and liberals in 5%. The combined weight of the climate change countermovement is

¹⁰ More details on how these scholars built their lists can be found in their respective works.

¹¹ The periods are: 1) 1980-1997 (Pre-Kyoto Conference), 2) 1998-2005 (Pre-Inconvenient Truth), 3) 2006-2014

only featured in 15% of coverage, while dedicated climate denialists and contrarian scientists are only present in 4% of coverage. Consequently, explanations of climate change polarization centered on ideology and organized climate skeptics have to deal with the fact that these signals are simply not very common in the information most Americans are consuming about climate change.

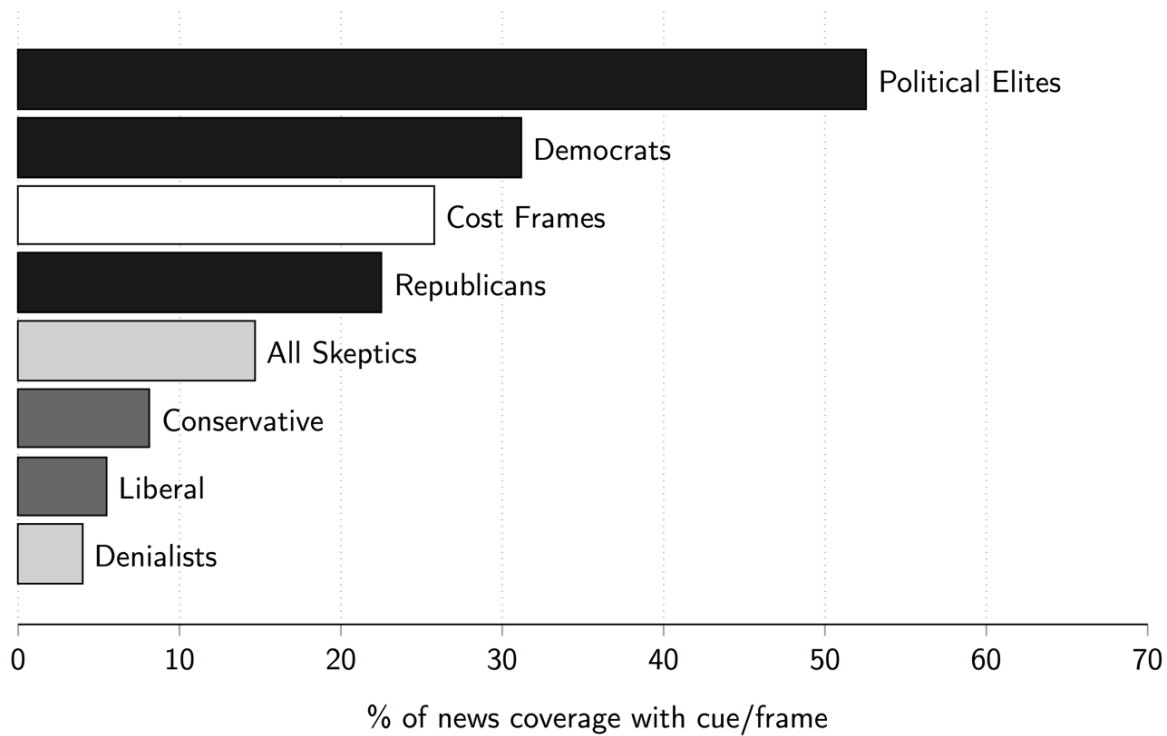


Figure 2.2 Share of all news stories with polarizing information

Salience of this topic, however, has increased substantially, especially since 2006, so these figures may tell us more about the media environment recently than in the past. The percentage of coverage with each of our classes of polarizing information are plotted over time in Figure 2.3. Panel A illustrates that party cues are increasingly common in coverage, rising from 25% of coverage when the issue first emerged on the political scene in the late 1980s to close to 60% at present. Party cues increase their presence, unsurprisingly, during notable events like the Rio conference in 1992, Kyoto in 1997, and Bonn in 2001. Democratic and Republican cues have not moved in sync. Only Democratic cues have steadily increased over time, while Republican cues have been on the decline since 2001. Combined with rising salience since 2006, messages from Democratic elites, in particular, are increasingly reaching the public.

In stark contrast are the results for other cues. Liberal and conservative group cues been rare in coverage, though there has been a notable uptick in the past few years. Organized skeptics have also failed to receive much traction in the press despite their considerable financial clout. If anything, their presence has been on the decline since the Kyoto debate. They have not been present in excess of 20% of coverage since that time. The core of the countermovement, for its part, barely registers in coverage. This flies against the conventional wisdom about the power of these groups and the tendency of journalists to engage in ‘false balance.’ Economic cost frames, however, have been reasonably prominent and consistent in coverage, rising periodically with notable events and policy debates.

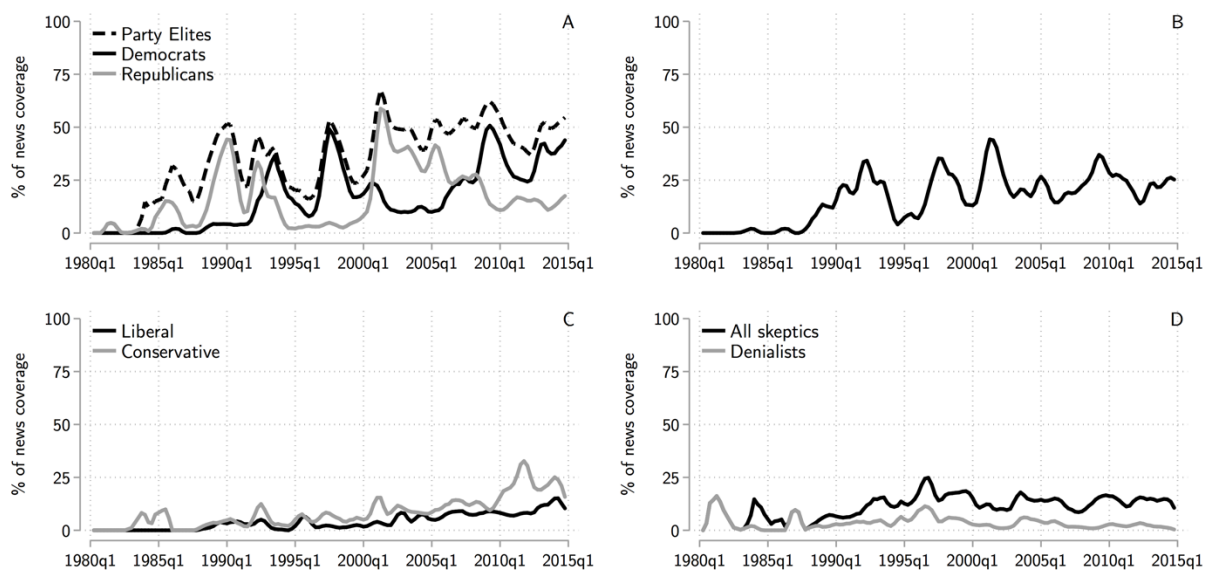


Figure 2.3 Share of polarizing information in climate coverage over time. A) Party elites; B) Economic cost frames; C) Ideological identity cues; D) Organized climate skeptics. Note: all series lowess smoothed with a 0.05 bandwidth.

4.2 Comparisons across time and media format

Our large database of media coverage on climate change gives us a unique opportunity to shed light on whether there has been statistically significant trends in media coverage with our classes of polarizing information (RQ2) and whether this information tracks with the overall salience of climate change (RQ3). To help us answer these research questions we estimate the following two equations to measure the association between each class of polarizing information and a linear trend (1), and salience independent of the trend (2) controlling for cross-sectional fixed effects (μ). We use

Prais-Winsten regression to correct for autocorrelation and panel-corrected standard errors (PCSE) to adjust the standard errors for inevitable cross-sectional correlation.

$$\% \text{polarizing information}_{n,t} = \alpha + \beta_1 \text{trend}_t + \mu_n + \epsilon_{n,t} \quad (2.1)$$

$$\% \text{polarizing information}_{n,t} = \alpha + \beta_1 \text{salience}_{n,t} + \beta_2 \text{trend}_t + \mu_n + \epsilon_{n,t} \quad (2.2)$$

β_1 in equation 2.1 tells us the effect of an increase of a quarter on the share of coverage with each class of polarizing information. β_2 in equation 2.2 gives us the effect of one additional news article on the share of each class of polarizing information after controlling for the trend. Possible influences on climate polarization should have positive and significant coefficients. We display the coefficients in Figure 2.4 below and provide the estimates in Table H.1 of the Appendix. We take these coefficients to be simply descriptive and not reflective of any causal associations.

We are also keen in exploring variation across media and outlet ideology controlling for common shocks through time (RQ4). On the one hand, broad similarities across very different media can give us confidence that the findings above generalize across a wider portion of the media environment. On the other hand, we have strong reason to expect some differences may exist as noted above. We can gain leverage over this question by estimating models that predict the quarterly share of articles with different classes of polarizing information with news format (AP, print, cable, broadcast), outlet conservatism (conserv), controlling for a linear time trend (trend), quarter (qt), and yearly fixed effects (δ) as shown below in equation 2.3. These equations are again estimated with Prais-Winsten regression and PCSEs:

$$\% \text{polarizing information}_{n,t} = \alpha + \beta_1 \text{print}_n + \beta_2 \text{cable}_n + \beta_3 \text{broadcast}_n + \beta_4 \text{conservative}_n + \text{trend}_t + \text{qt}_t + \delta_t + \epsilon_{n,t} \quad (2.3)$$

Coefficients β_1 through β_3 provide us the effect of each medium on the share of our cues or frames in coverage compared to the AP newswire after controlling for outlet ideology. We expect β_2 to be positive across the board with the possible exception of economic cost frames. β_4 gives us the effect of conservative outlet slant, after controlling for news format, on the share of stories with our classes of polarizing information. We expect this coefficient to be positive for organized climate

skeptics and economic cost frames. We present the linear predictions of the models in Figures 2.5 and 2.6 below. The estimates can be found in Table H.2 of the Appendix.

We begin by describing the time varying results in Figure 2.4 (RQ2). The top panel provides the coefficients for the linear trend in equation 1. First, there is significant positive trending in cues from party elites – specifically Democrats. For every quarter that passes, the share of stories with cues from parties and from Democrats increase by 0.17 ($p < 0.001$) and 0.15 points ($p < 0.001$), such that every five years the share of coverage with party elites and Democrats is expected to rise 3.4 and 3 points, respectively. Republican cues, however, show no evidence of an upward trend.

Liberal and conservative group cues are also trending upward over time, but at a more modest rate. For every quarter, the share of coverage with conservative and liberal cues is expected to rise 0.06 ($p < 0.001$) and 0.07 points ($p < 0.001$), such that every five years the share of coverage with liberal and conservative cues is expected to increase 1.2 and 1.4 points, respectively. In contrast, there is no evidence of trending for economic cost frames. There is also no evidence of a trend for organized skeptics, while dedicated climate denial organizations and contrarian scientists have been declining in their share of coverage ($p < 0.001$). For every quarter, their share of coverage has declined by 0.07 points, such that over five years their share of coverage is expected to decrease by 1.4 points. In sum, it is party cues, particularly from Democrats, that have been sharply increasing over time, possibly providing fuel for polarization.

We are also interested in how each of our polarizing cues or frames tracks with overall salience (RQ3). These results are shown in the bottom panel of Figure 2.4. It appears that party cues, particularly from Democrats, are most strongly associated with overall media salience. After controlling for the trend, a one article increase in salience is associated with a 0.18 point increase in the share of coverage with party elites ($p < 0.001$), a 0.14 point increase in the share of coverage with Democratic cues ($p \sim 0.004$), and a 0.1 point increase in the share of coverage with Republicans ($p \sim 0.06$). More substantively, this means that every standard deviation increase in salience (about 25 articles) is associated with a 4.5, 3.5, and 2.5 point increase in the share of coverage with cues from all parties, Democrats, and Republicans, respectively.

In contrast, both liberal and conservative ideological group cues are not associated with salience after controlling for a linear trend. Economic cost frames are unsurprisingly associated with salience. A one article increase in salience is associated with a 0.09 point increase in the share of coverage with economic cost frames, such that a one standard deviation increase in salience is associated with a 2.25 point increase.

In contrast, the share of coverage with organized skeptics is negatively associated with salience ($p \sim 0.06$). A one article increase in salience is associated with a decrease in the share of coverage with skeptics of 0.04 points, such that an increase in salience of one standard deviation is expected to reduce their coverage share by 0.8 points. Coverage of denialists, however, is not associated with salience. If we expect drivers of polarization to be increasing in the media over time and associated with periods of high issue visibility, cues from parties, particularly Democrats, are the most likely culprits.

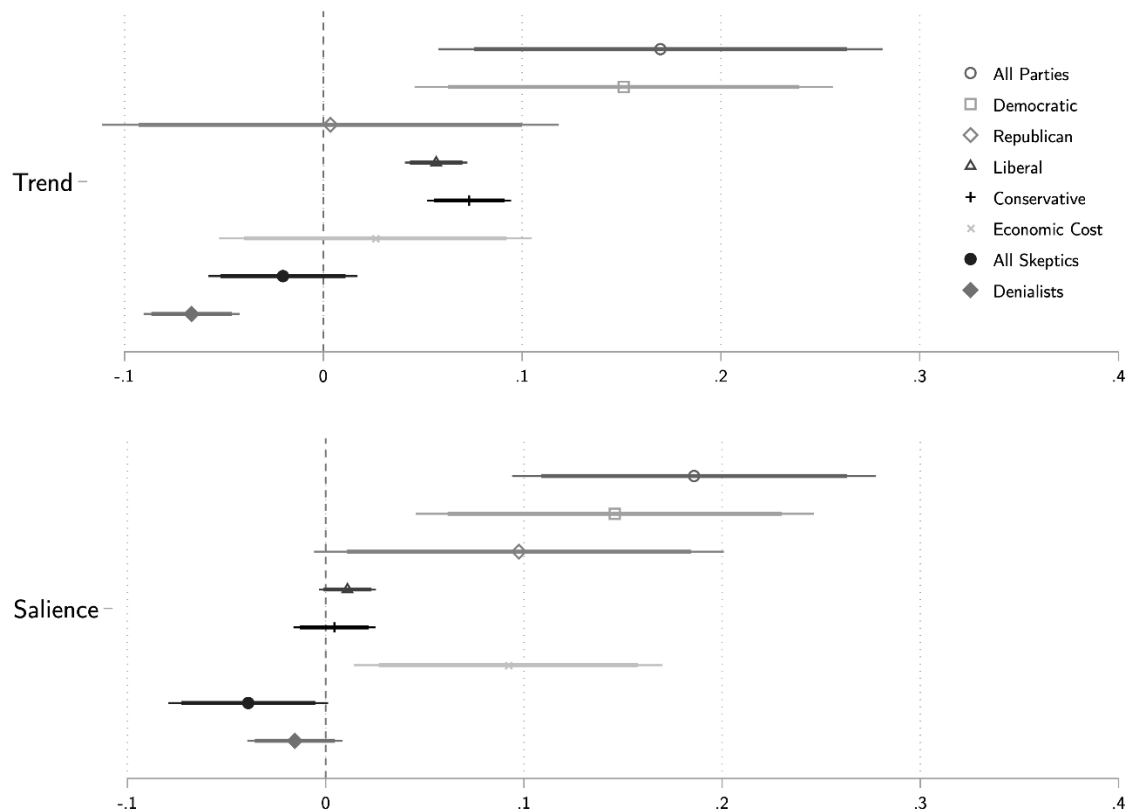


Figure 2.4 Coefficients on quarterly trend (top) and salience (bottom) for each class of polarizing information. Note: trend is measured quarterly. Salience is operationalized as the total number of news articles on climate change per quarter. Salience coefficient is after controlling for a linear trend. 90 and 95% confidence intervals.

The results of our cross-sectional comparisons across news format are displayed in Figure 2.5, while comparisons across outlet ideology are in Figure 2.6. Panel A of Figure 2.5 shows that, as expected, cable news is significantly more likely to cover party elites compared to other media (AP,

$p \sim 0.02$; Print, $p < 0.001$; Broadcast, $p < 0.001$) with almost 60% of its coverage featuring these actors. And significant differences apply to both Democratic (AP, $p < 0.001$; Print, $p < 0.001$; Broadcast, $p < 0.001$) and Republican cues (AP, $p < 0.001$; Print, $p < 0.001$; Broadcast, $p < 0.001$), shown in panels B and C. These differences are substantively large. Anchoring the other extreme is broadcast news, which features party elites the least. Only 36% of its content features parties, which is significantly different than other formats (AP, $p < 0.001$; Print, $p < 0.001$; Cable, $p < 0.001$). These significant differences are substantively meaningful and are consistent for both Democratic (AP, $p < 0.001$; Print, $p \sim 0.004$; Cable, $p < 0.001$) and Republican cues (AP, $p < 0.001$; Print, $p < 0.001$; Cable, $p < 0.001$). The big takeaway is that cable, by far, offers the most politicized coverage of climate change and broadcast news the least. The partisan and ideological slant of the outlet does not appear to matter once media format is taken into account for this class of polarizing information.

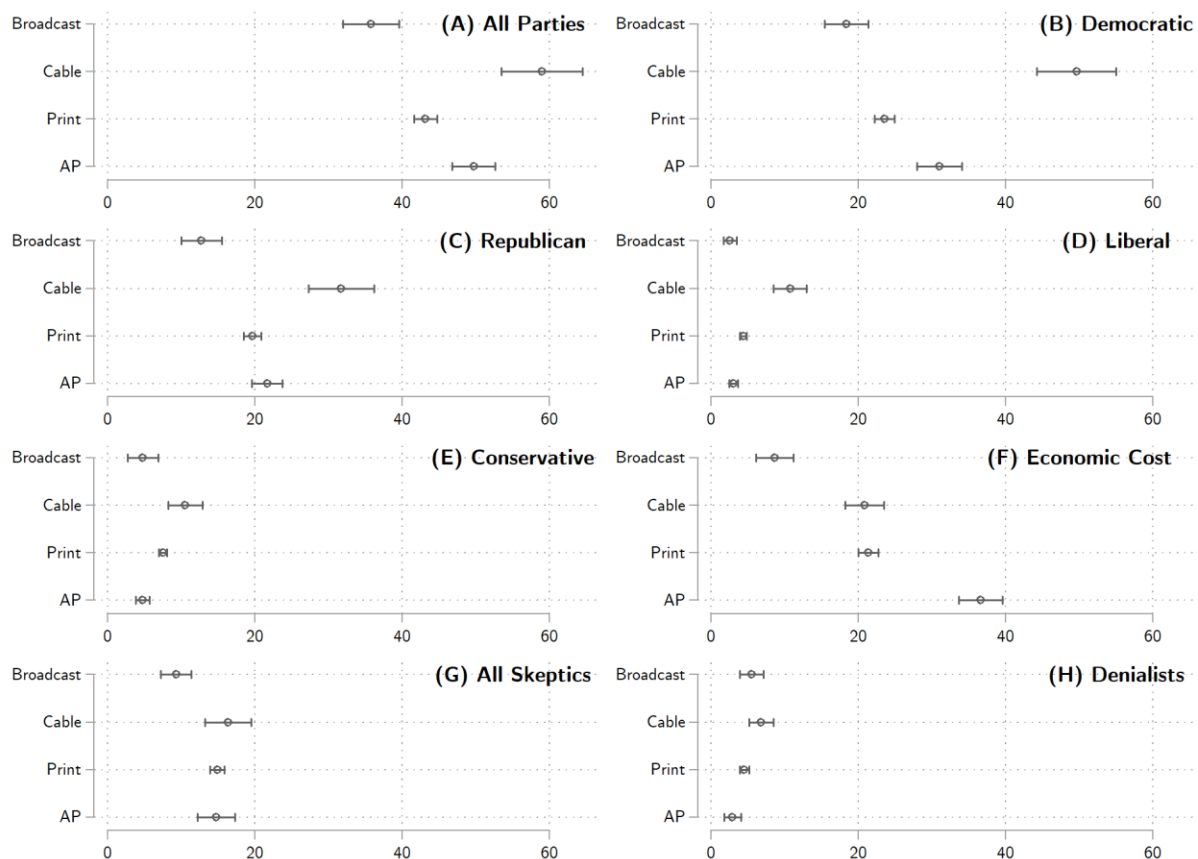


Figure 2.5 Estimated share (%) of coverage with polarizing information by news format.
Note: 90% confidence intervals.

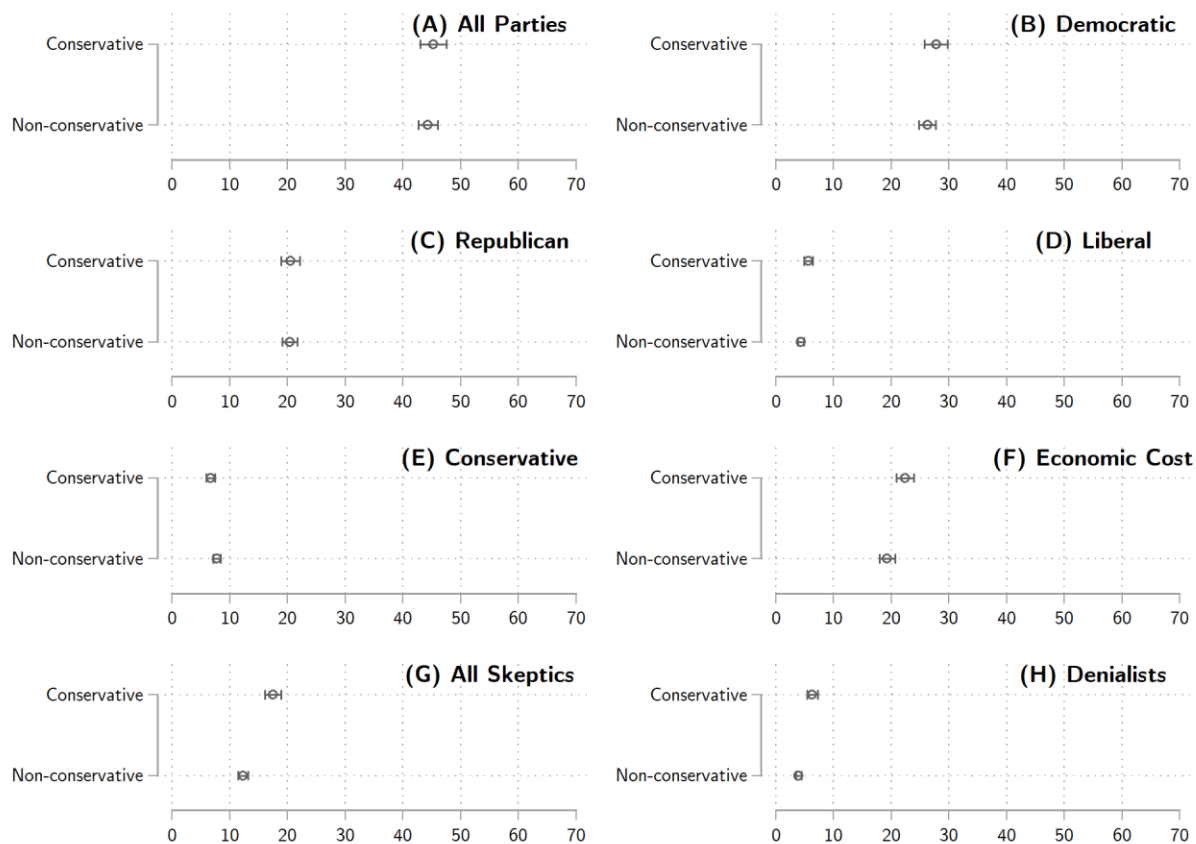


Figure 2.6 Estimated share (%) of coverage with polarizing information by outlet ideology.
Note: 90% confidence intervals.

Ideological cuing, unsurprisingly, shows many of the same patterns as the coverage of party elites. Panels D and E of Figure 2.5 show that cable carries both liberal and conservative group cues more frequently in its coverage of climate change. 11% of its transcripts feature each ideological identity cue, respectively. This is significantly higher than the AP ($p < 0.001$ & $p < 0.001$), print ($p < 0.001$ & $p \sim 0.04$), and broadcast ($p < 0.001$ & $p \sim 0.005$). Again broadcast is the least polarizing, featuring particularly low levels of liberal (2.4%) and conservative ideological identity cues (4.8%). But it is joined this time by the AP newswire. Panels D and E of Figure 2.6 show that there also appears to be some very slight differences across outlet ideology, with conservative outlets more 1.31 points more likely to cite liberal cues ($p \sim 0.02$), and 1.1 points less likely to make references to conservatives ($p \sim 0.09$) compared to other outlets – a sign such identity cues are may be used derogatorily in news content. All told, however, cable stands out as having the most coverage of ideological identities. It is important to contextualize this information, however. The average share

of coverage with liberal and conservative identity cues are a paltry 8% and 5%, respectively. These cues are simply not that common in climate change news content across media.

Our findings for economic cost frames line up with our expectations. Panel F of Figure 2.6 shows that conservative media are 3.1 points more likely to use such frames in content, but this difference is substantively modest ($p \sim 0.004$). More important are differences across format, which we had few prior expectations. These results are displayed in panel F of Figure 2.5. The AP newswire features economic cost frames in over 36% of content, which is substantially higher than other outlets (Print, $p < 0.001$; Cable, $p < 0.001$; Broadcast, $p < 0.001$), while broadcast news is least likely to do so at 9% of coverage.

Finally, our expectations for organized skeptics are only partially met. Panels G and H of Figure 2.6 show that conservative media are 5.2 points more likely to use these sources than other outlets ($p < 0.001$) and this is also true for dedicated climate denialists (2.36, $p < 0.001$), but these differences are small, and must be considered with the baseline in mind – 11.8% and 3.9%, respectively. Panel G of Figure 2.5 shows that, surprisingly, cable's coverage of organized skeptics is indistinguishable from the AP ($p \sim 0.52$) and print ($p \sim 0.47$) after controlling for outlet ideology. Broadcast stands alone for its notable avoidance of organized skeptics compared to other media, featuring these actors in only 9% of news stories. The picture changes somewhat when focusing on dedicated climate denial organizations and contrarian scientists. For this group, cable is more likely to give them coverage (AP, $p < 0.001$; Print, $p \sim 0.05$; Broadcast, $p \sim 0.37$), but these differences are small. While there is an indication that conservative media are modestly more likely to cover skeptics, there is minimal evidence to suggest cable news fare worse on this dimension after controlling for outlet ideology. Differences across media in their coverage of skeptics are very modest and they do not take away from the general finding that their presence in the media is very limited. The false balance dreaded by critics of the media seems to be an uncommon phenomenon.

All told, some of our expectations are met. Cable is by far the most politicized medium across both partisan and ideological dimensions, though this format is perhaps less associated with coverage of climate skeptics than we might expect, after controlling for news outlet ideology. Additionally, the limited coverage of organized skeptics by broadcast news suggests any link between the television medium and false balance is overstated at best. Conservative media are also more likely to cite skeptics, but the differences are substantively modest. Of all news sources, broadcast news most consistently limited the exposure of viewers to polarizing information. They were less likely to carry party and ideology cues, and messages from organized skeptics. They were also least

likely to focus on the economic cost of climate change mitigation. But, on balance, the media are more similar in their coverage of climate change on these dimensions than they are different.

4.3 Messages by polarizing actors

The above analysis gives us a very good idea of what polarizing information appears in which outlet and the dynamics of that coverage, but it does not address in detail the types of signals these actors are sending in relation to climate change. In this section, we report the results of a content analysis of the types of messages that each of these actors are sending on climate change.

At some level, our surface descriptive data does not do justice to the large discrepancy in the prominence of party elites compared to the organized climate skeptics many scholars and commentators have spent a great deal of energy criticizing. Our dictionary of organized skeptics is comprised of references to four different sets of actors: dissenting scientists, organizations dedicated to casting doubt on climate change, conservative think tanks and advocacy groups, and industry organizations. We cannot simply assume that the latter two groups propagate climate denialism when they attract media attention. We hand coded a random sample of 500 articles each with references to these industry groups and think tanks, and found that only 18 percent and 37 percent of articles with references to these groups, respectively, represent messages that cast doubt on the science of climate change. The remainder largely focus on the consequences of mitigation policy for economic competitiveness and energy prices.

We also cannot assume that parties are sending clear and consistent signals on climate change to their supporters. It certainly seems plausible that these cues from party elites are driving increased climate skepticism. One big question that is difficult to address with a dictionary approach is the direction of party cues. We cannot assume that all Republican cues are stances opposed to the scientific consensus or Democratic cues are in support, even though recent comments from members of both parties would support such a claim. Muddled signals from party elites are unlikely to contribute to public opinion polarization.

For the television broadcasts, we manually coded all of the transcripts containing references to party elites. For cable and newspapers, however, we took a random sample of 350 articles that were coded as having Republican references and another 350 articles that were coded as having Democratic references for manual coding for each format. This sample was stratified by presidential administration. This served two purposes. This allowed us to code for the direction of the cue, and

the message of anti-climate cues from the parties to check for whether they were giving consistent signals on climate change to their supporters over time.

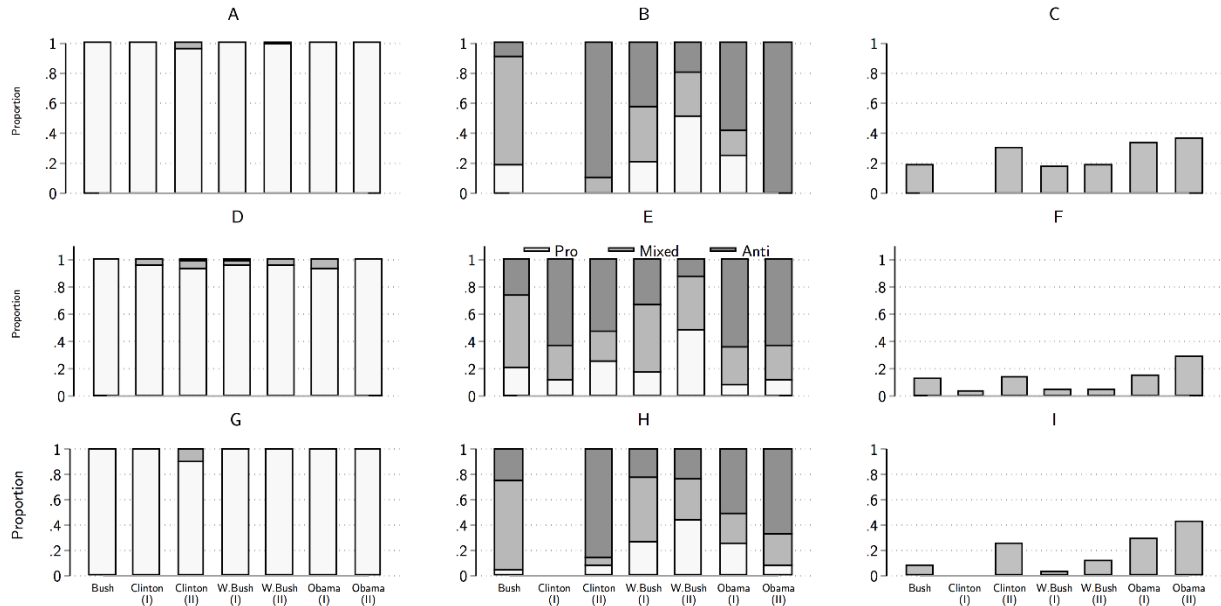


Figure 2.7 Party elite messages on climate change, by presidential administration. A) Democratic cues in broadcast; B) Republican cues in broadcast; C) Denialist Republican cues in broadcast; D) Democratic cues in newspapers; E) Republican cues in newspapers; F) Denialist Republican cues in newspapers; G) Democratic cues on cable; H) Republican cues on cable; I) Denialist Republican cues on cable.

Articles were first coded for whether a cue was present in the article. We define cue as a stance by a party or particular party official on climate science or policy action on climate change. All told, approximately 80 percent of our identified cues via automated coding held up, although this varies over time. Accuracy improves in later administrations. Of our identified cues, we coded them as either pro-climate consensus, anti-climate consensus, or ambiguous. They were coded pro-climate if the politician or party was linked to a stance in support of the scientific consensus on climate change and/or implicitly adopted that consensus by supporting policy action on climate change. Cues were coded anti-climate if they either rejected the climate science consensus by denying or expressing uncertainty in the science, and/or they rejected policy action on climate change. Pro-climate messages could not have any traits of anti-climate messages and vice versa. Ambiguous messages

contained elements of both.¹² We made additional note of anti-climate messages that focused on the supposed uncertainties of climate science or allegations that climate change is a hoax.

Figure 2.7 shows the proportions of the coded articles with cues that were either pro- or anti-climate for Democrats and Republicans in broadcast television (top row), newspapers (middle row), and cable news coverage (bottom row). Two things become immediately apparent. First, the Democrats took a consistently pro-climate stance in the media over the entire timeframe. Between 90 and 100 percent of cues were coded as pro-climate consensus. The remaining 10 percent were mainly references to the reluctance of coal-state Democrats to support climate initiatives on economic grounds. Secondly, Republican cues, contrary to expectations, have been ambiguous in their messages over time, with a sizable proportion of both pro-climate and ambiguous messages, in addition to strong anti-climate positions. The right-side panels also demonstrate that the majority of GOP cues are not ones that express uncertainty in climate science. Republican climate denial has increased in the press relatively recently during the Obama administration.

5 Is party elite debate associated with climate skepticism and polarization?

Our analysis so far clearly demonstrates that the media have increasingly carried cues from party elites about climate change to voters. There was increasing politicization before 2001, and a massive increase in salience since then. Voters are exposed to more party cues on the topic than ever before. These cues are uniformly consistent for Democrats and more ambiguous for Republicans, though anti-climate messages have become dominant for the party in recent years. Do these party elite cues have a role in persuading largely Republican portions of the public to turn against climate science and policy action? Republican voters could learn the appropriate position to take on climate change from the elites they trust. This explanation seems wanting on its own given remarkable ambiguity in Republican messages on climate change. It is also possible Democratic leaders are persuading Republican voters to take positions opposite to their own. Both Berinsky (2009) and Nicholson (2012) have noted the importance of out-group cues in persuasion. A similar dynamic may well be occurring with climate change. If this is true, we should observe an association between

¹² We had an undergraduate research assistant code a random sample of 100 articles with Democratic references and 200 articles with Republican references to validate our coding. There was 90 percent agreement on the presence of Democratic cues, and a Krippendorff's Alpha score of 1 for agreement on the direction of Democratic messages. We had 93 percent agreement on the presence of Republican cues, and a Krippendorff's Alpha of 0.83 for the direction of Republican messages. Coding instructions can be found in Appendix I.

aggregate measures of public attitudes on climate change and the prevalence of party cues, even after controlling for other possible influences (RQ5).

5.1 Data and methods

First, we need time series measures of public opinion on climate change. Despite a seeming abundance of public opinion polling, there is a shortage of reliable time series opinion measures on specific matters of policy that extend long enough to confidently study over time dynamics. For this reason, many studies that look at long-term opinion dynamics and how they feed into public policy focus on macro policy indicators like policy mood – a measure developed by Stimson (1999). In his work, Stimson was interested in combining results from disparate survey questions that captured the general left-right mood of the American public over the entire postwar era. To do so, he developed a method of standardizing results from different survey questions and then extracting the general underlying trend in those standardized responses over time. This approach has been replicated with some climate change opinion data (Carmichael, Brulle, & Jenkins, 2012; Carmichael & Brulle, 2017). We use a similar approach here, by combining 172 different poll questions since the late 1980s from the Roper Center archive at Cornell University, which is a repository of a wide selection of polls addressing climate change attitudes.

The questions we used for our measures included those that asked respondents whether or not climate change is happening, whether or not climate change is a serious problem, whether or not they are worried about global warming, and whether or not climate change is caused by humans.¹³ After ensuring all of the questions were coded in the same direction, we used them to extract a latent measure of public skepticism on climate change. It is important to remember that the extracted measure does not have levels that are easily interpretable. That is not a concern for us, however, as we are interested in the variation of public opinion on climate change over time and not interpreting the levels of skepticism at specific points in time. Based on the availability of polling we were able to construct an annual measure beginning in 1986 and a quarterly measure starting in 2001. Our climate skepticism mood measures are presented in the top two panels of Figure 2.8.

¹³ The data presented in the paper is based on the broadest set of questions that we found, coupled with the questions shared by Carmichael, Brulle and Huxster. This measure excludes outliers, though they do not substantively change the results. More information on the mood measure can be found in Appendix J.

One limitation of these measures is that they measure aggregate levels of climate skepticism in the public, but they do not tell us what is happening with supporters of specific parties. The number of polls containing partisan breakdowns is smaller than the overall total, but Carmichael and Brulle (2017) were able to construct a quarterly measure for Republicans and Democrats starting in 2001. Their *Partisan Climate Change Threat Index* (PCCTI) uses a slightly different set of climate change questions – focused on perceptions of climate change threat – but it is still useful in understanding the correlates of aggregate attitudes for Republicans and Democrats. These series are displayed in panel C of Figure 2.8. For the PCCTI measures, higher values mean a higher level of agreement with the notion that climate change is a serious threat. From these two series we can also construct a measure of climate polarization as well, which is plotted in panel D.

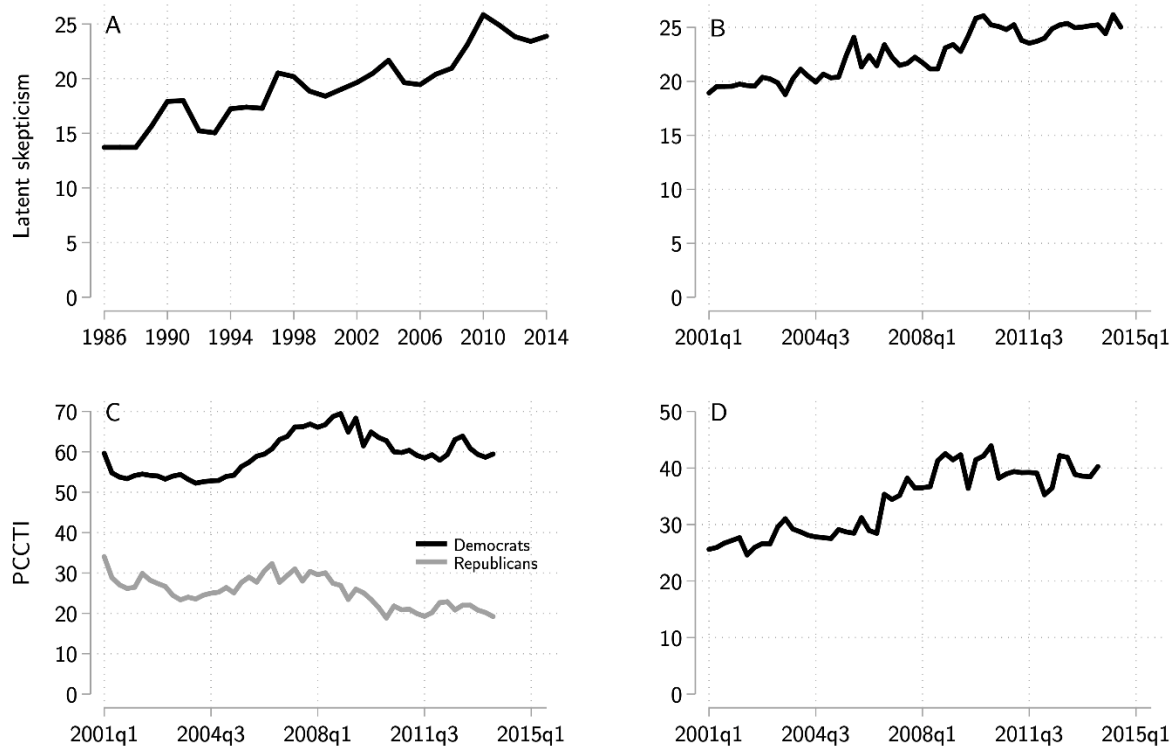


Figure 2.8 Aggregate climate change skepticism. A) Annual, 1986-2014, B) Quarterly, 2001-2014, C) Carmichael and Brulle's Partisan Climate Change Threat Index (PCCTI); D) Polarization between Democratic and Republican identifiers in the PCCTI

We use our mood measures (climate change mood) as our dependent variables of interest. We expect public attitudes to be a function of the salience of the issue, operationalized by the total climate change article count in a period (salience), and the proportion of Democratic (%democratic)

and Republican (%gop) cues in the news media. We also account for other possible explanations of climate skepticism, such as ideological cuing (%ideology), and economic cost frames (%cost). These measures are based on the coverage of the *New York Times* and the *Washington Post*, as the sources most likely to serve as agenda setters for the broader media environment. Finally, we include a measure of cues from organized climate skeptics (%skeptic). Our measure of climate skeptics is constructed as an average of cues in *Fox News* and the *Wall Street Journal* to account for the fact these sources typically come from conservative media and are covered in a more positive fashion.¹⁴

Other factors may simultaneously influence party and denial cues in the press and aggregate climate skepticism in the public. Following Carmichael and Brulle (2017) we account for four sets of these factors: congressional activity, climate changes, economic changes, and events. First, as noted above, Republican messages are mixed. So a raw count of Republican messages may not adequately measure over time variance in Republican opposition to climate change. If the dynamics in their opposition are correlated with Democratic messages on climate change, it may serve as a confounder. Consequently, we include a measure of Republican positions on climate change, operationalized by roll call scores from the League of Conservation Voters (GOP LCV, scaled 0 to 100 where positive numbers indicate more support for environmental protection). We also include a measure of general congressional activity on climate change, operationalized by the number of House and Senate congressional hearings on climate change per period (hearings).¹⁵

Second, we constructed a standardized index of two factors from the NOAA climate extremes index that have been found by Carmichael and Brulle (2017) to drive media coverage of climate change: percentage of days below the average temperature in the continental United States and percentage of days with drought conditions. Abnormal weather can be seen as focusing events that bring attention to an issue (Weber & Stern, 2011), which can influence the number of party cues in the media environment and directly affect climate change attitudes.

Third, skepticism of climate change and general antipathy towards environmental policy tends to increase as the economy sours or energy prices increase (Scruggs & Benegal, 2012). Party elites, for their part, will choose to push or dial back environmental messaging as a result. We will include variables relating to crude oil prices and the unemployment rate taken from the FRED database of

¹⁴ Our denial measure is comprised of cues from corporations (like Exxon), think tanks (like Cato Institute), dedicated climate denial organizations (like Science & Environmental Policy Project) and contrarian scientists tied to climate denial (like Fred Singer).

¹⁵ We are very grateful to Jo Huxster, Robert Brulle, and Jason Carmichael for generously sharing their data with us and answering all of our questions so patiently.

the St. Louis Federal Reserve. Finally, we may expect high profile events to affect climate skepticism and elite cues, such as major international climate change conferences, the release of IPCC reports, and potentially the release of the blockbuster documentary *An Inconvenient Truth*. Party elites are often quoted and cited in response to these events.

Our main model is a standard lagged dependent variable model (LDV) run annually from 1986 to 2014 and quarterly from 2001 to 2014. We have theoretical reason to expect memory in our dependent variable – climate skepticism at $t-1$ is likely to partially cause its value at t because there tends to be stickiness in public opinion. Not including a lagged dependent variable in these circumstances will lead to biased coefficients. The inclusion of the lagged dependent variable does change the interpretation of the coefficients, which represent the effect of a one unit change in the independent variable on the dependent variable at time t . We can also calculate the cumulative effect of a given independent variable across the current period and all possible lags of climate mood with simple arithmetic ($\beta X / (1 - \text{mood}_{t-1})$). More formally, the model is represented as follows in equation 2.4 where X represents a vector of our non-media control variables:

$$\begin{aligned} \text{climate change mood}_t = & \alpha + \delta_1 \text{climate change mood}_{t-1} + \beta_1 \% \text{democratic}_t + \beta_2 \% \text{gop}_t + \beta_3 \% \text{ideology}_t \\ & + \beta_4 \% \text{cost}_t + \beta_5 \% \text{skeptic}_t + \beta_6 \text{salience}_t + X + \epsilon_t \end{aligned} \quad (2.4)$$

Our four potential polarizing influences are represented by β_1 through β_5 . If they are linked to climate skepticism, they should have significant positive coefficients. For the models using Carmichael and Brulle's PCCTI, coefficients should be negative, and for polarization they should be positive. We do not control for a linear trend because we do not think it is theoretically defensible. Ultimately, we are interested in accounting for any trends in aggregate climate skepticism. In light of our constrained T we start by producing running LDVs with our party cues measures alone, then add our other media variables, and finally include our controls to any significant results. Along the way we will only preserve variables with correctly-signed, significant coefficients.¹⁶

¹⁶ The first and second lag of the dependent variables is controlled for in the annual models to ensure errors followed a white noise pattern and the elimination of residual serial correlation.

	Annual Climate Skepticism			Quarterly Climate Skepticism		
	1	2	3	4	5	6
% Democratic $_t$	0.06*** (0.02)	0.06** (0.02)	0.08** (0.03)	0.02* (0.01)	0.03** (0.01)	0.03** (0.01)
% GOP $_t$	0.01 (0.01)			-0.03*** (0.01)		
Salience $_t$		0.00 (0.00)			-0.00 (0.00)	
% Ideology $_t$		0.08 (0.06)			0.02 (0.03)	
% Cost $_t$		-0.03 (0.03)			-0.02 (0.01)	
% Organized Skeptic $_t$		-0.04 (0.03)			0.00 (0.02)	
GOP LCV $_t$			-0.13* (0.07)			0.00 (0.05)
Hearing $_t$			-0.00 (0.01)			-0.01 (0.02)
Climate Index $_t$			0.91*** (0.30)			-0.10 (0.12)
Unemployment $_t$			0.19 (0.17)			0.22* (0.11)
Oil Prices $_t$			0.03* (0.02)			0.01 (0.01)
IPCC Report $_t$			-0.40 (0.87)			0.37 (0.50)
Conference $_t$			-0.73 (1.13)			-0.65* (0.35)
Inconvenient Truth $_t$			0.67 (0.74)			-0.02 (0.46)
Skepticism $_{t-1}$	1.09*** (0.20)	0.82*** (0.17)	0.62*** (0.18)	0.65*** (0.09)	0.74*** (0.07)	0.54*** (0.14)
Skepticism $_{t-2}$	-0.35* (0.18)	-0.22 (0.18)	-0.49 (0.22)			
Constant	3.73***	6.40**	15.36***	7.99***	4.88***	7.41**
N	27	24	27	54	54	54
R	0.86	0.88	0.92	0.88	0.87	0.89

Table 2.2 Climate skepticism OLS estimation results. Note: Heteroskedastic-robust standard errors in parentheses; *p<0.1, **p<0.05, ***p<0.01

	Republican			Democratic			Polarization		
	1	2	3	4	5	6	7	8	9
% Democratic _t	-0.06** (0.03)	-0.08** (0.03)	-0.04** (0.02)	-0.00 (0.03)			0.13*** (0.03)	0.19*** (0.04)	0.17*** (0.03)
% GOP _t	-0.03 (0.02)			-0.04 (0.02)			-0.06** (0.03)		
Salience _t		0.01** (0.01)	0.02** (0.01)		0.00 (0.01)			-0.00 (0.01)	
% Ideology _t		0.02 (0.07)			-0.01 (0.03)			-0.09 (0.06)	
% Cost _t		-0.01 (0.03)			-0.08*** (0.03)	-0.06* (0.03)		-0.08** (0.03)	-0.02 (0.03)
% Organized Skeptic _t		-0.03 (0.04)			0.04 (0.04)			0.03 (0.05)	
GOP LCV _t			0.32*** (0.12)			0.02 (0.13)			0.12 (0.12)
Hearing _t			-0.01 (0.04)			-0.02 (0.08)			0.01 (0.08)
Climate Index _t			-0.32 (0.30)			-0.41 (0.39)			-0.52 (0.34)
Unemployment _t			-0.80*** (0.20)			-0.23 (0.36)			0.54 (0.48)
Oil Prices _t			-0.02 (0.01)			0.01 (0.01)			0.03 (0.02)
IPCC Report _t			0.97 (1.58)			-0.24 (0.86)			-1.10 (1.47)
Conference _t			0.68 (0.82)			-0.11 (0.92)			0.74 (1.08)
Inconvenient Truth _t			-2.72 (1.65)			1.53 (1.28)			1.52 (1.53)
Climate Threat _{t-1}	0.81*** (0.10)	0.68*** (0.09)	0.14 (0.18)	0.86*** (0.08)	0.90*** (0.07)	0.92*** (0.11)	0.52*** (0.11)	0.59*** (0.08)	0.38** (0.15)
Constant	7.07***	8.51***	22.97***	9.87**	7.38**	7.30*	15.70***	13.55***	11.12***
N	55	54	54	54	54	54	54	54	54
R	0.73	0.76	0.84	0.86	0.88	0.89	0.87	0.88	0.90

Table 2.3 Partisan Climate Change Threat Index (PCCTI), OLS estimation results. Note: Heteroskedastic-robust standard errors in parentheses; *p<0.1, **p<0.05, ***p<0.01

5.2 Results

Table 2.2 presents the results of estimations using aggregate climate skepticism as the dependent variable. Models 1 through 3 use annual measures starting in 1986. According to the results in model 1, a 10 point increase in the share of news coverage with Democrats is associated with a 0.6 point increase in climate skepticism (0.19 SDs). Across all future lags, a 10 point increase in the share of Democratic coverage is associated with a 2.4 point (0.77 SDs) increase in climate skepticism. In contrast, Republican cues are not associated with climate skepticism. Model 2 illustrates the robustness of our Democratic cue measure to the introduction of other media variables – none of which are significantly associated with climate skepticism in their own right. Model 3 shows that this effect is robust to the introduction of our other controls, but the cumulative effect over time weakens – a 10 point increase in Democratic coverage share is now associated with a 0.9 point increase in climate skepticism across all lags (0.29 SDs). There also appears to be some evidence Republican cues are associated with climate skepticism in model 3, but through the positions they have taken in Congressional roll call votes. A 10 point decrease in the average GOP congressional member's LCV score is associated with a 1.3 point increase (0.42 SDs) in climate skepticism ($p \sim 0.10$).

The results of our quarterly models, presented in the next three columns, are similar. Model 4 shows that the share of coverage featuring Democrats is linked to climate skepticism. A 10 point increase in the Democratic share of coverage is associated with a 0.2 point increase in climate skepticism. Across all lags, this effect increases to 0.57 points (0.26 SDs, $p \sim 0.05$). The share of coverage with Republican cues this time is associated with climate skepticism ($p \sim 0.01$), but the coefficient is signed in the wrong direction. Model 5 shows that the effect for Democratic cues is robust to the inclusion of our other media variables – none of which are significant, while Model 6 indicates it is robust to the inclusion of our controls. The most consistent finding across our models predicting aggregate climate skepticism is the importance of Democratic cues in the mainstream press.

The results for the analyses using the Republican PCCTI are provided in models 1 through 3 of Table 2.3. Model 1 shows that the share of coverage with Democratic cues are linked to climate change threat perceptions among Republicans. A 10 point increase in Democratic coverage share is associated with a 0.6 point decrease in Republican perceptions of climate change threat (0.16 SDs, $p \sim 0.02$). This result is robust to the inclusion of our media variables, and, if anything, it strengthens (Model 2). Model 3 introduces our control variables. The effect of Democratic cues remains

significant ($p \sim 0.04$). Here, Republican cues seem to matter when operationalized by their roll call scores in Congress. A 10 point increase in GOP LCV scores is associated with an increase of 0.87 standard deviations in climate change threat perceptions ($p \sim 0.01$). Republican identifiers appear responsive to cues from Democrats and Republican elites.

The same, however, cannot be said for Democratic identifiers. Model 5 shows that party cues in the media are not associated with Democratic perceptions of climate change threat. Model 6 introduces the media variables. The results suggest that Democratic identifiers are responsive to the prevalence of economic cost frames in climate change coverage. A 10 point increase in the share of news coverage with cost frames reduces Democratic perceptions of climate change threat by 0.8 points in Model 5 (0.16 SDs, $p \sim 0.01$), which is robust to the inclusion of controls in Model 6. Although aggregate climate skepticism appears to be linked to the prevalence of party elite cues, it appears that there is some asymmetry – Republican identifiers are more responsive to these cues than Democrats.

The final three models assess the relationship between our measures and polarization – the distance between Democratic and Republican identifiers on perceptions of climate change threat. Model 7 shows that a 10 point increase in the share of coverage with Democratic cues increases the distance between Democratic and Republican identifiers by 1.3 points (0.22 SDs, $p < 0.001$), which increases to 2.7 points across all lags (0.45 SDs, $p < 0.001$). This result is robust to including our other media variables (Model 8) and the controls (Model 9). Republican cues are signed in the wrong direction. Economic cost frames also appear to have a depolarizing effect – by reducing climate change threat perceptions of Democratic identifiers it pushes them closer to Republicans. This last result does not survive the introduction of controls in Model 9, however. Democratic cues remain significantly associated with polarization between Republican and Democratic identifiers in their perceptions of climate change threat.

5.3 Teasing out directions of causality

It appears from the above results that party elite cues, particularly from Democrats, are strongly associated with climate skepticism and polarization. However, one limitation with the above models is their inability to tease out causal direction. A large literature in opinion formation tells us that elites are often an important influence on public opinion (Zaller, 1992; Lenz, 2012), but policymakers are often responsive to public opinion as well (Erikson, Mackuen, & Stimson, 2002).

There is a possibility that the coefficients on our party elite measures from above are biased because of reverse causality.

We can shed some light on this problem by estimating a reduced form vector autoregression (VAR) where our endogenous variables are regressed on their past values and the past values of the other endogenous variables in our system. The downside of this approach is that it does not tell us anything about the contemporaneous relationships between the variables. We cannot use the results to infer causality in a strict sense. We can, however, learn whether one variable “granger causes” another – that is, do past values of an variable facilitate the prediction of current values of another variable above and beyond the previous values of other variables in the system. We estimates a series of VAR equations to tease out the relationship between Democratic and Republican attitudes towards climate change threat on the one hand, and elite cues, such as Congressional roll call scores and cues in the news media, on the other.¹⁷ Included in this system are exogenous controls for crude oil prices and unemployment, which could influence both elite behaviour and public attitudes related to climate change.

# of Lags	Granger causality tests (Republican)	chi2	P-value
2	% of coverage with Democrats → Republican PCCTI	12.971	0.002
	Republican PCCTI → % of coverage with Democrats	1.061	0.588
1	REPUBLICAN LCV score → Republican PCCTI	6.632	0.010
	Republican PCCTI → REPUBLICAN LCV Score	2.191	0.139
# of Lags	Granger causality tests (Democratic)	chi2	P-value
2	% of coverage with Democrats → Democratic PCCTI	1.59	0.452
	Democratic PCCTI → % of coverage with Democrats	13.512	0.001
2	Democratic LCV score → Democratic PCCTI	1.829	0.401
	Democratic PCCTI → Democratic LCV score	11.325	0.003

Table 2.4 Granger causality tests

¹⁷ VAR estimates are somewhat sensitive to the chosen lag lengths, particularly with T in the small to intermediate range. Theoretically, we do not expect our variables to cause other variables past a lag length of four quarters, or a year. There are a number of different methods to choose the appropriate lag length. In cases of disagreement between the tests on the appropriate lag length, the higher lag length was chosen. All characteristic roots lie inside the unit circle, meeting the stability condition for a stationary VAR system.

The full estimates for the VAR equations are presented in Appendix K. Displayed in Table 2.4 are the results of granger causality tests. The top panel shows our tests for Republican identifiers. Unsurprisingly, there is little evidence that Republican climate change threat perceptions granger cause the share of Democratic elites in coverage ($p \sim 0.588$), but there is strong suggestion that the reverse is true ($p \sim 0.002$). There is also some evidence that Republican roll call voting in Congress related to the environment granger causes Republican climate perceptions ($p \sim 0.01$). Republican voters seem attuned to elite cues. The lack of correlation between Republican cues in the media and Republican climate perceptions is likely due to the heterogeneous nature of those messages – Republicans have not always been skeptical of climate change in their media cues over time. There is some suggestion that Republican climate perceptions granger cause Republican roll call voting, but this effect just misses statistical significance.

Democratic identifiers, however, are not responsive to elite cues in the same way. Neither Democratic cues in the media ($p \sim 0.452$), nor Democratic roll call voting ($p \sim 0.401$) granger cause Democratic climate change threat perceptions. However, there is some evidence that Democratic elites follow their voters. Democratic climate change threat perceptions appear to granger cause the share of Democratic elites in climate coverage ($p \sim 0.001$) and Democratic roll call voting on the environment ($p \sim 0.003$). Elite cues matter in shaping public attitudes towards climate change, but there appears to be substantial asymmetry.

6 Discussion

Climate change is one of the biggest challenges the global community faces moving forward. Tackling the problem is complicated by tremendous collective action problems. Solutions have lagged in no small part because of obstinate refusal, until recently, of the United States to be a part of the solution. Climate scientists, international politicians and political scientists alike have been perplexed that a reasonably large, and seemingly growing, portion of the American public rejects climate science, particularly among Republican voters.

There have been numerous theories and conjectures about why this is the case. Some have pointed to the influence of Big Oil and their financing and peddling of misinformation about the science of climate change, others to the role of ideology or media framing, and more recently to influence of party elites. All of these factors could very well influence climate attitudes in the isolation of a survey experiment, but this does not mean they are meaningful drivers of the dynamics of American polarization on climate change. We believe scholars need to examine dynamics the

information environment over time to answer this question, which has been thus far neglected in research. Somewhat relatedly, there has been a common thread through most explanations of climate change polarization that it is a special case. As a result, research that does exist is somewhat disconnected from what we know about opinion formation and persuasion on other political issues.

This paper addresses both of these problems by situating climate change polarization in the larger literature on citizen cue-taking, media indexing, and opinion formation and persuasion, while examining an original dataset of 26,000 news stories from a large and diverse sample of media outlets. This allows us to draw several important conclusions about the nature and dynamics of climate change coverage and its implications for public attitudes on the topic.

First, we identified four primary factors that, if communicated through the media, could possibly play a role in shaping public opinion on climate change: party elite cues, ideological identity cues, economic cost frames, and cues from organized climate skeptics. We found party cues to dominate. In total, over half of the news stories in our sample featured such a message. Unlike our other sources of polarization, party cues are both increasing in their share of coverage over time and linked to periods of high salience, particularly those from Democratic elites. Party cues have been increasingly available to form American attitudes on climate change. The results of our manual coding of party messages also provide suggestive evidence of a Democratic role in climate polarization. Their cues, in addition to being more voluminous, are far more consistent. Republican cues have been mixed on climate change until recently. In contrast, ideological cues and messages from organized climate skeptics are not very common. The former has only become more frequent in recent years, while the latter's share of coverage has generally been on the decline since Kyoto.

Second, using two different approaches to measuring aggregate climate change attitudes, at both annual and quarterly levels of analysis, we find that the most consistent factor that is associated with climate skepticism, Republican attitudes towards climate change threat, and partisan polarization, is the prominence of Democratic cues in news coverage on climate change after controlling for other influences we thought were important. That is not to say that Republican cues did not matter. Our measure of Republican cues in the press reflects a mixture of inconsistent messages from Republican elites. A more fine-grained measure of the dynamics of cues clearly against the climate consensus may have produced a different result. A possible role of Republican elites is hinted at by the fact we find some evidence that their activity in Congress is associated with climate skepticism and Republican perceptions of climate change threat. In short, we show that the story behind climate change polarization may be little different from any other salient political issue

of the day: members of the public were exposed to a large volume of partisan messages on climate change, primarily from Democrats, as the issue grew in salience and formed their attitudes accordingly. We need not focus on unique attributes of climate change as an issue to understand why polarization occurred.

There are, of course, important limitations to this study worth noting. Ultimately time series analyses, particularly with modest T as used here, are limited in their ability to provide clean tests of causality. We ultimately show associations between party cues and a number of measures of climate skepticism, partisan attitudes on climate change, and overall polarization that are robust to controlling for other factors that have been identified in the literature. And, with the VAR extension, we can say that, at least for Republicans, party cues lead rather than follow opinion. More evidence is needed at the experimental level to provide stronger evidence of causality. Further follow up should be taken on the potential asymmetry we have identified between Republicans and Democrats in their respective responsiveness to elite cues.

The growth of climate change skepticism in the Republican Party is a concern. It has prevented the development of a consensus necessary for the United States and its large number of veto-points, to take aggressive action on climate change. We must, however, resist the temptation to conclude that the presence of a scientific consensus makes this topic fundamentally different than other political issues. Party elites have the ability to persuade like-minded voters on particular issues to serve their interests, and the ability to repel partisans that oppose them. An ambivalent public that only peripherally pays attention to many issues often take their cues from their parties on how to form opinions. Politically sophisticated voters, for their part, tend to form highly charged positive and negative affective attachments to parties and their leaders, and this likewise guides their opinion formation process. They are also more likely to be exposed to elite debate in the media environment. It is really not a puzzle why the most educated are the most polarized on climate change.

This is the case with most political issues. Party elites have persuaded the public on climate change through their cues in the media. This work joins an emerging literature on the role of the media and elite cues in climate change polarization (Guber, 2013; Carmichael & Brulle, 2017; Tesler, 2017), work showing the persuasive influence of out-group party cues (Berinsky, 2009; Nicholson, 2012) and research on the possibility of boomerang effects in science communication where messages designed to persuade may do the opposite for certain segments of the public (Hart & Nisbet, 2012).

There are three major implications of our finding. First, party elites who strongly identify with the scientific consensus on climate change or other issues must weigh the costs and benefits of aggressively communicating their stance in the news media. Although the politicization of coverage on climate change was inevitable at some level because of the need for large-scale policy action, Democratic elites should perhaps resist the urge to turn climate change into a political bludgeon. On other issues, like GMOs and vaccines, little policy action needs to be taken and likely should be avoided. Efforts by pro-GMO groups to block state labelling efforts or by the medical community to curb conscience-based vaccine exemptions with legislation may lead to unanticipated consequences. The recent trend of Republican elites backing parental exemptions for childhood vaccines and questioning the safety and efficacy of vaccines is deeply troubling.

Second, emphases on ideology and motivated skepticism, while important to understanding why persuading Republicans and conservatives about the perils of climate change is a tough task at present, is perhaps of more limited utility in helping us understand how we got to this point in the first place. Democratic and Republican identifiers were not always so divided on climate change. They likely listened to, and formed opinions based on, signals from trusted elites. By viewing the roots of climate change skepticism primarily in deep-seated ideological and value constructs, we minimize the degree to which elites can shape those constructs. It also means that these elites can turn the tide by taking climate change out of the realm of hyper-partisan conflict.

Lastly, literature and public scholarship on the role of nefarious conservative and industry organizations in polarizing the American public are, at best, missing the mark, and at worst, making the problem worse. There is very little evidence that these organizations have played the outsized role that has been claimed in sowing the seeds of doubt in the public, nor does it seem that mainstream conservative media have been unapologetic purveyors of these actors' messages. More importantly, this line of attack against conservative movement groups heightens the partisan and ideological divides in current climate change politics. We need to find ways to depoliticize and depolarize climate change, not pour gasoline on the fire. Only then can we find ways to mobilize societal consensus for meaningful action on climate change.

Paper III

Anti-intellectualism, Anti-elitism, and motivated resistance to expert agreement

1 Introduction

Citizens are often in disagreement with scientific opinion on a wide range of issues that have important implications for policy making. The bulk of scholarly attention to this matter has been dedicated to climate change. At some level this is understandable. Climate change is one of the most pressing issues of our time and one where we have struggled to find and implement long-term policy solutions. However, a focus on climate change potentially distorts our understanding of how citizens are persuaded by expert advice on other issues. A large majority of citizens in the United States agree with the climate change consensus, but opinion is very heavily structured by ideology and partisanship. Thus, explanations about the failure of citizens to accept expert advice tend to center on ideology-driven motivated reasoning. This structure of public opinion, however, is not present on other issues, like GMOs or water fluoridation, among others. So, it is likely not the whole story on these science-based issues.

I advance the argument here that one of the central predispositions that govern citizens' acceptance of expert knowledge is anti-intellectualism – a disdain for intellectual and scholarly pursuits that results in a generalized mistrust of experts and intellectuals. Not a lot of work has explored the nature of this predisposition and how it may shape attitudes towards areas of expert consensus. This paper contributes to this nascent literature in three ways. First, I establish anti-intellectualism as a strong predictor of agreement with positions of expert consensus above and beyond left-right ideology. Second, using a survey experiment, I demonstrate that anti-intellectualism moderates the persuasiveness of messages of expert consensus on a variety of issues. Third, I connect anti-intellectualism to the broader predisposition of populism – a worldview that sees political conflict as primarily between ordinary citizens and a privileged societal elite. I further show with my experimental design that anti-elite rhetoric – even rhetoric that does not directly pertain to experts and intellectuals – activates anti-intellectualism as a predisposition and in so doing limits the persuasiveness of consensus messages from experts among those most in need of persuasion.

2 Anti-intellectualism and the rejection of expertise

Starting with the seminar work of Hoftstadter (1962), scholars have shown that anti-intellectualism has a long history in American politics. The roots of this worldview are in a belief that “intellectuals....are pretentious, conceited...and snobbish; and very likely immoral, dangerous, and subversive” and that “the plain sense of the common man....is an altogether adequate substitute for, if not actually much superior to, formal knowledge and expertise” (Hoftstadter, 1962, p.19). Experts are seen as dangerous because they occupy the halls of power and profess to know how citizens should better run their lives. The rising importance of the expert with the growth of government after the Second World War may have helped spark a rise in anti-intellectualism (Hofstadter, 1962).

Not all scholars agree on how to conceptualize anti-intellectualism. Rigney (1991) identifies three distinct components to anti-intellectualism: 1) Anti-rationalism, or the dismissal of critical thinking as a desirable trait; 2) Unreflexive instrumentalism, or the devaluing of long term payoffs for short term material gain; and 3) anti-elitism, or the disparagement of intellectuals and experts. Some have viewed anti-intellectualism as a rhetorical style that emphasizes plain-spokenness (Lim, 2010; Shogun, 2007), while others see it as an important component of populist rhetoric (Brewer, 2016; Harris, 2010; Kazin, 1995).

For my purposes here, anti-intellectualism is defined as *a suspicion and mistrust of intellectuals and experts of whatever kind resulting from a disdain for scholarly and intellectual pursuits*. Such disdain can have a number of sources. Some citizens might view expert authority as fundamentally at odds with religious authority that they may privilege. Or, they might not see the value of education and critical thought, particularly if they see it as coming at the expense of practical knowledge and common sense (Rigney, 1991). Some citizens may be resistant to new technologies and resulting societal change, and thus harbour resentment towards those that make it possible, echoing the luddites of the distant past. Or, they may be skeptical of acquired knowledge because they see it as a tool of an exploitative societal elite (Brewer, 2016) – a point which will be returned to below. Whatever the source, the result is a generalized mistrust of expert authority.

Anti-intellectualism has important implications for the acceptance of expert consensus. Perceptions of speaker knowledge are important for messages to be persuasive to the lay citizen, but they are not sufficient. Citizens peripherally pay attention to politics and assimilate knowledge with the aim of minimizing costly mistakes. This requires citizens to *trust* speakers, which is dependent on either perceived common interests or a perception that lying is costly to the speaker (Lupia &

McCubbins, 1998). By definition, those that hold anti-intellectual predispositions lack this trust in expert sources. Thus, we should expect them to exhibit lower levels of agreement with important positions of scientific consensus. Motta (2017) found this to be the case for climate change and the safety of nuclear power, but it should also apply to issues of lesser salience. We should also expect the persuasiveness of messages emphasizing scientific agreement to be lower among these citizens. This leads to the first two hypotheses pursued in this paper.

Hypothesis 1 (H1): Anti-intellectualism is correlated with opposition to positions of expert agreement holding other factors, like ideology and partisanship, constant.

Hypothesis 2 (H2): Anti-intellectualism conditions the effect of expert agreement cues on support for positions of expert agreement with effects weaker effects expected among those with stronger anti-intellectual predispositions.

3 Anti-elite rhetoric as an activator of motivated resistance

Perhaps the larger contribution for this paper is in exploring possible influences in the real world that might make this highly conditional acceptance of expert consensus more apparent. One possibility is anti-elite rhetoric. The study of populism has been extensive, but there has been tremendous disagreement on how to define it. Scholars have searched for the common denominator to link together movements that have little in common at the surface. A useful starting point is provided by Kazin (1995), who argues that populism is a worldview that pits average citizens against elites in political and economic conflict. His emphasis on underlying attitudes is pitched in the American context, but this definition has broader use. For example, Roodujn (2014) finds that a common thread linking populist movements globally is a belief that politics is in part defined by a struggle between the people, imagined as a collective, and powerful societal elites. His emphasis, in contrast to Kazin, is in populism as a rhetorical strategy. Following these scholars, and others (Mudde, 2004; Taggart, 2000) this paper treats populism as *both* a worldview and a rhetorical strategy employed by politicians that emphasizes conflict between the people, imagined as a collective, and political elites or the establishment.

In short, populism is minimally defined by its *anti-elitism* – a hostility towards elites, of whatever kind and for whatever reason. The roots of this anti-elitism can vary. On the political left, hostility towards elites is anchored in concerns about the wealth and privilege of economic elites and

their effects on marginalized communities. On the political right, this suspicion may be rooted more in concern about excessive government power over individuals. In either case, ire is directed towards societal elites for reasons that are not linked to the level of intellect or education of those elites.

Anti-elitism is perhaps the only thing that links together recognized populist movements in America (Brewer, 2016). Anti-elitism can be found in Anti-federalist opposition to the Constitution (Cornell, 1999), the movement to elect Andrew Jackson (Harris, 2010; Hofstadter, 1962), the agrarian populists of the 19th century (Kazin, 1995), and the popularity of Ross Perot in the 1990s. There is evidence that populist rhetoric has been pervasive in presidential campaign discourse. Such rhetoric allows outsider candidates to distinguish themselves from others closer to the power centres in each party (Bonikowski & Gidron, 2016). More recently, anti-elite sentiment has emerged in the aftermath of the Financial Crisis, manifesting in the rise of the Tea Party and Donald Trump on the right (Motta 2017; Skocpol & Williamson, 2013), and the growing clout of liberal populists in the Democratic Party (Oliver & Rahn, 2016).

There is likely to be a strong connection between anti-elitism and anti-intellectualism. Suspicion of experts can be rooted in a perception that expert knowledge will be used to control ordinary citizens, which shades into populist discourse. As Brewer notes “American populism tends to be highly resentful of being told by experts ‘we know best’” (2017, p. 253). Some populists may see experts as part of the ruling elite because of their status and importance in policy debates.

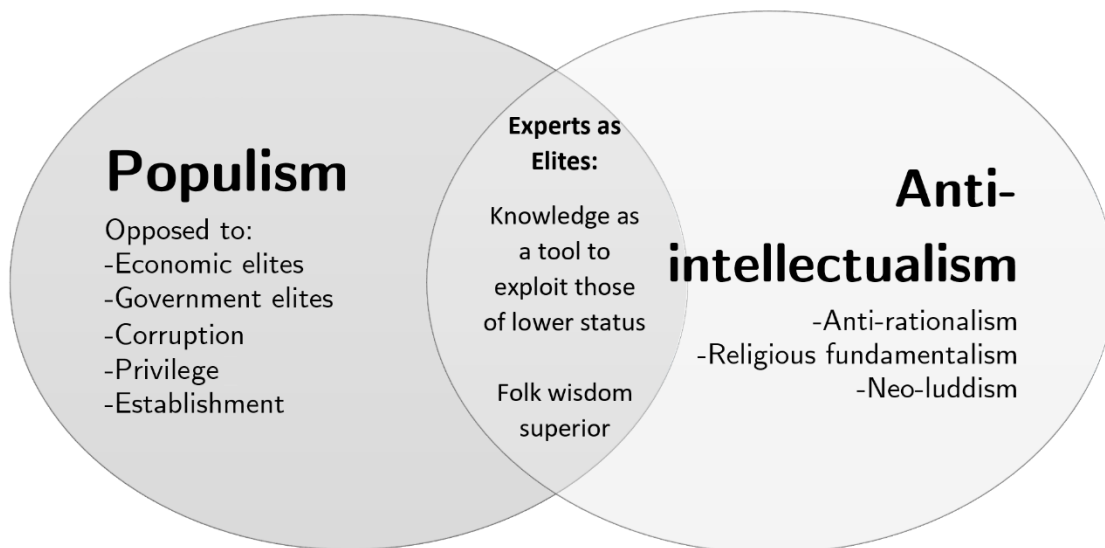


Figure 3.1 Conceptual relationship between populism and anti-intellectualism

However, it would be a mistake to see these concepts as indistinguishable. There are other sources of anti-intellectualism that are distinct from populist concerns about knowledge asymmetries between experts and ordinary citizens, such as religious fundamentalism and anti-rationalism, as noted above. Similarly, some populists fail to identify experts as part of the ruling elite. For example, populist progressives in the early 20th century saw expertise and professionalism as a solution to the machine politics they abhorred. Marxist leaders often make considerable use of anti-elite rhetoric, but their movement has historically often been led by intellectuals and fueled by important philosophical texts. Anti-elitism and anti-intellectualism are complex, layered concepts. We can imagine the relationship between them looks something like the Venn diagram in Figure 3.1.

Notwithstanding these complexities, we have strong grounds to expect an association between them, which leads to my third hypothesis:

Hypothesis 3 (H3): Anti-intellectualism is correlated with populist sentiment after holding other factors, like ideology and partisanship, constant.

An association between populism and anti-intellectualism implies that anti-elite rhetoric may have important implications for the public's support for areas of expert agreement. Rhetoric has the power to shape political attitudes (Chaiken, 1980; Petty & Cacioppo, 1986), particularly through the use of *frames* in political communication, where political actors use rhetoric and argument in order to emphasize certain considerations of an issue to the exclusion of others (Chong & Druckman, 2007).

Initial studies of framing effects in political science looked at the effect of evoking entirely different considerations of an issue on policy attitudes. However, frames can also link people's underlying world views to political and scientific questions. Particular focus has been placed on the influence of moral rhetoric. Research has found that such language can activate citizens' moral intuitions to shape policy evaluations (Barker, 2005; Clifford et al., 2015; Shen & Edwards, 2005). The power of moral rhetoric is facilitated by the fact that moral intuitions are automatic and often unconscious predispositions that might be triggered by the political environment (Haidt, 2001). It is not surprising then that a wide range of literature has found moral framing to be influential in shaping attitudes (Haider-Markel & Joslyn, 2001; Kidwell, et al., 2013; Winterich, et al., 2012). For example, conservatives become more likely to endorse environmental protection when framing environmental issues to focus on the sanctity foundation of Haidt's (2001) moral foundations theory

(Feinberg & Willer, 2013). Similarly, rhetoric on stem cell research that taps into the care foundation was found to be persuasive among those that privilege that foundation (Clifford et al., 2015).

The fact that rhetoric from political elites can activate underlying predispositions of citizens to shape downstream political behaviour does not have to be limited to those of the moral variety. Ideological and value-based predispositions result in citizens often having a wide range of positive and negative affective attachments to political objects that unconsciously shape their processing of political information (Lodge & Taber, 2014). Rhetoric that taps into salient underlying predispositions – broadly speaking – has the capacity to shape political behaviour. A strong association between populism and anti-intellectualism would suggest that for many people experts are seen as elites. If this is true, we might expect anti-intellectualism to moderate the effect of expert agreement cues even more strongly when respondents are exposed to anti-elite rhetoric – even when that rhetoric does not directly pertain to experts and related issues.

Hypothesis 4 (H4): Anti-intellectualism will condition the effect of expert agreement cues more strongly when respondents are exposed to anti-elite rhetoric.

	GSS (2016)	MTurk (2018)
Male	44%	42%
White	73%	75%
College Degree or Higher	30%	56%
Conservative	34%	32%
Republican (Lean Included)	35%	36%
Monthly Church Attendance or Greater	44%	30%
Employed Full-Time	46%	60%
Under \$20,000 Family Income	19%	12%
Age (Mean)	49	39

Table 3.1 Comparison of 2016 GSS survey and 2018 Amazon Mechanical Turk sample

4 Data and methods for observational analyses

I use the General Social Survey (GSS) and a 2018 survey of 3,614 American citizens who participated through Amazon Mechanical Turk (MTurk) to test the hypotheses I have outlined. This latter sample cannot make claims to representativeness, but some of its broad characteristics are similar to the public as a whole. Table 3.1 provides a comparison of the 2016 GSS and the MTurk

sample used in the paper. MTurk respondents are reasonably representative of the American population in terms of gender, race, partisanship, and ideology, but it is substantially younger, more educated, less religious, and more affluent.

4.1 Measuring anti-intellectualism

Very little work has tried to understand and measure anti-intellectualism as a predisposition in the general public. The GSS, for its part, is limited to a question that asked respondents their degree of confidence in the scientific community (a great deal/only some/hardly any). I use this question for the GSS analyses, rescaled from 0 to 1 where 1 is having hardly any confidence in the scientific community. This is obviously insufficient on its own. Confidence is not the same concept as trust, while the scientific community only represents one set of actors in a broader constellation of experts and intellectuals in society.

One recent attempt by Oliver and Rahn (2016) measured anti-intellectualism with responses to the following questions (strongly agree to strongly disagree, 7-point):

- I'd rather put my trust in the wisdom of ordinary people than the opinion of experts and intellectuals.
- When it comes to really important questions, scientific facts don't help that much.
- Ordinary people can really use the help of experts to understand complicated things like science and health.

They find that these questions correlate strongly with conservative ideology and religious fundamentalism. But, the questions themselves seem to tap strongly into populist themes, while emphasizing attitudes toward science rather than experts more broadly. Anti-intellectualism is certainly related to these issues, but, as discussed in section 2, it is likely a multidimensional concept that is not fully captured by these questions.

Absent rich, theoretical work that teases out the dimensions of anti-intellectualism for measurement purposes, I lean on the conceptualization I advance here. Whatever the particular source of anti-intellectualism – whether it is religious fundamentalism, populism, or anti-rationalism – citizens that harbour this predisposition will have a *generalized* mistrust of experts. So, I gave respondents a randomized battery where they rated their trust in a number of different groups in society with the following lead (distrust a lot to trust a lot, 7-point):

Below is a list of groups in society. Please tell us the degree to which you trust or distrust members of these groups.

Among these groups are experts, scientists, economists, university professors, doctors and medical professionals, legal professionals, and financial experts. The distributions of these variables are displayed below in Figure 3.2 as box and whisker plots. As is clear from the graph, Americans are generally trusting of experts across the board, but scientists and doctors have an edge over most groups with a median of 5 on the 0 to 6 scale, while legal professionals are trusted the least with a median of 4. Legal professionals aside, only one quarter of respondents or less are distrusting – at any level – of any given expert community.

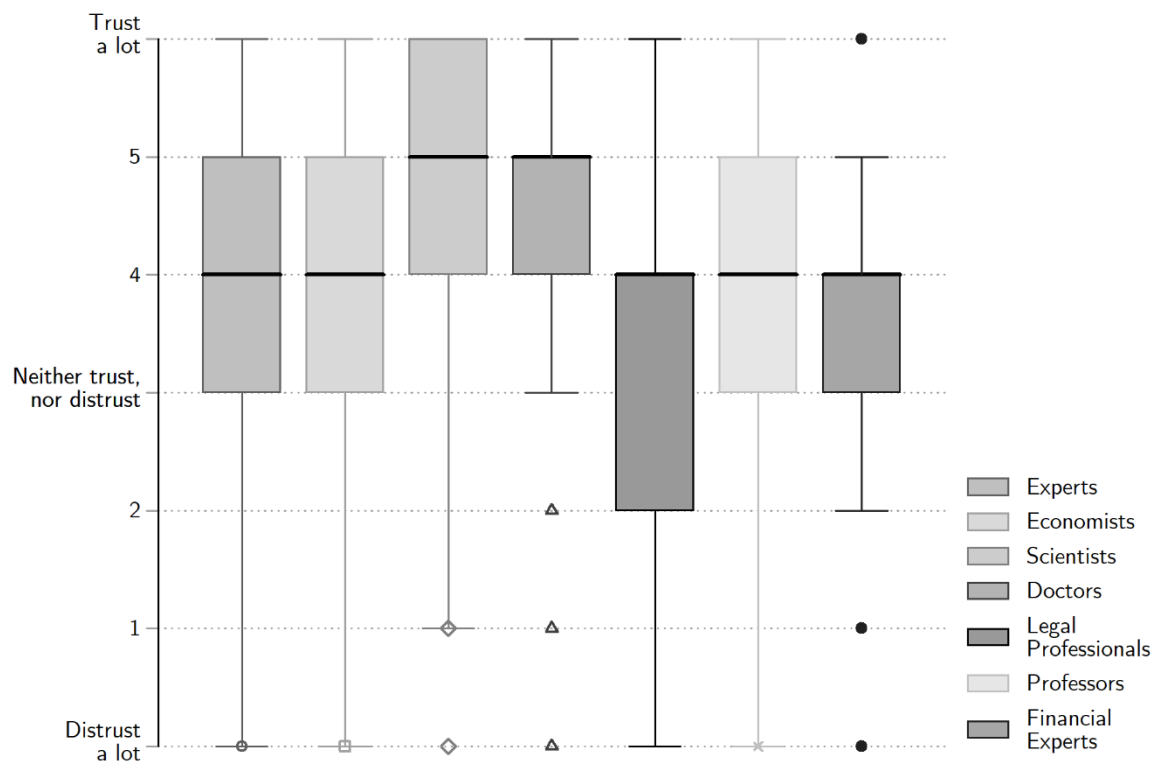


Figure 3.2 Distribution of trust in expert communities, box and whisker plots

Notwithstanding these modest differences, principal components analysis reveals that these items load together strongly on one dimension. These factor loadings are displayed in Table 3.2. On balance, respondents did not appear to make fine grained distinctions between types of experts. If you trust one class of expert, you are very likely to trust the rest. As a result, these items can be used

to construct an index of expert mistrust, which I take as measuring the concept of anti-intellectualism. The Cronbach's Alpha on such an index is 0.86, suggesting high reliability. Item drop scores show us that the reliability of the index cannot be improved by removing any items. These are shown in Table 3.2 as well.

Anti-intellectualism	Factor loading	Item-drop
Experts	0.80	0.83
Economists	0.73	0.84
Scientists	0.77	0.83
Doctors	0.74	0.84
Legal professionals	0.68	0.84
University professors	0.74	0.84
Financial experts	0.69	0.84
Cronbach's Alpha		0.86

Institutional Confidence	Factor loading (GSS)	Item-drop (GSS)	Factor loading (MTurk)	Item-drop (MTurk)
Congress	0.73	0.60	0.80	0.79
Federal executive	0.69	0.62	0.80	0.80
Supreme Court	0.67	0.63	0.73	0.82
Major companies	0.61	0.65	0.78	0.80
Banks & finance	0.62	0.65	0.79	0.80
Cronbach's Alpha		0.68		0.83

Table 3.2 Factor loadings and reliability scores for anti-intellectualism and institutional confidence

Consequently, I construct an index of all of these groups, rescaled from 0 to 1 where 1 is the most anti-intellectual, as indicated by a consistent and complete mistrust of expert communities. The distribution of this measure is displayed in Figure 3.3. Anti-intellectualism as measured here is not all that common among respondents. The average score is approximately 0.34 on the 0 to 1 index. Further, approximately two thirds of Americans find themselves between 0.17 and 0.51, indicating a reasonably narrow distribution. Only about 20% of respondents find themselves at the mid-point of the scale or higher.

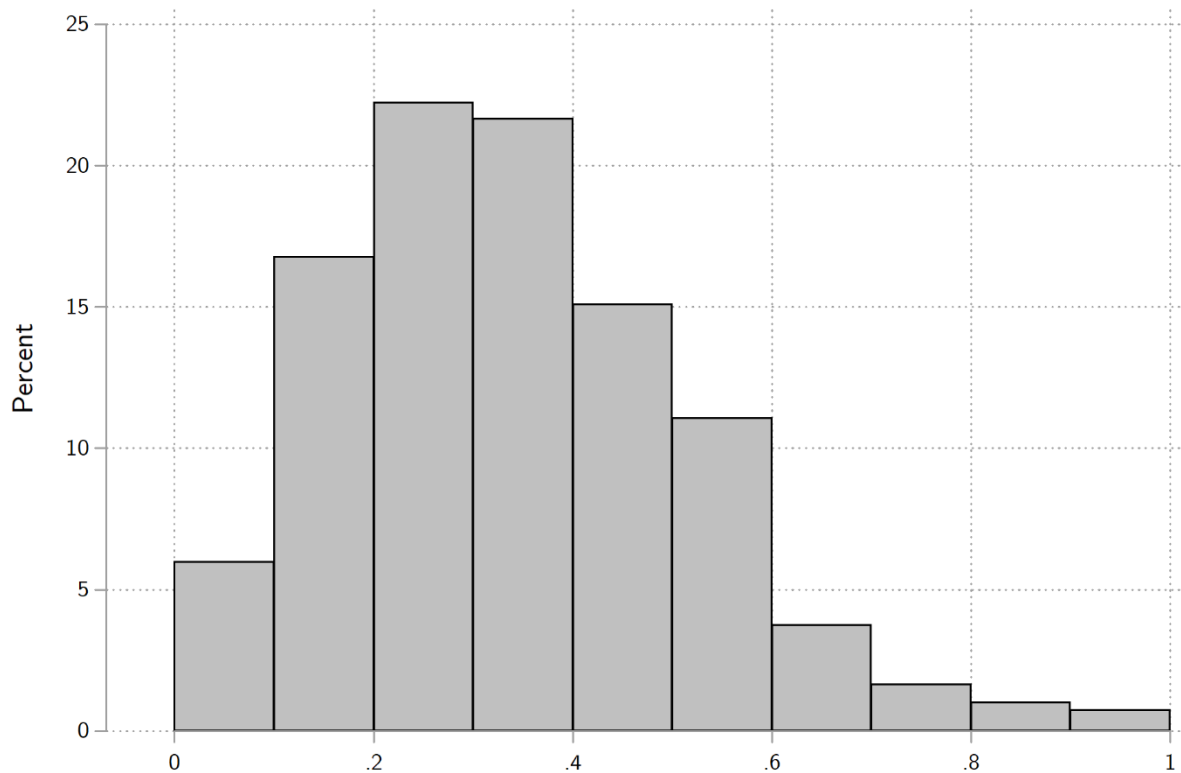


Figure 3.3 Distribution of anti-intellectualism. Note: measured on a scale of 0-to-1; the average is 0.34 with a standard deviation of 0.17.

4.2 Predicting support for positions of expert consensus

The GSS lacks consistent over time questions on areas of expert consensus. The closest questions that can be found are the following that addressed climate change, nuclear power, and GMOs, respectively:

- Using coal or gas contributes to the greenhouse effect (definitely true to definitely not true, 4-point; asked in 1993, 1994, and 2000)
- How dangerous is nuclear power for the environment? (extremely dangerous to not dangerous at all, 5-point; asked in 1993, 1994, and 2010)
- How dangerous is modifying genes in crops for the environment? (extremely dangerous to not dangerous at all, 5-point; asked in 2000 and 2010)

72% of Americans believed coal and gas definitely or probably contributed to the greenhouse effect. 83% of Americans viewed nuclear power as somewhat to extremely dangerous for the environment, while 72% thought the same for GMOs.

These questions do not fully or appropriately reflect the expert consensus on these issues and were asked long ago. So I had my MTurk respondents report their level of agreement with four positions of expert consensus on climate change, nuclear power, GMOs, and water fluoridation.¹⁸ 80% of MTurk respondents agreed at some level with the expert position on climate change, versus 48% on nuclear power, 46% on GMO safety, and 53% on water fluoridation. I rescale these measures from 0 to 1 where 1 indicates full support for the expert position. I estimate a model using OLS regression to examine the link between anti-intellectualism and support for each of our expert positions where X represents a vector of additional control variables:

$$\text{support for expert position} = \alpha + \beta_1 \text{anti-intellectualism} + \beta_2 \text{ideology} + X + \epsilon \quad (3.1)$$

β_1 should be negative and significant to support H1. Ideology is measured as a 7-point scale (Extremely liberal-to-Extremely conservative). I also control for partisanship, which is measured in a similar fashion (Strong Democrat-to-Strong Republican). Both of these variables are rescaled from 0 to 1. Controls for education and political interest are also worth noting. They are used here to soak up information effects. It is possible that anti-intellectuals are simply not as informed about positions of expert consensus, and it is this lack of information that is doing the heavy lifting as opposed to the motivated rejection of expert messages. Descriptions of all the control variables can be found in Table A1 of the Appendix.

4.3 The association between populism and anti-intellectualism

The primary independent variable of interest for H3 is populism. This is measured two ways. I operationalize it as the first factor that emerges from a principal components analysis of questions in the GSS that gauge respondents' confidence in political and economic institutions, such as Congress, the federal executive, the U.S. Supreme Court, major companies, and banks and financial institutions (a great deal/only some/hardly any). Institutional confidence is standing in here as a rough proxy for populism in the absence of better measures that were asked consistently over time.

¹⁸ 1) Earth's climate is warming and this is due to the human production of greenhouse gases like carbon dioxide; 2) Nuclear power is a safe and environmentally-friendly form of energy production compared to conventional sources of energy like fossil fuels; 3) Genetically modified foods are safe, and pose no greater risk to human health than non-GM foods; 4) Water fluoridation improves oral and dental health with no safety risk (strongly agree to strongly disagree, 7-point).

A similar confidence measure is constructed with MTurk respondents. In both cases each of these items load on the same factor as shown in Table 3.2. Respondents largely do not make a distinction between political and economic institutions.

Second, I built a populist sentiment index with MTurk respondents that is based on the predicted first factor of a principal components analysis on the level of respondent agreement with five statements that tap into such sentiment taken from Oliver and Rahn (2016).¹⁹ Respondent lack of confidence in institutions and populist sentiment are correlated in the MTurk sample (0.32). All measures are re-scaled from 0 to 1 where higher values represent more populist sentiment. I estimate the following model to predict anti-intellectualism in both the 2016 GSS and the MTurk sample. β_1 should be positive and significant to provide support for H3:

$$\text{anti-intellectualism} = \alpha + \beta_1 \text{populism} + \beta_2 \text{ideology} + X + \epsilon \quad (3.2)$$

5 Observational results

The results for the observational analyses testing H1 are displayed in Figure 3.4. The top panel plots the coefficients for anti-intellectualism (operationalized as confidence in the scientific community) and ideology. The full estimation results can be found in Tables M.1 and M.2 in the Appendix. The results display a remarkably consistent link between anti-intellectualism and support for positions of expert agreement. Moving from having a great deal of confidence in the scientific community to having no confidence is associated with a 0.05 drop in support for the scientific consensus on the greenhouse effect ($p \sim 0.005$), and a 0.04 ($p \sim 0.05$) and 0.08 reduction ($p \sim 0.003$) in the perceived safety of nuclear power and GMOs, respectively, on 0-to-1 scales. Ideology, in contrast, has inconsistent effects. Conservative ideology is negatively associated with support for the scientific consensus on the greenhouse effect ($p \sim 0.001$), while it is positively associated with the expert positions on nuclear power ($p \sim 0.15$) and GMOs ($p \sim 0.05$), although not always significantly. Anti-intellectualism is a more consistent predictor of resistance to expert consensus than ideology.

¹⁹ 1) People like me don't have much say in what government does; 2) Politics usually boils down to a struggle between the people and the powerful; 3) The system is stacked against people like me; 4) It doesn't really matter who you vote for because the rich control both political parties; 5) People at the top usually get there from some unfair advantage (7-point, Strongly agree-to-Strongly disagree).

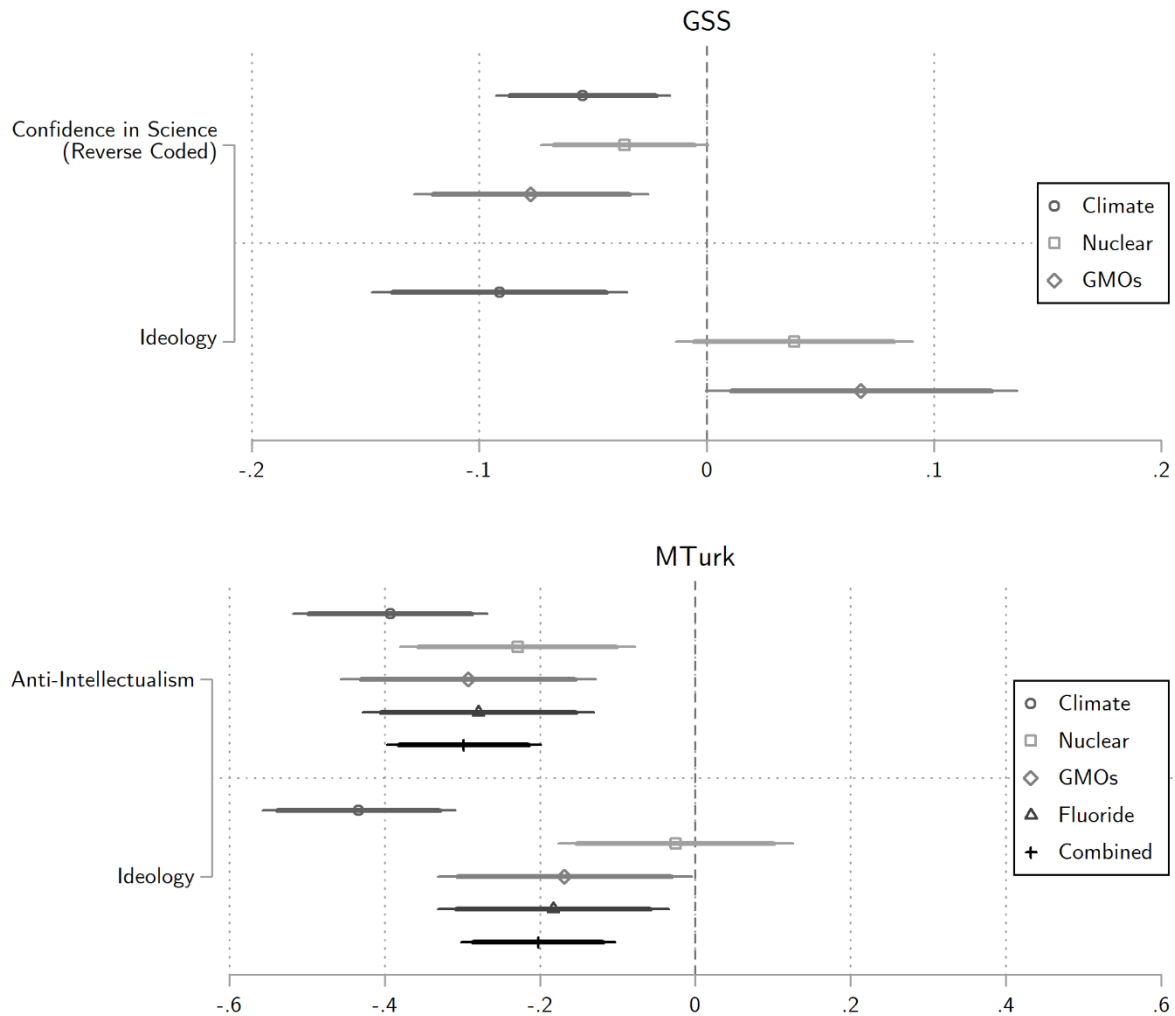


Figure 3.4 Determinants of support for expert consensus in the GSS (top) and MTurk sample (bottom). Note: controls for gender, employment status, race, age, income, education, church attendance, partisanship, generalized trust, and political interest (MTurk only). 95 and 90% confidence intervals.

Even stronger findings are apparent in the MTurk sample. The coefficients are displayed in the bottom panel of Figure 3.4. The full results can be found in Table M.2 of the Appendix. The consistency in the strength of the association between anti-intellectualism and each area of scientific consensus is striking. Moving across the anti-intellectualism index is associated with a reduction of 0.39 points in support for the scientific consensus for climate change ($p \sim 0.003$), 0.23 points for nuclear power ($p < 0.001$), 0.29 points for GMOs ($p < 0.001$), and 0.28 points for water fluoridation on 0-1 scales ($p < 0.001$). These are sizable effects. When averaging across all issues, movement

across the range of the anti-intellectualism index is associated with a reduction in support for positions of expert consensus of 0.30 points ($p < 0.001$).

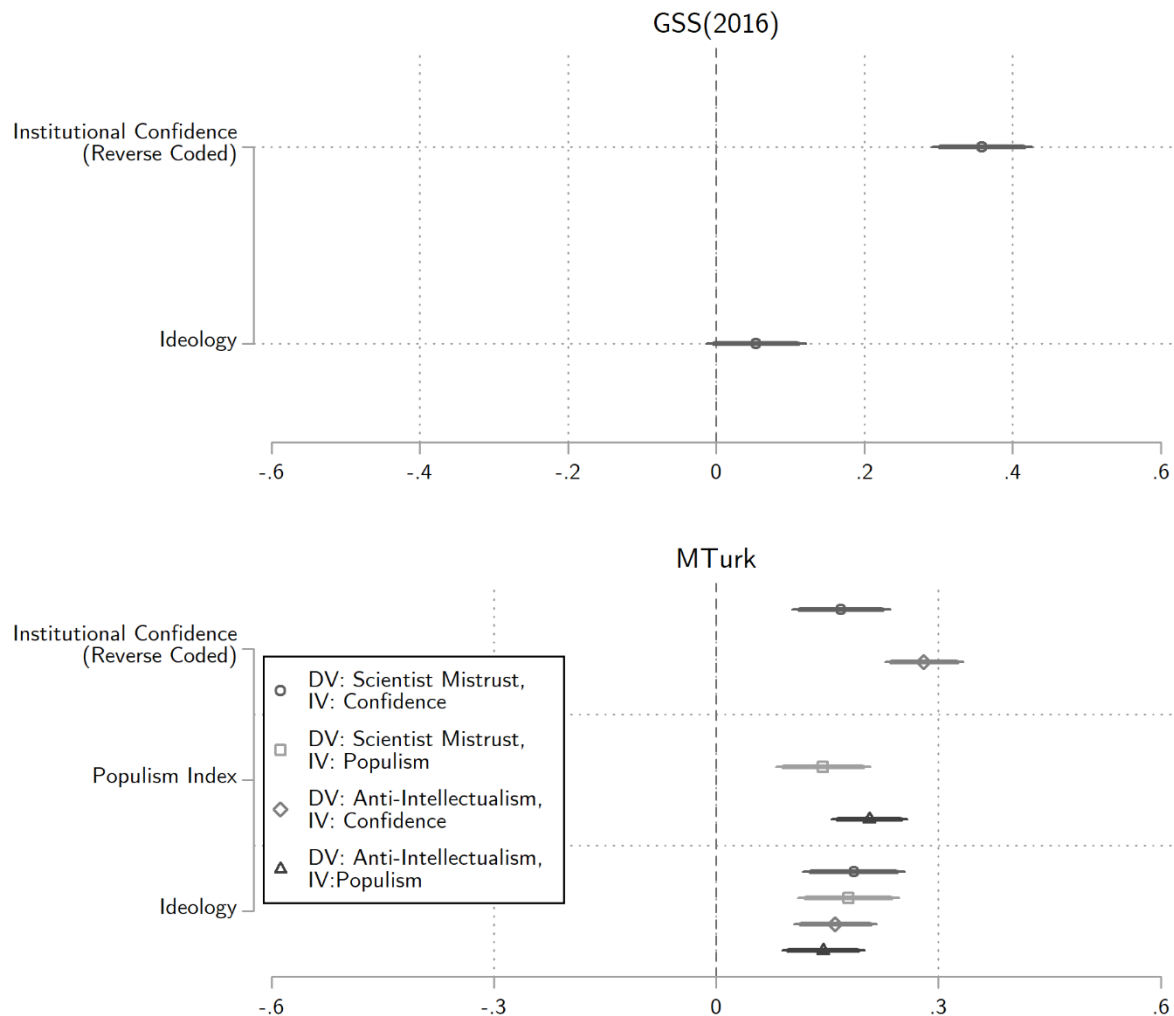


Figure 3.5 Association between anti-intellectualism and populism in the GSS (top) and MTurk sample (bottom). Note: controls for gender, employment status, race, age, income, education, church attendance, partisanship, generalized trust, and political interest (MTurk only). 95 and 90% confidence intervals.

Conservative ideology is associated with opposition to the climate consensus ($p < 0.001$), GMOs ($p \sim 0.04$), and fluoride ($p \sim 0.02$). Averaging across all issues, moving from extreme liberals to extreme conservatives is associated with a reduction in support for areas of expert consensus of a more modest 0.20 points ($p < 0.001$). Taken together, there is strong support in our observational

analyses for H1. Anti-intellectualism is a strong predictor of support for expert consensus above and beyond the effects of left-right ideology.²⁰

5.1 Are populism and anti-intellectualism connected?

It is clear that anti-intellectualism is an important predictor of opposition to expert positions. Could generalized anti-elite rhetoric magnify this effect by activating anti-intellectualism as a predisposition? Before proceeding to the experimental design, it would be helpful to establish an observational connection between populism and anti-intellectualism. The results are plotted in Figure 3.5. Full estimation results are shown in Table M.4 of the Appendix. The top panel contains the results using the 2016 GSS. Moving the full range of populism (operationalized as a lack of confidence in political and economic institutions) is associated with a large reduction in confidence in the scientific community of 0.36 points on a 0-1 scale ($p < 0.001$).

The operationalization of both anti-intellectualism and populism is unsatisfactory in the GSS, so I turn to the MTurk sample, the results of which are plotted in the bottom panel of Figure 3.5. This panel displays the coefficients from a series of models that utilize each combination of my variables of interest. For example, the first model, represented by the circle, operationalizes the dependent variable as mistrust in scientists (DV: Scientist Mistrust), while populism is represented by the institutional confidence index (IV: Confidence). The second model, signified by the diamond, uses the populism index (IV: Populism) in lieu of the confidence in institutions measure, while keeping the dependent variable the same.

For the first model, moving the full range of institutional (lack of) confidence is associated with a large increase in scientist mistrust of 0.17 points ($p < 0.001$) after controlling for other factors. Similarly, for model 2, moving the full range of the populism index is associated with an increase in scientist mistrust of 0.14 points ($p < 0.001$). This result holds when using our more complete index of anti-intellectualism in models 3 and 4. Moving the full range of institutional (lack of) confidence is associated with an increase in anti-intellectualism of a sizable 0.28 points ($p < 0.001$), while moving the full range of the populism index is linked to a large increase of 0.21 points ($p < 0.001$). Regardless of specification, there is a strong, robust association between anti-intellectualism and populism in

²⁰ There is some additional evidence that this association is the result of the rejection of expert messages. Information effects, as operationalized by political interest, appear to decline as anti-intellectualism rises. More detail can be found in the Appendix (Table M.3, Figure M.1).

support of H3. The strength of this association rivals and even exceeds that of ideology and anti-intellectualism.

6 Experimental design

There appears to be an observational connection between anti-intellectualism and both populism and support for areas of expert consensus. An experiment can more convincingly establish a causal link between these three factors. I embedded a 3X2 factorial design in the MTurk survey for the purposes of testing H2 and H4.

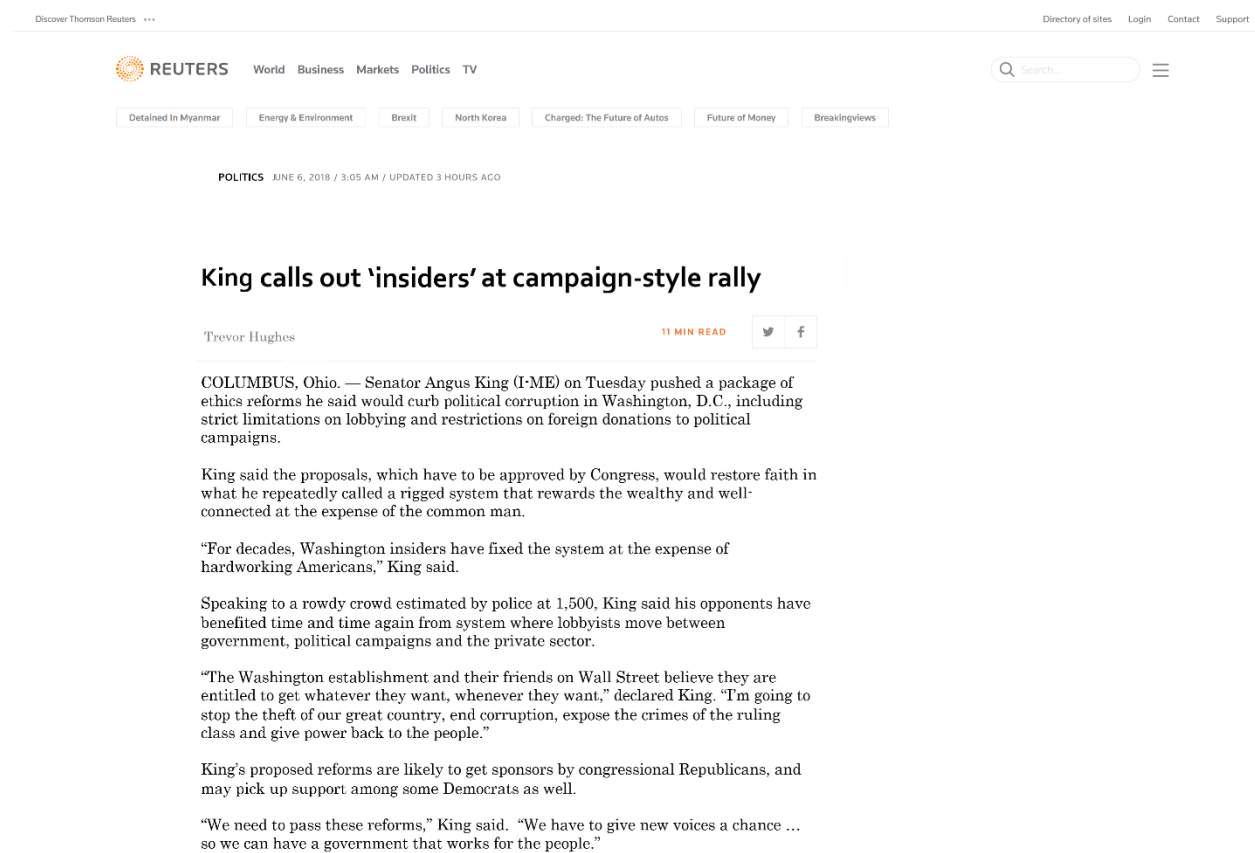


Figure 3.6 Mock news article, independent treatment condition

First, I randomly assigned subjects into three groups. The first treatment group was asked to read a mock news article from *Reuters* describing a political rally during which Senator Angus King (I-ME) used anti-elite rhetoric. The mock article was based on coverage of a real rally held by, at the time, Republican presidential candidate Donald Trump. The language was altered so that it could

plausibly come from either a Democrat or a Republican politician. Importantly, none of this rhetoric taps into anti-intellectual themes or the scientific issues used in this paper. The discussion is centred on corruption on Wall Street and in Washington. This test allows us to test whether generalized anti-elite rhetoric activates anti-intellectualism. I used Senator King because of his status as an independent and as a senator from a small state. This would allow for an examination of the effect of the rhetoric independent of partisanship. This article is shown in Figure 3.6. The other articles can be found in Appendix N.

The second group received an identical article with one exception – the source was altered to be Donald Trump, for respondents who identify with or lean to the Republican Party, or Bernie Sanders for everyone else. Sometimes the effectiveness of messages are dependent on characteristics of the speaker (Kuklinski & Hurley, 1994). Bernie Sanders and Donald Trump have reputations as populist, anti-establishment politicians and are both very popular within their respective political constituencies.²¹ The third group – the control condition – instead read a short article related to a NASA discovery.

Second, I independently randomly assigned subjects into two groups. One group received the battery of questions asking their opinions on climate change, nuclear power, GMOs, and water fluoridation with the following lead:

“Surveys indicate that most scientists and policy experts agree with the following statements. To what extent do you agree or disagree with these positions?”

The control group was simply asked to state their agreement or disagreement with each of those positions. We should generally expect respondents in the treatment condition to be more supportive of the expert position, but, in support for H2, the effect of this should be weaker among those with anti-intellectual predispositions. The combined experimental conditions are shown in Table 3.3.

The experimental protocol was as follows. Respondents consented to the survey and completed a number of pre-treatment questions gauging their political attitudes and demographics. They were then asked to read the mock news article, which they believed to be real news content, and answered the question battery related to support for scientific positions. Finally, they were

²¹ There was little evidence that the source of the rhetoric made a difference in the results that follow as shown in Table O.1 and Figure O.1 of the Appendix, so these conditions will be collapsed for the following analysis.

debriefed on the nature of the deception in the experiment, given the opportunity to withdraw their consent and provided a code to receive payment through Amazon.^{22 23}

	No consensus cue	Consensus cue	Total
No rhetoric	N=619	N=573	N=1192
Rhetoric – Non-partisan	N=590	N=615	N=1205
Rhetoric – Partisan	N=580	N=637	N=1217
Total	N=1789	N=1825	N=3614

Table 3.3 Experimental conditions

6.1 Models

I test H2 using OLS regression with an interaction of the scientific agreement cue and anti-intellectualism. However, because moderating variables are observational, we need to worry about confounders (Kam & Trussler, 2017). Thus, the treatment is also interacted with controls (X), including ideology and partisanship, generalized trust, and political interest. Ideology, partisanship, and generalized trust may condition how respondents process consensus cues from experts and are all highly correlated with anti-intellectualism as conceptualized and measured here. We also have some expectation that political sophisticates are less likely to be responsive to experimental manipulations with their stronger priors, so it is controlled for as well. β_3 should be negative and significant to provide support for H2:

$$\text{support for expert position} = \alpha + \beta_1 \text{consensus cue} + \beta_2 \text{anti-intellectualism} + \beta_3 \text{consensus cue} * \text{anti-intellectualism} + X + \text{consensus cue} * X + \epsilon \quad (3.3)$$

Finally, we expect anti-elite rhetoric treatment to prime anti-intellectuals to resist messages of expert consensus. This requires a three-way interaction between both treatments and anti-intellectualism, as shown in equation 4:

²² 83% passed a pair of attention checks embedded in the survey. 68 respondents withdrew their consent and were dropped from all analyses in the paper.

²³ The expert trust battery was asked post-treatment for a different research question. This could potentially bias the results for this design (Montgomery, Nyhan, & Torres, 2018). However, there is no indication that my rhetoric manipulation directly affected trust in experts. Diagnostic tests on this can be found in Table O.2 of the Appendix.

$$\begin{aligned} \text{support for expert position} = & \alpha + \beta_1 \text{consensus cue} + \beta_2 \text{rhetoric} + \beta_3 \text{anti-intellectualism} + \\ & \beta_4 \text{consensus cue} * \text{rhetoric} + \beta_5 \text{consensus cue} * \text{anti-intellectualism} + \\ & \beta_6 \text{rhetoric} * \text{anti-intellectualism} + \beta_7 \text{consensus cue} * \text{rhetoric} * \text{anti-intellectualism} + \epsilon \end{aligned} \quad (3.4)$$

Estimated marginal effects are plotted to aid in the interpretation of the interactions in support of H2 and H4.

7 Experimental results

Table 3.4 presents the results of an OLS estimation without the controls from equation 3 for a first test of H2. The top row displays the unconditional treatment effect of the expert agreement cue on support for expert positions. The treatment was effective for nuclear power ($p \sim 0.05$), and for water fluoridation ($p \sim 0.001$), but the effects are substantively small – a 0.02 point increase in support of the expert position for the former and a 0.03 point increase for the latter. This is to be expected as treatment effects for consensus cues are likely to be highly heterogeneous.

In line with the second hypothesis, it appears that anti-intellectualism consistently moderates the effectiveness of the consensus cue treatment across all issues. The interaction is not quite significant for climate change ($p \sim 0.12$), but it is strongly so for nuclear power ($p \sim 0.001$). A consensus cue is expected to be modestly persuasive for those who are the least anti-intellectual (0.09, $p < 0.001$), but crossing the whole range of the anti-intellectualism index leads to a *negative* treatment effect of 0.10 points on the 0-to-1 scale ($p \sim 0.01$). That is, anti-intellectuals double down on their rejection of expert positions in response to a consensus cue. This finding is similar to the “backfire effect” sometimes found in fact-checking experiments where directionally motivated experimental subjects become more entrenched in their misperceptions in response to the intervention (Nyhan & Reifler, 2010).

	Climate 1	Nuclear 2	GMO 3	Fluoride 4	Combined 5
Cue (Baseline)	-0.01	0.02**	-0.00	0.03***	0.01
Cue * Anti-intellect	-0.08	-0.20***	-0.14**	-0.17***	-0.14***
Cue (Anti-intellect=0)	0.02	0.09***	0.04	0.09***	0.06***
Anti-intellect (Cue=0)	-0.60***	-0.11***	-0.31***	-0.38***	-0.35***

Table 3.4 OLS estimates for H2, no controls. Note: * <0.1 , ** <0.05 , *** <0.01

The interaction terms are similarly significant for GMOs ($p \sim 0.03$) and fluoride ($p \sim 0.003$). A consensus cue is expected to move those that are the least anti-intellectual towards the expert position on fluoride by a meaningful 0.09 points ($p < 0.001$), but not quite significantly for GMOs (0.04, $p \sim 0.11$). Crossing the range of the anti-intellectualism index is expected to generate a noteworthy backfire effect of 0.10 points in the case of GMOs ($p \sim 0.02$) and 0.08 points for fluoride ($p \sim 0.05$). Averaging across all of the issues used here we would expect a consensus cue to move those that are least anti-intellectual 0.06 points towards the expert consensus position ($p < 0.001$), while producing a backfire effect of 0.09 points among those most anti-intellectual ($p \sim 0.002$). The interaction term is highly significant ($p < 0.001$). The unintended net effect of a consensus cue intervention is to polarize citizens by reported levels of anti-intellectualism.

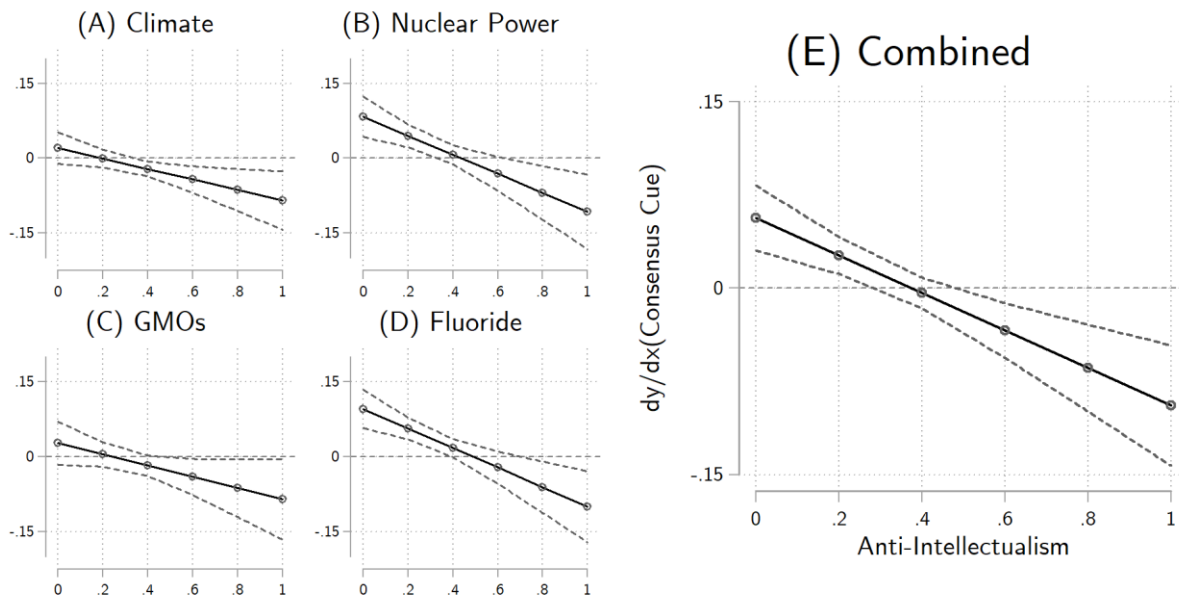


Figure 3.7 Marginal effects of expert agreement cue conditioned by anti-intellectualism. A) Climate change; B) Nuclear power; C) GMOs; D) Fluoride; E) Average across issues. Note: controls for ideology, partisanship, generalized trust, and political interest. 90% confidence intervals.

Controls need to be added because the moderator of interest is observational. Table M.5 in the Appendix provides the regression estimates for this task. The results continue to suggest anti-intellectualism is a powerful moderator in the effectiveness of consensus cues. The interaction is significant on three of our four issues below the 0.05 level. The marginal effects of these estimates are shown in Figure 3.7. Respondents that are the least anti-intellectual are expected to increase their support for the climate consensus by a slight 0.02 points in response to the consensus cue, which is

not significant ($p \sim 0.28$). This decreases approximately 0.10 points for those with the highest levels of anti-intellectualism such that the treatment will *reduce* the agreement of strong anti-intellectuals with the expert position by a sizable 0.08 points ($p \sim 0.02$). The interaction term is significant ($p \sim 0.04$).

This backfire effect is again common for all of the issues used here. Respondents with the lowest levels of anti-intellectualism are expected to increase their support for the expert position on nuclear power by 0.08 points ($p \sim 0.001$). This effect decreases 0.19 points for those with the highest levels of anti-intellectualism such that they also reduce their agreement with the expert position by 0.11 points ($p \sim 0.02$). The interaction term is highly significant ($p \sim 0.004$). The consensus cue also increases support for the expert position on fluoride by a substantial 0.10 points among those that are the least anti-intellectual ($p < 0.001$), but with a similar backfire effect of 0.10 points among those that are the most anti-intellectual ($p \sim 0.02$). Again, the interaction term is highly significant ($p \sim 0.002$). The interaction for GMOs is not quite significant after including controls ($p \sim 0.11$).

Averaging across all issues, those with the weakest anti-intellectual predispositions increase their support for positions of expert consensus by 0.06 points ($p < 0.001$), while we expect a backfire effect of 0.09 points among those who are the most anti-intellectual ($p \sim 0.001$). The interaction term is strongly significant ($p < 0.001$). All told, there is strong support for H2. Anti-intellectualism appears to have a consistent moderating effect on the acceptance of consensus cues from experts. These effects are modest in size, but are precisely estimated because of the large sample used here. The propensity of these cues to backfire among those who hostility towards experts is the strongest often wipes out the gains made among those who are least anti-intellectual in the aggregate – a troubling finding for scholars who see consensus cues as an important tool of persuasion for science communicators.

7.1 Anti-elite rhetoric as an activator of anti-intellectualism

Observationally there appears to be a very close link between populism and anti-intellectualism. This finding is not particularly surprising given the anti-intellectual themes scholars have found in anti-elite discourse. But, it also means that anti-elite rhetoric may prime people to resist signals from expert communities who are predisposed to doing so. It may do this even when the rhetoric is not about experts per se. The results for this test are presented below. The three-way interaction is difficult to interpret. So marginal effects plots are shown below in Figure 3.8. The estimates themselves are provided in Table M.6 of the Appendix.

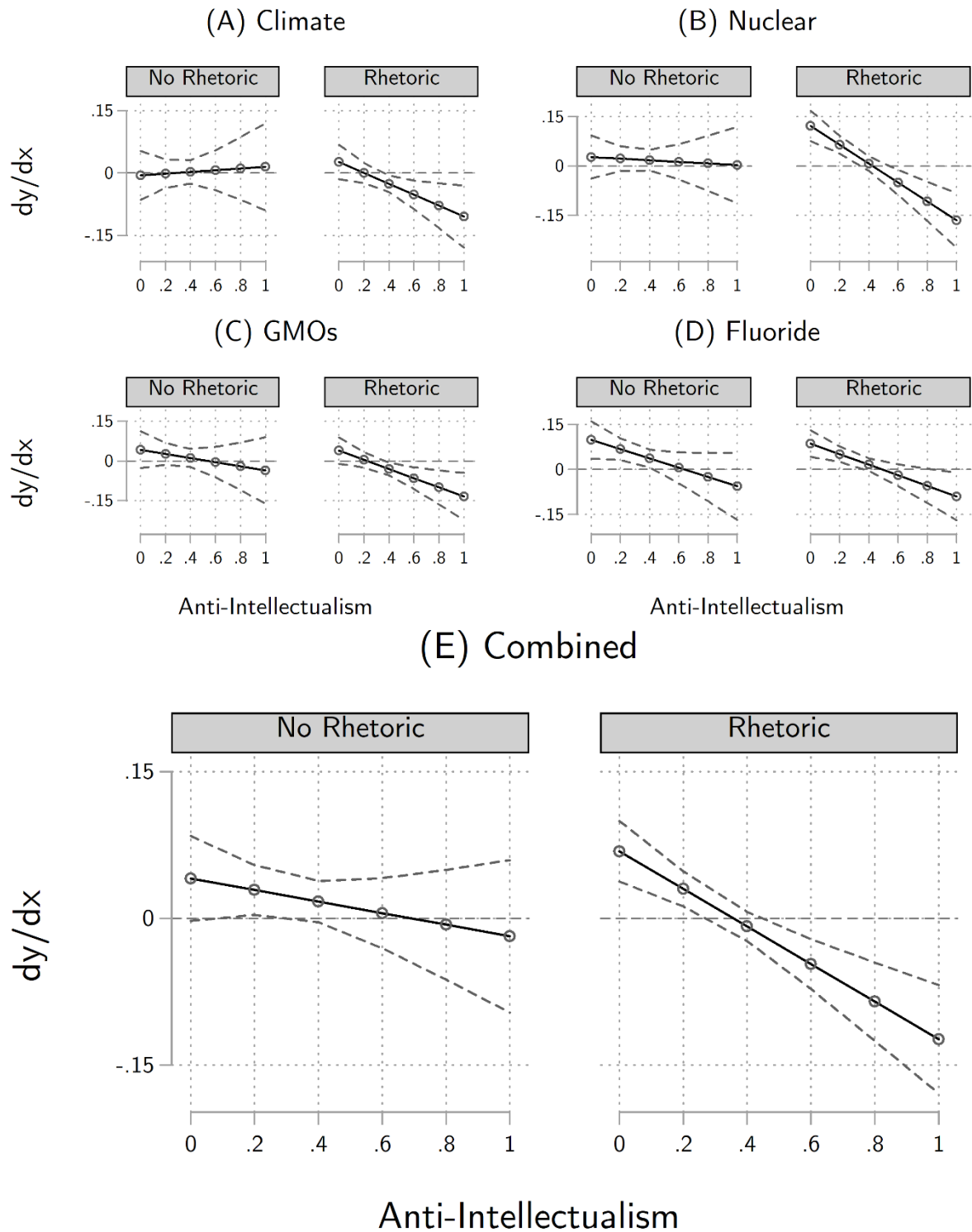


Figure 3.8 Marginal effects of expert agreement cue conditioned by anti-intellectualism and anti-elite rhetoric. A) Climate change; B) Nuclear power; C) GMOs; D) Fluoride; E) Average across issues. Note: 90% confidence intervals.

The results provide some evidence that the anti-elite rhetoric primed those that mistrusted experts to resist the cue on three of four issues. Anti-intellectualism moderated the effectiveness of the consensus cue for climate change, nuclear power, and GMOs, but only when exposed to anti-elite rhetoric. These results provide compelling support for H4 and some troubling evidence that rising anti-elite rhetoric may undermine the persuasiveness of experts among the people that are in most need of persuading. The net result of this is polarization based on reported levels of anti-intellectualism.

8 Discussion

Anti-intellectualism has been well-documented in American political life. But, we do not have a good understanding of what this concept is, which citizens are more attracted to it, and the implications of this predisposition for political behaviour. This paper offers two primary contributions. First, this paper finds that anti-intellectualism – the generalized mistrust and suspicion of intellectuals and experts – has relevance for political behaviour in its own right and not simply as a component of conservative ideology. Anti-intellectualism is a strong predictor of support for positions with widespread expert agreement, such as the climate consensus, and the safety of nuclear power, GMOs, and water fluoridation (H1). Its consistency and strength as a predictor exceeds that of left-right ideology. There is experimental evidence that anti-intellectualism conditions people's acceptance of cues signaling expert agreement even after controlling for ideology, partisanship, political interest, and generalized trust (H2). Scholars seeking to understand what influences public acceptance of expert messages should place more attention on anti-intellectualism as a structuring predisposition. The finding that consensus cues have the potential to backfire on those who are most anti-intellectual is a troubling unintended consequence of these interventions. More work should be done to extend this finding to other science-based issues, and perhaps issues of consensus for communities of experts other than scientists and doctors.

Second, this paper shows that anti-intellectualism is strongly associated with populism (H3). This association is not all that surprising since populism and anti-intellectualism conceptually overlap. But it also means that populist rhetoric may play a role in activating anti-intellectualism as a predisposition when citizens process information in their environment. This paper provides experimental evidence of exactly this. Anti-intellectualism conditioned the acceptance of cues signaling expert agreement more strongly when respondents were exposed to generalized anti-elite rhetoric. The implication is that rising anti-elite rhetoric may make anti-intellectualism a more salient

determinant of support for expert positions in the future. Science communicators will be less able to persuade those most in need of persuading.

Future research should be attentive to the role of anti-intellectualism in shaping political attitudes and behaviour. We need stronger theorization of anti-intellectualism as a potentially rich, multi-dimensional concept. Following Rigney (1991), perhaps there is a dimension that captures skepticism toward the value of critical thinking and a privileging of practical, experience-based knowledge, versus abstract, education-based knowledge. Or, there may be a strain of anti-intellectualism rooted in an epistemological rejection of truth, or yet another dimension anchored in people's alienation from intellectuals, who they see as a dominating class of citizens. Much more work needs to be done in theorizing anti-intellectualism to guide efforts at measurement so we can fully understand how this concept relates to mass behaviour.

Conclusion

There are large enduring gaps between public and expert opinion on a wide range of issues. The goal of this thesis was to identify three reasons for these gaps that have been overlooked in scholarly literature. I argue in the first paper that we cannot fully understand divergence between expert and public opinion without appreciating the degree to which the news media are unable to convey this information to ordinary citizens. Using a content analysis of over 280,000 news articles from a wide variety of sources on 10 issues where there exists important areas of expert agreement, I find that messages from experts related to such agreement are not common – particularly clear cues that communicate the fact that a consensus or strong majority opinion exists. This is true even when coverage is relevant to the area of expert agreement. Future research needs to come to grips with the fact that messages of consensus often do not reach the public in any meaningful way.

I also show that expert messages on pertinent areas of consensus, when they exist, are typically not cited alongside those from contrarian experts – *false balance*. Rather, expert messages are more often carried in the midst of a political debate featuring polarizing sources of information, which can prime motivated citizens to resist their messages. Experts have relevance for political debates, so this practice is likely unavoidable. Regardless, it is a practice scholars need to acknowledge when evaluating the persuasiveness of consensus messages from expert communities.

In the second paper Dominik Stecula and I contend that party elites likely played an important role in facilitating the rise of climate skepticism and the polarization of Americans through their messages in the news media. Citizens often learn what positions on policy to take in line with their identities from signals by elite sources that they trust (or mistrust). This process can help us explain dynamics in American attitudes towards climate change, and specifically why Republicans and Democrats became divided on their beliefs in climate science.

We use a content analysis of over 26,000 news stories to construct measures of over time dynamics in possible polarizing influences in the media environment. We find that party elite cues dominate other measures in their frequency and have been increasing over time – particular those from Democratic elites. We also demonstrate the existence of a strong, robust association between cues from Democratic elites in the mass media and a number of measures of aggregate climate skepticism and polarization constructed from available polling data. This paper offers a necessary corrective to ideology-driven accounts of climate change politics. Republicans and conservatives

were not always opposed to climate science. These explanations underplay the role of elites in shaping public attitudes.

Finally, in the third paper I maintain that many issues of scientific or expert consensus are not obviously associated with left-right ideology or partisan identities. Anti-intellectualism – the mistrust of experts and intellectuals – has importance in structuring attitudes towards expert consensus above and beyond left-right ideology. I use the General Social Survey and an original survey of over 3,600 Americans to show that anti-intellectualism is correlated with support for expert consensus on a wide range of issues, and, with an experimental manipulation, that the persuasiveness of expert consensus cues is moderated by anti-intellectualism. Further, I show that populism and anti-intellectualism are strongly associated, and, through experimental manipulation, that anti-elite rhetoric can prime anti-intellectuals to resist consensus messaging from experts. Rising anti-elite rhetoric in public discourse may have important implications for the reception of expert consensus messaging in a sizable segment of the public.

Taken together, there are some important implications for the findings in this thesis for future research and for efforts at science communication. Perhaps most importantly, they suggest we need to take the information environment seriously. Most areas of expert consensus exist on answers to rather technical questions. More often than not this information does not find its way into episodic, event-based news coverage. Although it is true that processes of motivated reasoning often block counter-attitudinal signals from experts, this is not universally the case. Scholars have shown that consensus cues from scientists can be persuasive even on a highly polarized issues like climate change (Lewandowsky et al. 2012; van der Linden et al., 2016). Journalists have done a fair job conveying the existence of expert consensus on climate change with clear cues in coverage – a practice that has not been mirrored on other issues even when coverage is directly relevant to the expert consensus in question. Journalists need to extend this practice into other domains. Expert communities, for their part, need to do a better job in martialling consensus documents on important issues, as has been done on climate change, to allow journalists to more easily identify what points have widespread agreement among relevant experts and which do not.

There is a lesson for scholars as well. We need to be attentive to the way information from experts is typically communicated in the real world. More often than not we use stylized experiments for insight on how certain messages, such as those from experts, influence behaviour. However, this information never exists in isolation. More often than not expert messages are found alongside messages from polarizing information sources, whether it is former Vice President Al Gore

defending the climate change consensus or Monsanto representatives insisting on the safety of their products. It is not obvious that anything can or should be done to change journalistic practice on this front. Expert messages have relevance for policy debates, so parties, interest groups, and advocacy organizations will inevitably receive coverage and deserve to have their voices heard. We need a better understanding of the implications of this politicization on persuasion via expert consensus messaging. Are consensus cues persuasive in this context? If not, are there alternative ways of conveying messages of expert consensus that can be effective?

The dominant role of anti-intellectualism in structuring attitudes towards expert consensus also opens up another possible challenge to science communicators who have focused on communication strategies to overcome left-right ideological conflict. Consensus cues appear to polarize citizens based on their reported levels of anti-intellectualism. The prospect that consensus cues may backfire on a sizable, ideologically heterogeneous segment of citizens is troubling. It is unlikely that appeals to authority in the form of expert consensus cues will ever be persuasive to citizens that by definition are hostile to these information sources. Scholars should explore alternative messaging strategies with the aim of persuading these citizens of the merits of mainstream expert positions. One promising avenue may be the use of citizens' assemblies and deliberative mini-publics where randomly drawn citizens are informed on the merits and drawbacks of certain propositions with the aim of making reports and recommendations to influence public opinion and policy makers. Positions advanced by these bodies may have credibility in the eyes of those distrusting of experts, particularly for those whose suspicion is rooted in a populist worldview.

Finally, the papers in this thesis highlight the limitations of a strong, static view of ideology-centred motivated reasoning in explaining public opinion formation. There is no doubt that this process plays a central role in explaining the unwillingness of many citizens to adopt the positions of expert communities. But there are some important caveats. First, directional motivation need not always come from values and beliefs that are related to partisanship or left-right ideological conflict. Numerous other predispositions may provide the motivation to resist seeking out and processing political information. While this might strike readers as obvious, the focus on ideology has led to the identification of persuasive strategies that may "backfire" for other citizens, such as a focus on expert consensus cues. We need to be attuned to possible unintended consequences if these strategies are applied to other issues with scientific and expert consensus.

Second, and perhaps more importantly, motivated skepticism is a static theory that on its own does not do justice to the fact that our directional motivations usually come from somewhere. It

does not take enough account of the dynamic political environment in which people learn about politics. Republicans were not always as hostile to climate science as they are now. They had to learn that being a Republican was synonymous with a rejection of climate science. Our motivation to resist messages from experts is open to change – usually by elites with whom we share common identities and values. This is no small point. The implication is that on issues that have been polarized by elites we should perhaps be less interested in communication strategies to depolarize citizens and more concerned with finding ways to change elite behaviour under the expectation that public opinion will follow in due course.

Along the same lines, rhetoric from political elites has the capacity to activate our predispositions when processing information. The experiment presented here in the third paper shows that anti-intellectualism is an important predisposition that affects the acceptance of expert consensus and that rhetoric that attacks elites activates this predisposition. Partisan and ideological rhetoric likely has a similar influence as well – and we have some strong evidence provided by the first paper in this thesis that political conflict is very much present in news coverage of expert consensus on a variety of issues. As strong as our directional motivations may be, we are still open to elite influence. Future research should explore in more depth how motivated reasoning interacts with communication flows that exist in real world political discourse to tease out these implications.

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Appendices

Appendix A – Areas of expert agreement

Climate Change (Favour): the climate is warming, it is being primarily driven by human production of greenhouse gases, it will have severe economic and environmental consequences, and it needs to be addressed by public policy.

Immigration (Favour): immigration is economically beneficial because it expands the tax and consumer base, and fills gaps in the labour market at the high and low skilled positions. Displacement effects on low-skilled workers are minimal.

Road Pricing (Favour): tolls are net beneficial for citizens. They can provide revenue for transportation infrastructure like highways and public transit, and it can help control congestion.

Federal Reserve Independence (Favour): Federal Reserve independence is necessary to prevent electorally-motivated distortions in monetary policy, which could lead to inflation and prevent actions to maintain economic growth.

Nuclear Power (Favour): nuclear power is a safe source of power – if not the safest compared to its competitors.

GMOs (Favour): GMOs are as safe as conventional alternatives and have a number of beneficial traits that can improve food security and reduce the environmental costs of agriculture.

Rent Control: (Oppose): rent control leads to a net loss of wealth for Americans by pushing up rental prices in the long-run due to deteriorating housing stocks and increased rates of abandonment.

Free Trade (Favour), Protectionism (Oppose): free trade is net beneficial for Americans and reversion to economic protectionism could be economically damaging for everyone. It lowers the

price of goods and services (thereby improving purchasing power), improves productivity and innovation. Displacement effects on low-skilled native workers are minimal. Moves towards protectionism may spark trade wars that are punishing for consumers.

Vaccines (Favour): childhood vaccines are safe and effective at stopping the spread of preventable diseases like the measles, mumps, rubella, and whooping cough.

Farm Support (Oppose): Farm support programs are bad for taxpayers, consumers, and farmers. Subsidies incentivize poor farm practices, are costly to taxpayers, and tend to flow to the wealthy. Supply controls punish consumers by propping up prices and prevent competition from imports. They also cost taxpayers when governments buy surplus crop.

Appendix B – Source selection

Appendix B.1 – Lexis and LexisNexis keywords and subject tags

Climate Change

global warming OR climate change; Subject: global warming OR climate change

Immigration

immigrant OR immigration OR immigrate; Subject: immigration AND (law OR policy)

Road Pricing

toll road OR road toll OR highway toll OR toll highway OR road pricing; Subject: toll road

Federal Reserve

Federal Reserve AND (audit OR congressional oversight); Subject: central bank

Nuclear Power

nuclear power OR nuclear energy OR nuclear plants; Subject: nuclear power OR nuclear energy, NOT arms control OR nuclear weapons

GMOs

GM food OR genetically modified food OR GMO OR genetically modified organism OR genetically modified crop; Subject: genetic engineering OR genetically modified food OR genetically modified organism OR agriculture, NOT pharmaceutical OR vaccine

Rent Control

rent control; Subject: rent control

Trade Protectionism

trade pact OR trade agreement OR free trade OR protectionism OR protectionist OR origin label OR trade barrier OR tariff OR quota OR export subsidy OR export subsidies OR WTO OR NAFTA OR CAFTA OR TPP OR World Trade Organization OR Trans Pacific Partnership OR trade authority OR trade negotiation OR bilateral w/5 trade OR buy American w/10 label; Subject: international trade OR tariff OR protectionism OR free trade OR import

Childhood Vaccinations

vaccination schedule OR vaccine schedule OR childhood immunization OR childhood vaccine OR childhood vaccination OR MMR OR M.M.R. OR measles OR mumps OR rubella OR DTaP OR diphtheria OR pertussis OR tetanus OR hepatitis B OR varicella OR chickenpox OR polio OR rotavirus OR haemophilus OR pneumococcal OR hepatitis A OR meningococcal OR meningitis OR HPV OR papillomavirus; Subject: vaccine OR vaccination OR immunization

Farm Support

agricultural subsidies OR agricultural subsidy OR agriculture subsidies OR agriculture subsidy OR farm subsidies OR farm subsidy; Subject: agricultural subsidies

		Start	Climate Change	Immigration	Trade	Nuclear Power	Road Pricing	Childhood Vaccines	GMOs	Federal Reserve	Farm Support	Rent Control
Print	New York Times	1980	13782	15431	15585	7256	1181	1851	431	131	1332	1252
	Washington Post	1980	11968	12945	10614	3566	2221	1684	235	133	987	657
	USA Today	1989	3058	3631	2596	935	203	717	68	27	245	26
	Dallas Morning News	1992	1507	9017	4190	971	2748	877	44	50	229	8
	Houston Chronicle	1991	2741	8989	4295	1415	1903	1105	85	46	299	17
	San Diego Union-Tribune	1983	2637	12788	4732	2208	685	921	177	16	244	556
Cable	CNN	1990	1149	5024	2382	812	35	527	26	15	150	8
	MSNBC	1999	230	946	95	58	1	29	6	0	9	1
	FOX	1997	823	2728	203	177	11	34	5	6	25	4
TV	ABC	1980	735	1000	262	509	37	272	36	3	68	4
	CBS	1990	514	1342	813	391	48	397	59	3	84	4
	NBC	1997	612	895	141	284	25	240	11	2	9	0
Wire	Associated Press	1980	9168	25297	27764	12122	693	3237	521	168	2499	298
Total	286334		48924	100033	73672	30704	9791	11891	1704	600	6180	2835

Table B.1 Corpus composition

Appendix C – Coding criteria for supervised machine learning

The purpose of the coding for this stage is to subset our sample of articles such that we only use articles in further analyses that contain news or editorial content that has content relevant to the expert consensus used in this paper. For the most part, this means there will be discussion by the writer or by sources on the perceived advantages or disadvantages of the topic at hand. Articles that contain relevant information were coded as “1” and articles without such information were coded as “0”. More detail is provided below on how these coding criteria were implemented for the issues used in this paper.

Climate Change

There is a consensus among scientists and climatologists that the climate is warming, that this warming is human-caused by the production of greenhouse gases, and that it will have severe environmental and human consequences in the future if emissions are not controlled and measures of climate adaptation are not taken.

Articles should be coded as “1” if there is discussion of the science of climate change or climate change impacts, and “0” if otherwise.

Immigration

There is widespread agreement among economists and immigration policy specialists that immigration is a net economic benefit for American citizens. Both low-skilled and high-skilled immigrants fill important gaps in the labour market that are not adequately met by an aging native workforce. They also provide an important source of demand for goods and services, and are not more likely than natives to use social welfare. Economic theory does predict some displacement effect for low-skilled American workers caused by increased competition, but empirical evidence suggests such an effect, if it exists at all, is minor.

Articles should be coded as “1” if there is discussion of the economic benefits or costs of foreign immigration to the United States, and “0” if otherwise.

Protectionism

There is widespread agreement among economists that liberalized trade is net beneficial for Americans and that movements towards protectionism with rising tariffs could be potentially catastrophic. Freer trade lowers the price of goods and services for Americans, with second order effects on employment, and improves business efficiency and innovation as a result of increased competition. There are winners and losers with free trade, as workers in export industries see gains, while workers in import-vulnerably industries see losses, creating displacement effects. Most economists believe this trade-off is worth it, and trade losers should be compensated with redistribution and job re-training. Articles should be coded “1” if there is discussion of the economic benefits or costs of liberalized trade or protectionism, “0” if otherwise. This would include free trade’s imperfect operationalization through FTAs such as GATT, the WTO, NAFTA, CAFTA, and the TPP.

Exclusion criteria: only contains discussion of extraneous elements of FTAs, such as the inclusion of labour, environment, and intellectual property rights.

Nuclear Power

There is a consensus among nuclear physicists and engineers that nuclear power is safe compared to alternative forms of energy. Risks posed by nuclear power are low, and have gotten lower over time with improvements in reactor design. Articles will be coded as “1” if there is discussion related to the safety of nuclear reactors, and “0” if otherwise.

Note: there is no such consensus on the economic viability of nuclear power, but this is not the focus here. Articles that only focus on the economics of nuclear power should be coded as “0”.

Road Pricing

There is a consensus among economists and transportation experts that transportation infrastructure, particularly roads and highways, should be increasingly financed by user fees such as tolls, and adjust to demand in order to control congestion (i.e. congestion pricing). These funding mechanisms will raise reliable revenue for transportation infrastructure that has not been met through taxation and control road congestion by incentivizing people to use other methods of transportation. Articles will be coded “1” if there is discussion of the advantages or disadvantages of pricing or tolls, and “0” if otherwise.

Note: There will be some coverage on the debate on the development of specific tollways. This is true in the Texas newspapers, where focus is on the development of new highways rather than in managing congestion on existing highways. Articles should only be coded as “1” if there is discussion on the merits or disadvantages of pricing *independent* of the merits or disadvantages of the new road itself.

Childhood Vaccination

There is a consensus among scientists, doctors, and pediatricians that childhood vaccinations are safe and effective. There is no credible scientific evidence to suggest any ingredients in modern day vaccinations are harmful or have a link to developmental disorders like autism. There are, however, rare occurrences of vaccine injury. This risk is far outweighed by the benefits of vaccines to the child and to society. Articles should be coded as “1” if there is discussion of the perceived benefits or risks of vaccinations given to children and adolescents, such as MMR (Measles, Mumps, and Rubella), DTaP (Diphtheria, Tetanus, Pertussis), Chickenpox (Varicella), Hepatitis A and B, and IPV (Polio).

Exclusion criteria: influenza immunization, adult vaccinations, vaccination campaigns in developing countries.

Genetically Modified Organisms (GMOs)

There is a consensus among geneticists and plant scientists that foods containing genetically modified organisms are as safe as conventional alternatives. There is little credible scientific evidence to suggest GMOs are harmful to people who consume them. There is also scientific consensus that GM crops have many potential benefits, such as higher yields, drought and pest-resistance, higher nutritional value, and less fertilization, which are particularly beneficial for farmers in developing countries. Articles should be coded as “1” if there is discussion on the advantages or disadvantages of GMOs or the safety of GMOs, and “0” if otherwise.

Exclusion criteria: other applications of genetic engineering such as cloning, normative arguments for GMO labelling such as having a “right to know”.

Federal Reserve Independence

There is widespread consensus among economists that the political independence of the Federal Reserve must be protected from encroachment by Congress. At present, the Federal

Reserve makes monetary policy independent of political influence. Economists believe this is essential in order to keep a lid on inflation, which tends to be exacerbated by election-orientated lawmakers who favor looser economic policy. Articles should be coded “1” if there is discussion on the merits or disadvantages of Federal Reserve independence. In practice, this will mean coverage of congressional efforts to impose audits of the Federal Reserve, or to dictate monetary policy, such as by the legislation of a monetary rule. Articles will be coded “0” otherwise.

Farm Supports

There is a consensus among economists and agriculture experts that subsidies and farm supports are harmful to taxpayers, consumers, and farmers themselves. Agriculture subsidies are costly to taxpayers and incentivize poor practices, such as farming marginal lands, while encouraging over production that harms farmers in developing countries. These subsidies also tend to be captured by wealthy farmers who are well above the income of the average American. In sectors where regulation controls supply, consumers are faced with higher costs as the government by surplus crop and blocks foreign competition with tariffs and quotas. Articles should be coded “1” if there is discussion of the benefits or costs of agriculture subsidies or other farm supports, and “0” if otherwise.

Exclusion criteria: Agriculture export subsidies that encourage dumping in developing countries.

Rent Control

There is widespread agreement among economists and housing experts that rent control regulation does more harm than good, even for low income residents. It substantially reduces incentive for developers to build or maintain rental properties. In the long-run, this leads to abandonment, lower vacancy rates, and a deterioration of the housing stock. Policy options favored by experts focus on increasing the supply of housing stock by relaxing zoning regulations and densifying urban centers.

Articles will be coded as “1” if there is discussion on the perceived benefits or costs of rent control or rent stabilization regulation. They will be coded “0” otherwise.

Appendix D – Diagnostics for supervised machine learning

Issue	Accuracy	Precision
Climate Change	82%	0.90
Immigration	91%	0.83
Trade Protectionism	80%	0.80
Nuclear Power	85%	0.86
Road Pricing	89%	1.00
Childhood Vaccination	91%	0.98
GMOs	90%	0.90
Federal Reserve	92%	0.80
Farm Support	92%	1.00
Rent Control	83%	0.89

Table D.1 Reliability scores for machine learning algorithms

Appendix E – Expert dictionaries

Generic

scholar, scholars, researcher*, research associate*, specialist*, expert, experts, analyst*, professor*, postdoctoral, doctoral candidate*, doctoral student*, phd*, senior fellow*, instructor*, lecturer*

Economics

economist*, economics, department of economics, economics department, school of economics, political scientist*, political science*, department of politics, politics department, department of political science, political science department, department of government, school of policy, policy school, school of public policy, public policy school, school of government

Climate Change

scientist*, doctor*, dr., climatologist*, meteorologist*, geologist*, physicist*, chemist*, ecologist*, biologist*, American Association for the Advancement of Science, American Geophysical Union, American Meteorological Society, American Physical Society, Geological Society of America, National Academy of Science*, Intergovernmental Panel on Climate Change

Nuclear Power

scientist*, doctor*, dr., physicist*, department of physics, physics department

Childhood Vaccinations

scientist*, American Academy of Pediatrics, Centres for Disease Control, Centers for Disease Control, Center for Disease Control, CDC, pediatrician*, World Health Organization, physician*, Academic Pediatric Association, American Pediatric Society

GMOs

scientist*, doctor*, dr., biologist*, agronomist*, botanist*, geneticist*, ecologist*, pathologist*, World Health Organization, Food and Drug Administration, Food and Agriculture Organization, American Medical Association, National Academy of Science*, American Association for the Advancement of Science

*Note: Case insensitive; * = wildcard*

Appendix F – Coding criteria for manual content analysis

The purpose of coding for this stage is to provide detailed information on how experts are treated in news coverage on topics that are relevant to areas of widespread agreement. Of particular interest is the degree to which there is “balance” in coverage, what political actors are providing that balance, and whether the media provides context to properly evaluate the information provided by experts, such as consensus cues. These guidelines will provide a general overview of the coding criteria used at this stage, followed by subject specific guidelines.

Is the expert position (for or against) reflected in the news story? (Y/N)

If Y: Is this position attributed to experts? (Y/N)

If Y: Is there indication of agreement among experts of this position? (Y /N/U)

If Y: Was there indication of “hard” consensus (i.e. there is a consensus or widespread agreement among experts) (Y/N)

If Y: Did any political actors support the expert position? (Y/N)

If Y: What actors?

- ➔ Party elites (P)
- ➔ Advocacy group (A)
- ➔ Interest group or corporation (I)
- ➔ Other

Is the expert position criticized or opposed in the article? (Y/N)

If Y: By whom?

- ➔ Another Expert (E)
- ➔ Party elites (P)
- ➔ Advocacy group (A)
- ➔ Interest group or corporation (I)
- ➔ Other (specify)

If E: Does the journalist present information to indicate its status as a minority opinion?
(Y/N)

If E: Does the journalist present information regarding the credibility of the expert or his or her findings (i.e. conflict of interest)

If you were to give a score of the balance in favour or against the expert stance on the topic, ranging from -1 to 1 with 0 being perfectly balanced, what would you give it?

-1: The article is entirely slanted against the expert position, if there is engagement with arguments aligned with the expert position it is only to discredit such arguments. This is common in Op-Eds.

-0.5: On balance, the article is slanted against the expert position, though there is some degree of engagement with arguments and sources aligned with the expert position even if they are not experts themselves.

0: Article provides a balance between perspectives aligned with the expert community and those that stand opposed to expert opinion. There is roughly parity in the number of arguments and sources used on either side of the debate, and the journalist does not take a side.

0.5: On balance, the article is slanted in favour of the expert position, though there is some degree of engagement with arguments and sources opposed to the expert position.

1: The article is entirely slanted in favour of the expert position, if there is engagement with arguments opposed to the expert position it is only to discredit such arguments. This is common in Op-Eds.

Appendix G – Cue dictionaries

(R-	Mitch McConnell
Bill Frist	Mitt Romney
Bob Dole	Newt Gingrich
Bob Michel	President Bush
Dan Quayle	President Reagan
Dennis Hastert	Republican
Dick Cheney	republican
G.O.P.	Ronald Reagan
George Bush	Speaker Boehner
George H.W. Bush	Speaker Gingrich
George W. Bush	Speaker Hastert
GOP	Trent Lott
Howard Baker	Vice President Bush
John McCain	Vice President Cheney
John Rhodes	Vice President Quayle
John Boehner	

Table G.1 Republican Party dictionary. Lists the keywords and phrases we searched for to establish the measure of Republican elite cues.

(D-	Nancy Pelosi
Al Gore	President Clinton
Barack Obama	President Obama
Bill Clinton	Robert Byrd
Democrat	Speaker Foley
democrat	Speaker O'Neill
Democratic	Speaker Pelosi
democratic	Speaker Wright
George Mitchell	Tip O'Neill
Gephardt	Tom Daschle
Harry Reid	Tom Foley
Jim Wright	Vice President Biden
Joe Biden	Vice President Gore
John Kerry	Walter Mondale
Michael Dukakis	

Table G.2 Democratic Party dictionary. Lists the keywords and phrases we searched for to establish the measure of Democratic elite cues.

Congressman	Rep.
Congresswoman	Representative
Governor	Sen.
governor	Senator
Lieutenant Governor	Speaker of the House
lieutenant governor	state Representative
Lt. Governor	State Representative
lt. governor	state senator
Majority Leader	State Senator
Minority Leader	

Table G.3 General politician dictionary. Lists the keywords and phrases we searched for to establish the measure of general political cues.

Advancement Of Sound Science Center	Institute For Study Of Earth And Man
American Council On Science And Health	International Climate And Environmental Change Assessment Project
Australian Climate Science Coalition	International Climate Science Coalition
Center For Study Of Carbon Dioxide And Global Change	Junkscience
Co2 Is Green	Lindenwood University
Cooler Heads Coalition	National Council For Environmental Balance
Environmental Literacy Council	National Environmental Policy Institute
George Marshall Institute	New Zealand Climate Science Coalition
George C. Marshall Institute	Oregon Institute Of Science And Medicine
Global Warming Policy Foundation	Plants Need Co2 Org
Greening Earth Society	Science And Environmental Policy Project
Independent Commission On Environmental Education	Science And Public Policy Institute
Institute For Biospheric Research	Smithsonian Astrophysical Observatory
Biospheric Research Institute	Statistical Assessment Service
Institute For Regulatory Science	Weidenbaum Center

Table G.4 Climate skeptic dictionary. Lists the keywords and phrases we searched for to establish the measure of organizations whose sole mission is climate denial, the so-called “Merchants of Doubt”. List comes from Farrell (2016).

American Coal Foundation	National Association Of Manufacturers
American Coalition For Clean Coal	National Black Chamber Of Commerce
American Farm Bureau	National Mining Association
American Fuel And Petrochemical Manufacturers	National Petroleum Council
American Gas Association	National Rural Electric Cooperative Association
American Natural Gas Alliance	Peabody Energy
American Petroleum Institute	Shook Hardy And Bacon
Association Of Global Automobile Manufacturers	Us-Russia Business Council
Chamber Of Commerce	American Energy Alliance
Dci Group	Americans For Balanced Energy Choices
Edison Electric Institute	Citizens For Affordable Energy
Exxon	Coalition For Vehicle Choice
Exxon Mobile	Coalition For American Jobs
Federation For American Coal Energy And Security	Consumer Energy Alliance
Global Climate Coalition	Industrial Energy Consumers Of America
Independent Petroleum Association Of America	Small Business Survival Committee
Intermountain Rural Electric Association	United For Jobs
Koch Industries	

Table G.5 Industry and Astroturf group dictionary. Lists the keywords and phrases we searched for to establish the measure of industry and astroturf organizations. List comes from Farrell (2016).

60 Plus Association	Heartland Institute
Accuracy In Media	Heritage Foundation
Action Institute	Hoover Institution
Alexis De Tocqueville Institution	Hudson Institute
American Conservative Union	Illinois Policy Institute
American Council For Capital Formation	Independence Institute
American Energy Freedom Center	Independent Institute
American Enterprise Institute	Independent Womens Forum
American Friends Of Institute Of Economic Affairs	Initiative For Public Policy Analysis
American Legislative Exchange Council	Institute For Energy Research
American Policy Center	Institute For Liberty
American Spectator Foundation	Institute Of Humane Studies
American Tradition Institute	Institute Of Public Affairs
Americans For A Limited Government	International Council For Capital Formation
Americans For Prosperity	International Policy Network
Americans For Tax Reform	International Republican Institute
Annapolis Center	James Madison Institute
Atlantic Legal Foundation	John Locke Foundation
Atlas Economic Research Foundation	Knowledge And Progress Fund
Capital Research Center And Greenwatch	Koch Foundation
Capital Research Center	Landmark Legal Foundation
Greenwatch	Legal Center For The Public Interest
Cascade Policy Institute	Lexington Institute
Cato Institute	Locke Institute
Center For American And International Law	Mackinac Center
Center For Defense Of Free Enterprise	Manhattan Institute
Center For Security Policy	Media Research Center
Center For Strategic And International Studies	Mercatus Center
Centre For New Europe	Mountain States Legal Foundation
Charles Koch Institute	National Center For Policy Analysis
Citizens For A Sound Economy	National Center For Public Policy Research
Collegians For Constructive Tomorrow	National Wilderness Institute
Committee For Constructive Tomorrow	National Policy Forum
Communications Institute	National Taxpayers Union
Competitive Enterprise Institute	Oklahoma Council Of Public Affairs
Consumer Alert	Pacific Legal Foundation
Consumers Alliance For Global Prosperity	Pacific Research Institute For Public Policy
Cornwall Alliance For The Stewardship Of Creation	Property And Environment Research Center

Defenders Of Property Rights	Reason Foundation
Donors Trust	Responsible Resources
Donors Capital Fund	South Eastern Legal Foundation
Energy Makes America Great	Sovereignty International
Environmental Conservation Organization	State Policy Network
Federalist Society	Tech Central Science Foundation
Fraser Institute	Texas Public Policy Foundation
Free Enterprise Education Institute	Thomas Jefferson Institute
Freedom Action	Tsaugust
Freedomworks	Virginia Institute For Public Policy
Frontiers Of Freedom Institute	Washington Legal Foundation
George Mason University Law And Economics Center	Washington Policy Center

Table G.6 Conservative think tank and advocacy group dictionary. Lists the keywords and phrases we searched for to establish the measure of conservative think tanks and advocacy organizations. List comes from Farrell (2016).

Adrian Gordon	Edward Liebsch	John Rhoads	Rigoberto Garcia
AF Smith	Edward Terry Wimberley	John Shade	Roar Larsen
Ahmed Boucenna	Edward Tomlinson	Jon Jenkins	Roar Larson
Alan Moran	Edward Wegman	Jonathan Katz	Rob Meleon
Albert Engelhardt	Edwin Berry	Jose Carlos de Almeida Azevedo	Rob Scagel
Albert Gold	Eigil Friis- Christensen	Josef Zboril	Robert Ashworth
Albert Jacobs	Elliot Abrams	Joseph Bast	Robert Austin
Albrecht Glatzle	Endel Lippmaa	Joseph Cain	Robert Balling
Alex Robson	Ernst-Georg Beck	Joseph D'Aleo	Robert Carter
Alexander Kaplan	Ferenc Marc Miskolczi	Joseph Kunc	Robert Cunningham
Alexander Robertson	Forese-Carlo Wezel	Joseph Silverman	Robert Dunshee Elliott
Alfred Pekarek	Franco Battaglia	Joseph Zabransky	Robert Durrenberger
Alister McFarquhar	Frank Milne	JP Lodge	Robert Essenhigh
Allan Cortese	Frank Paolini	Katya Georgieva	Robert Gauldie
Allen Simmons	Frank Tipler	Keith Hage	Robert Jacomb Foster
Amos Meyer	Fred Decker	Keith Lockitch	Robert Knox
Andre Bernier	Fred Goldberg	Kelvin Kemm	Robert Kovach
Andreas Prokoph	Fred Michel	Kenneth Beard	Robert LeLevier
Andrei Illarionov	Fred Singer	Kenneth Green	Robert Levine
Andrew Detwiler	Fred Starheim	Kenneth Haapala	Robert Neff
Andrew Kaldor	Frederick Bopp	Kesten Green	Robert Perkins
Anthony Lupo	Frederick Seitz	Kiminori Itoh	Robert Roper
Anthony Watts	Frederick Singer	Kirill Kondratyev	Robert Roseman
Anton Uriarte	Freeman Dyson	Klaus Heiss	Robert Stevenson
Antonio Zichichi	Gabriel T Csanady	Klaus Wyrski	Robert Wentworth
Arie Bodek	Garth Paltridge	Laim Nagle	Robert Whitten
Arlin Super	Gary Kubat	Lance Endersbee	Robert Zabrecky
Arnold Woodruff	Gary Sharp	Larry Brace	Robin Vaughan
Art Horn	Geoff Austin	Laurence Gould	Roderick Van Koughnet
Arthur Anderson	Geoffrey Duffy	Lee Eddington	Rodger Gamblin
Arthur Bourne	George Chilingar	Lee Gerhard	Rodney Nichols
Arthur Chadwick	George Kukla	Len Walker	Roger Cohen
Arthur Robinson	George McVehil	Leonid Khilyuk	Roger Dewhurst
Arthur Rorsch	George Reilly	Les McDonald	Roger Pielke
Asmunn Moene	George Stroke	Leslie Lemon	Roger Pocklington
Atholl Sutherland- Brown	George Sutton	Lev Gandin	Roger Young

August Auer	George Taylor	Lord Nigel Lawson	Romuald Bartnik
Austin Hogan	George Wolff	Louis Fowler	Ronald Sundelin
Barry Berman	Gerd-Rainer Weber	Louis Hissink	Ross Hays
Benjamin Herman	Gerhard Gerlich	Lowell Brown	Ross McKittrick
Benny Peiser	Gerhard Kramm	Lubos Motl	Roy Leep
Bernd Huettner	Gerrit van der Lingen	Madhav Khandekar	Roy Spencer
Berol Robinson	Goesta Walin	Malcolm Taylor	Rune Larsen
Bill Kappel	Goran Ahlgren	Manik Talwani	RWJ Kouffeld
Bjarne Andresen	Goran Tullberg	Marcel Leroux	Sallie Baliunas
Bjorn Malmgren	Gordon Fulks	Mark Campbell	Sally Bernier
Bob Breck	Gordon Oehler	Martin Coniglio	Salomon Kroonenberg
Bob Zybach	Gordon Swaters	Martin Hertzberg	Salvatore Torquato
Boris Winterhalter	Graham Smith	Matthew Bastardi	Samuel Werner
Brian Fiedler	Grant Goodell	Maureen Gallagher	Scott Armstrong
Brian Pratt	Gregory Balle	Melvyn Shapiro	Sherwood Idso
Brian Sussman	Gregory Canavan	Michael Clover	Sonja Boehmer-Christiansen
Brian Valentine	Habibullo Abdussamatov	Michael Coffman	Soren Floderus
Bruce Boe	Hans Erren	Michael Fox	Stan Zlochen
Bruce Borders	Hans Jelbring	Michael Garstang	Stanley Goldenberg
Bruce Bullough	Hans Labohm	Michael Higgsberger	Stanley Robertson
Bruce Schwoegler	Harald Kehl	Michael Mogil	Stanley Smith
Bruce West	Harold Agnew	Michael N Monce	Sten Kaijser
Bryan Leyland	Harrison Schmitt	Michael Uhart	Stephan Wilksch
Bryce Wilkinson	Harry Lins	Michael Vershovsky	Stephen Brown
Charles Anderson	Harry Priem	Mike Gruntman	Stephen Murgatroyd
Charles Clough	Harry Ringermacher	Miklos Zagoni	Steve Hynek
Charles Hammons	Hazen Bedke	Milos Setek	Steve Japar
Charles Wax	Heinz Hug	Mitchell Taylor	Steven Hanna
Chauncey Starr	Heinz Lettau	Moorad Alexanian	Stewart Franks
Chris Borel	Heinz Sundermann	Nathaniel Guttman	Stuart Berger
Chris de Freitas	Helmut Metzner	Neil Frank	Sultan Hameed
Chris Schoneveld	Hendrik Tennekes	Neil Hutton	Susan Crockford
Chris Yakymyshyn	Henry Linden	Neil Waterhouse	Syun-Ichi Akasofu
Christiaan Van Sumere	Horst Malberg	Nicola Scafetta	Szymon Suckewer
Christopher Essex	Howard Greyber	Nigel Calder	T Jim Sprott
Christopher Monckton	Howard Hayden	Nils-Axel Moerner	Tad Murty
CJF Boettcher	Howard Maccabee	Nir Shaviv	Tatiana Valentinovna

Claude Culross	Hugh Ellsaesser	Norman MD Brown	Ted Hinds
Cliff Ollier	Ian Bock	O'Dean Judd	Terrance Clark
Clive Schaupmeyer	Ian Clark	Olav Kvalheim	Terrell Johnson
Colin Barton	Ian Plimer	Olavi Karner	Terry Dunleavy
Cornelis van Kooten	Indur Goklany	Ole Humlum	Terry Jackson
Craig Idso	Ingemar Nordin	Oleg Pokrovsky	Theodor Landscheidt
Curt Rose	Ismail Bhat	Oleg Sorokhtin	Thomas Gold
Curtis Osgood	Ivar Giaever	Otto Franzle	Thomas Gray
Dalcio Dacol	Jack Barrett	Owen McShane	Thomas Lockhart
Dan Carruthers	Jack Hollander	Paal Brekke	Thomas Schmidlin
Daniel Joseph Pounder	Jack Wedel	Paavo Siitam	Thomas Sheahen
Daniel McNaughton	James Brooks	Pat Palmer	Timothy Minnich
Dave Dahl	James Buckee	Patrick Frank	Timothy Ball
David Aubrey	James Clarke	Patrick Michaels	Timothy Calvin
David Bellamy	James DeMeo	Patrick Moore	Timothy Patterson
David Deming	James Dent	Patrick Powell	Tom Quirk
David Douglass	James Goodridge	Paul Copper	Tom Segalstad
David Evans	James Heimbach	Paul Drallos	Tom van Loon
David Gee	James Koermer	Paul Driessen	Tor Ragnar Gerholm
David Gray	James Lea	Paul Grant	Uberto Crescenti
David Hagen	James Marusek	Paul Handler	Vaclav Smil
David Henderson	James Moore	Paul Mielke	Vedat Shehu
David Holtkamp	James O'Brien	Paul Queneau	Vern Harnapp
David Kear	James Peden	Paul Reiter	Vincent Gray
David Legates	James Weeg	Per Engene	Vladimir Svidersky
David Nowell	Jarl Ahlbeck	Peter Arnold Toynbee	Walter Starck
David Rogers	Jay Lehr	Peter Dietze	Warren Anderson
David Wojick	Jean Thiebaut	Peter Friedman	Warren Berning
Denis Dutton	Jennifer Marohasy	Peter Giddings	Warwick Hughes
Dennis Avery	Jens Feder	Peter Leavitt	Wayne Goodfellow
Detlef Hebert	Jerry Cuttler	Peter Link	Wayne Kraus
Diane Douglas	Jerry Williams	Peter Oliver	Wayne Martin
Dick Morgan	Jim Mitroy	Peter Ridd	Werner Baum
Dick Thoenes	Jiri Blumel	Peter Salenius	Wibjorn Karlen
Don Aitkin	Jock Allison	Peter Stilbs	William Alexander
Don Easterbrook	Joe Bastardi	Petr Chylek	William Briggs
Donald Farley	Joel Kauffman	Philip Stott	William de Lange
Donald N Parkes	John Bales	Phillip Mange	William Evans
Donald Rapp	John Blaylock	Piers Corbyn	William Gray

Doug Hoffman	John Brignell	RAD Byron-Scott	William Happer
Douglas Barr	John Brosnahan	Ralf Tscheuschner	William Hubbard
Douglas Hoyt	John Christy	Raphael Wust	William Kininmonth
Douglas Leahey	John Coleman	Read McGrath	William Lindqvist
Douglas Southgate	John Emsley	Reid Bryson	William Mitchell
Duwayne Anderson	John Ferguson	Renato Henriques	William Nierenberg
Earl Droessler	John Gaynor	Rich Weiss	William Porch
Earle Williams	John Lindl	Richard Becherer	William Reifsnyder
Eckhard Grimmell	John Maunder	Richard Courtney	William Schaffer
Edgar Gartner	John McGinley	Richard Keen	William Tanner
Eduardo Ferreyra	John McLean	Richard Lindzen	Willie Soon
Eduardo Tonni	John Nicol	Richard Mackey	Wojciech Szalecki
Edward Blick	John Ralph Apel	Richard Newsome	Wolfgang Thune
Edward Brandes	John Reinhard	Richard Shepherd	Zbigniew Jaworowski

Table G.7 Contrarian scientist dictionary. Lists the keywords and phrases we searched for to establish the measure of contrarian scientists. List comes from Anderegg et al. (2010) and was downloaded from

http://www.eecg.utoronto.ca/~prall/climate/skeptic_authors_table_by_clim.html.

Appendix H – Full regression results, paper II

	Party	Dem.	GOP	Lib.	Con.	All Skeptics	Denialist	Cost Frame
Trend	0.17**	0.15**	0.00	0.06***	0.07***	-0.02	-0.07***	0.03
Salience	0.18***	0.14**	0.10*	0.01	0.00	-0.04†	-0.02	0.09*
Source FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panels	17	17	17	17	17	17	17	17
T (Min)	44	44	44	44	44	44	44	44
T (Max)	104	104	104	104	104	104	104	104

Table H.1 Time trends in polarizing information, Prais-Winsten regression with PCSEs. Note:

†p<0.1, *p<0.05, **p<0.01, ***p<0.001

	Party	Dem.	GOP	Lib.	Con.	All Skeptics	Denialist	Cost Frame
Print	-6.55***	-7.43***	-2.01†	1.30**	2.76***	0.12	1.62*	-15.24***
Cable	9.27*	18.61***	10.04***	7.68***	5.77***	1.59	3.91***	-15.78***
Broadcast	-13.96***	-12.62***	-8.93***	-0.51	0.02	-5.47**	2.60*	-27.97***
Conservative	0.98	1.50	0.15	1.31*	-1.09†	5.18***	2.36***	3.08**
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yearly FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panels	17	17	17	17	17	17	17	17
T (Min)	44	44	44	44	44	44	44	44
T (Max)	104	104	104	104	104	104	104	104

Table H.2 Cross-sectional differences in polarizing information, Prais-Winsten regression with PCSEs. Note: baseline for format variables is the AP. Baseline for conservative is non-conservative. †p<0.1, *p<0.05, **p<0.01, ***p<0.001

Appendix I – Coder instructions for party cue validation

Purpose of paper: to examine the signals or cues being sent to the voting public by Democratic and Republican Party elites on climate change policy and climate science through the mainstream media. We argue that these signals increased over time as the salience of climate change rose and as coverage became politicized. By politicized, we mean that as the issue became more prominent, the news coverage featured an increased number of politicians in addition to scientific experts. The public learned from this discourse and polarized accordingly.

Purpose of this coding exercise: to validate hand coding done by us. The articles or transcripts you will read were all coded as having reference to Democratic or Republican elites. You will be verifying whether or not they are indeed cues by party elites on climate change and the nature of the message they were sending.

There will be three steps: 1) Code whether a cue from either a Republican or Democratic elite is present in the newspaper article or a television transcript; 2) Code whether the cues present in a given article or transcript have a pro-climate and/or anti-climate slant in the text; 3) Code the justifications given by party elites for an anti-climate stance (economic or climate uncertainty/denial).

The articles and transcripts you read will have words highlighted indicating reference to climate change or party leaders. The purpose of this is to help draw your attention to potentially the most important parts. You should still read each item carefully, however. The dictionary we used to identify party elite references in articles can be found at the back of these instructions.

Operating definition of a cue: an explicit or implicit stance on climate change science or climate change policy attributed to either the Republican or Democratic Party or their elites in a newspaper article or broadcast transcript.

Operating definition of party elite: a person who holds political office and is identified as a Republican or Democrat; a member of the executive branch that is affiliated with the administration (President, Vice President, cabinet officials, agency heads); a member of the majority or minority congressional leadership (whips, committee chairs, leaders, the Speaker); a Democratic or

Republican party official; any person identified in the press as being currently linked to either the Republican or Democratic parties.

Note: sometimes series executive and congressional officials won't have their party identified. It is taken for granted in coverage what party they belong to. This is always the case for Presidents and Vice Presidents for example.

Coders should look for the following:

- 1) Are any of the references to the Democratic or Republican Party or their politicians in the article part of a climate change cue? (Y/N; If N, move on to next article)
- 2) If Y: Is there a cue supportive of the scientific consensus? (Y/N)
 - a. Should be scored Y if there is:
 - i. An explicit recognition either that climate change is real and human-caused, or that most scientists concur; or
 - ii. Support a policy action to address climate change, for example a carbon tax or cap and trade system (irrespective of magnitude of policy and the support it receives from environmentalists and other pro-climate actors)
- 3) If Y: Is there a cue opposing the scientific consensus? (Y/N)
 - a. Should be scored N if:
 - i. Claim climate science is uncertain; and/or
 - ii. Deny science of climate change full stop; and/or
 - iii. Oppose a proposal of climate change mitigation or international climate change treaty

Note: Articles can contain cues that run in both directions for a given party. This can happen in the following situations (not inclusive):

- a. Opposing cues with same party in an article (e.g. John McCain vs. other Republicans)
- b. Contradictory policy (e.g. oppose Kyoto, but support alternative climate change policy action)
- c. Changing opinions of same politician (e.g. Mitt Romney)
- d. Accept climate change is happening (consistent with Y), but reject proposed policy action (consistent with N)

- e. Claim science is uncertain (consistent with N), but support funding of more research on climate change impacts, and/or policy to mitigate potential risk of climate change (consistent with Y; common in early years)

For cues that are coded N on the second test and Y on the third (pure anti-climate signal):

- 1) Economy: is justification to opposing climate consensus, in part, related to economic concerns (jobs, the economy, economic competitiveness, need for developing world participation, energy costs, etc.)? (Y/N)
- 2) Uncertainty/Denial: is justification to opposing climate consensus, in part, related to alleged scientific uncertainty surrounding climate science or denying the seriousness, existence, or man-made nature of climate change? (Y/N)

Note: This is not all-inclusive. Many cues don't have clear justifications for stance on climate change.

Appendix J – Mood measure

The climate skepticism mood measure we utilize in this paper is a combination of all the questions on global warming and climate change that we were able to find at the Roper archive coded in the same, skeptical, direction. We also included questions that were not in our pool, but were included in Carmichael, Brulle and Huster. The measure is primarily composed of two types of questions that were most common over a long period. The first asked respondents how serious of a problem climate change is, and the second inquired as to whether climate change was happening. The wording varied slightly, but the general spirit of the questions remained the same. . There are a host of other questions asked periodically, including polls asking about global warming in terms of a threat, whether it was man made, and whether it is happening. Although questions were different, the mood measure remains rather robust.

The measure was purged of two outliers. One was a question about the existence of global warming, from February of 2006. Only 6 percent of the respondents said that global warming is ‘probably not happening,’ substantially below the average response at the time. The survey was conducted by a relatively unknown pollster, Ayers, McHenry & Associates. The other question came from a CBS/NY Times poll fielded on April of 2007, in which only 9 percent of respondents state that global warming is not a serious problem. The latter, however, has virtually no effect on the mood measure. It is worth noting that the reliability of the broad mood measure is the lowest of the four mood measures, at 0.76. More information about the skepticism measure and particular factor loadings is below.

	Quarterly	Annual
Number of series	18	18
Exponential smoothing	On	On
Period	1986.2 to 2015.2	1986 to 2015
Time points	117	30
Variance explained	79%	66%

Table J.1 WCalc6 details for quarterly and annual climate skepticism mood measures

Series	Cases	Dimension 1 loading	
		Quarterly mood	Annual mood
1	3	0.99	0.94
2	2	1	-1
3	2	1	-1
4	3	0.96	0.99
5	4	-0.89	-0.36
6	9	0.87	0.76
7	11	-0.26	-0.08
8	2	-1	1
9	8	0.92	0.68
10	2	1	-1
11	17	0.9	0.96
12	8	0.95	0.21
13	7	0.86	0.06
14	3	1	1
15	16	0.93	0.99
16	2	1	-1
17	2	-1	1
18	16	0.94	0.98

Table J.2 Dimension loadings for quarterly and annual climate skepticism mood measures.

Appendix K – VAR estimation

DV=	Perceived Climate Severity		Democratic Cues	
	Republicans	Democrats	Republicans	Democrats
PCCTI _{t-1}	0.58*** (0.13)	0.65*** (0.12)	-0.05 (0.74)	1.95*** (0.59)
PCCTI _{t-2}	-0.09 (0.11)	0.29** (0.13)	0.57 (0.65)	-0.94 (0.64)
Democratic Cues _{t-1}	0.07*** (0.02)	-0.02 (0.03)	0.38*** (0.14)	0.22 (0.14)
Democratic Cues _{t-2}	-0.08*** (0.02)	-0.03 (0.03)	0.31** (0.14)	0.25* (0.13)
Unemployment _{t-1}	-0.82*** (0.24)	-0.35** (0.17)	0.54 (1.38)	0.89 (0.83)
Oil Prices _{t-1}	0.01 (0.01)	0.04*** (0.01)	0.14*** (0.05)	0.05 (0.05)
R ²	0.82	0.90	0.64	0.71
N	53	53	53	53

Table K.1 VAR estimation for climate severity perceptions and Democratic elite cues. Note: standard errors in parentheses, *p<0.1, **p<0.05, ***p<0.01

DV=	Perceived Climate Severity		Roll Call Voting	
	Republican	Democrat	Republican	Democrat
PCCTI _{t-1}	0.26** (0.11)	0.63*** (0.12)	0.18 (0.12)	0.55*** (0.21)
PCCTI _{t-2}		0.27** (0.13)		-0.26 (0.21)
Roll Call _{t-1}	0.20** (0.08)	-0.10 (0.08)	0.77*** (0.08)	0.83*** (0.13)
Roll Call _{t-2}		0.03 (0.08)		-0.19 (0.13)
Unemployment _{t-1}	-0.97*** (0.22)	-0.45*** (0.14)	-0.15 (0.24)	0.15 (0.24)
Oil Prices _{t-1}	0.00 (0.01)	0.04*** (0.01)	0.01 (0.01)	-0.00 (0.02)
R ²	0.90	0.90	0.71	0.75
N	53	53	53	53

Table K.2 VAR estimation for climate severity perceptions and congressional roll call voting. Note: standard errors in parentheses, *p<0.1, **p<0.05, ***p<0.01

Appendix L – Variable descriptions

Variable	Description	Mean	SD	Max	Min
Anti-intellectualism	Combined index of expert trust questions	0.34	0.17	1	0
Scientist Mistrust	Mistrust a lot-to-Trust a lot, 7-point, rescaled to 3-point	0.23	0.23	1	0
Science Confidence	A great deal/only some/hardly any confidence in scientific community (GSS)	0.32	0.31	1	0
Climate Change	Rating of statement truth "Using coal and gas contributes to the greenhouse effect" (GSS, 1993, 1994 & 2000)	0.62	0.26	1	0
Climate Change	Support for statement "Earth's climate is warming and this is primarily due to the human production of greenhouse gases like carbon dioxide"	0.73	0.30	1	0
Nuclear Power	How dangerous is nuclear power for the environment? (GSS, 1993, 1994 & 2010)	0.39	0.27	1	0
Nuclear Power	Support for statement "Nuclear power is a safe and environmentally-friendly form of energy production compared to conventional sources of energy like fossil fuels"	0.50	0.31	1	0
GMOs	How dangerous is modifying genes in crops for the environment? (GSS, 2000 & 2010)	0.49	0.26	1	0
GMOs	Support for statement "Genetically modified foods are safe, and pose no greater risk to human health than non-GM foods"	0.47	0.47	1	0
Fluoridation	Support for statement "Water fluoridation improves oral and dental health with no safety risk"	0.55	0.30	1	0
Institutional Confidence	First factor from PCA of confidence questions on Congress, executive, Supreme Court, press, major businesses, and banks and financial institutions (GSS, reverse coded)	0.51	0.22	1	0
Institutional Confidence	First factor from PCA of confidence questions on Congress, executive, Supreme Court, press, major businesses, and banks and financial institutions (MTurk, Reverse coded)	0.69	0.20	1	0
Populism	First factor from PCA on populist sentiment questions (MTurk)	0.57	0.20	1	0

Variable	Description	Mean	SD	Max	Min
Ideology	Extremely liberal-to-extremely conservative (GSS)	0.51	0.25	1	0
Ideology	Extremely liberal-to-extremely conservative (MTurk)	0.43	0.30	1	0
PID	Strong Democrat-to-strong Republican (GSS)	0.44	0.32	1	0
PID	Strong Democrat-to-strong Republican (MTurk)	0.43	0.36	1	0
Male	GSS	0.44	0.50	1	0
Male	MTurk	0.42	0.49	1	0
Employed	Full-time worker (GSS)	0.46	0.50	1	0
Employed	Full-time worker (MTurk)	0.60	0.49	1	0
White	White, non-hispanic (GSS)	0.74	0.44	1	0
White	White, non-hispanic (MTurk)	0.75	0.43	1	0
Age	In years (GSS)	49	17.62	89	18
Age	In years (MTurk)	39	13.16	87	18
Income	Less than 1000/1000-2999/3000-3999/4000-4999/5000-5999/6000-6999/7000-7999/8000-9999/10000-14999/15000-19999/20000-24999/25000 or more (GSS)	10.88	2.41	12	1
Income	Under 20000/20000-39999/40000-59000/60000-79000/80000-99999/100000-119999/120000 and over (MTurk)	3.47	1.73	7	1
Education	Less than high school/high school/junior college/bachelor degree/graduate degree (GSS)	2.64	1.23	5	1
Education	Less than high school/high school/junior college/bachelor degree/graduate degree (MTurk)	3.66	0.88	5	1
Church Attendance	Never/less than once a year/once a year/several times a year/once a month/2-3x a month/nearly every week/every week/more than once a week (GSS)	3.42	2.81	8	0
Church Attendance	Never/less than once a year/once a year/several times a year/once a month/2-3x a month/nearly every week/every week/more than once a week (MTurk)	2.58	2.67	8	0
Trust	Can't be too careful/it depends/can generally be trusted (GSS)	1.31	0.92	2	0
Trust	Can't be too careful/it depends/can generally be trusted (MTurk)	0.86	0.78	2	0
Political Interest	Not at all interested/somewhat interested/interested/very interested (MTurk)	2.17	0.73	3	0

Table L.1 Variable descriptions and descriptive statistics

Appendix M – Full regression results, paper III

	Climate	Nuclear	GMO
	1	2	3
Confidence in Science (Reverse Coded)	-0.05*** (0.02)	-0.04* (0.02)	-0.08*** (0.03)
Ideology	-0.09*** (0.03)	0.04 (0.03)	0.07* (0.03)
PID	-0.07*** (0.02)	0.09*** (0.02)	0.03 (0.03)
Male	0.01 (0.01)	0.10*** (0.01)	0.09*** (0.02)
Employed	-0.03** (0.01)	0.01 (0.01)	0.01 (0.02)
White	0.01 (0.02)	0.06*** (0.02)	0.02 (0.02)
Age	-0.00** (0.00)	0.00*** (0.00)	0.00** (0.00)
Income	0.00 (0.00)	0.00* (0.00)	-0.00 (0.00)
Education	-0.00 (0.01)	0.03*** (0.01)	0.02** (0.01)
Church Attendance	-0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)
Trust	0.00 (0.01)	-0.03*** (0.01)	-0.01 (0.01)
Constant	0.76***	-0.01	0.24***
R ²	0.03	0.16	0.08
N	1868	2024	1047

Table M.1 Determinants of support for expert positions, GSS. Note: standard errors in parentheses, *p<0.1, **p<0.05, ***p<0.01

	Climate	Nuclear	GMO	Fluoride	Combined
	1	2	3	4	5
Anti-intellectualism	-0.39*** (0.06)	-0.23*** (0.08)	-0.29*** (0.08)	-0.28*** (0.08)	-0.30*** (0.05)
Ideology	-0.43*** (0.06)	-0.03 (0.08)	-0.17** (0.08)	-0.18** (0.08)	-0.20*** (0.05)
PID	-0.02 (0.05)	0.06 (0.06)	0.10 (0.07)	0.05 (0.06)	0.05 (0.04)
Male	0.01 (0.02)	0.12*** (0.03)	0.04 (0.03)	0.05** (0.03)	0.06*** (0.02)
Employed	0.02 (0.02)	-0.01 (0.03)	0.00 (0.03)	0.01 (0.03)	0.01 (0.02)
White	0.02 (0.02)	0.06** (0.03)	0.02 (0.03)	0.02 (0.03)	0.03 (0.02)
Age	0.00 (0.00)	-0.00* (0.00)	-0.01*** (0.00)	-0.00 (0.00)	-0.00*** (0.00)
Income	-0.00 (0.01)	0.01* (0.01)	0.00 (0.01)	0.01 (0.01)	0.00 (0.01)
Education	-0.00 (0.01)	0.05*** (0.02)	0.06*** (0.02)	0.04*** (0.01)	0.04*** (0.01)
Church Attendance	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.01)	-0.00 (0.00)	-0.00 (0.00)
Trust	-0.01 (0.01)	0.04** (0.02)	0.06*** (0.02)	0.03** (0.02)	0.03*** (0.01)
Political Interest	0.02 (0.01)	0.03* (0.02)	0.03 (0.02)	0.04** (0.02)	0.03*** (0.01)
Constant	1.03***	0.23***	0.44***	0.39***	0.52***
R ²	0.34	0.14	0.15	0.13	0.26
N	552	552	552	552	552

Table M.2 Determinants of support for expert positions, MTurk. Note: standard errors in parentheses, *p<0.1, **p<0.05, ***p<0.01

DV = Combined Expert Consensus Index	
Anti-intellectualism	-0.02 (0.16)
Political Interest	0.07*** (0.03)
Political Interest * Anti-intellectualism	-0.12* (0.07)
Constant	0.53***
Controls	Yes
R ²	0.25
N	552

Table M.3 Information, anti-intellectualism interaction, MTurk. Note: controls for ideology, partisanship, gender, employment, race, age, income, religiosity, and generalized trust; standard errors in parentheses, *p<0.1, **p<0.05, ***p<0.01

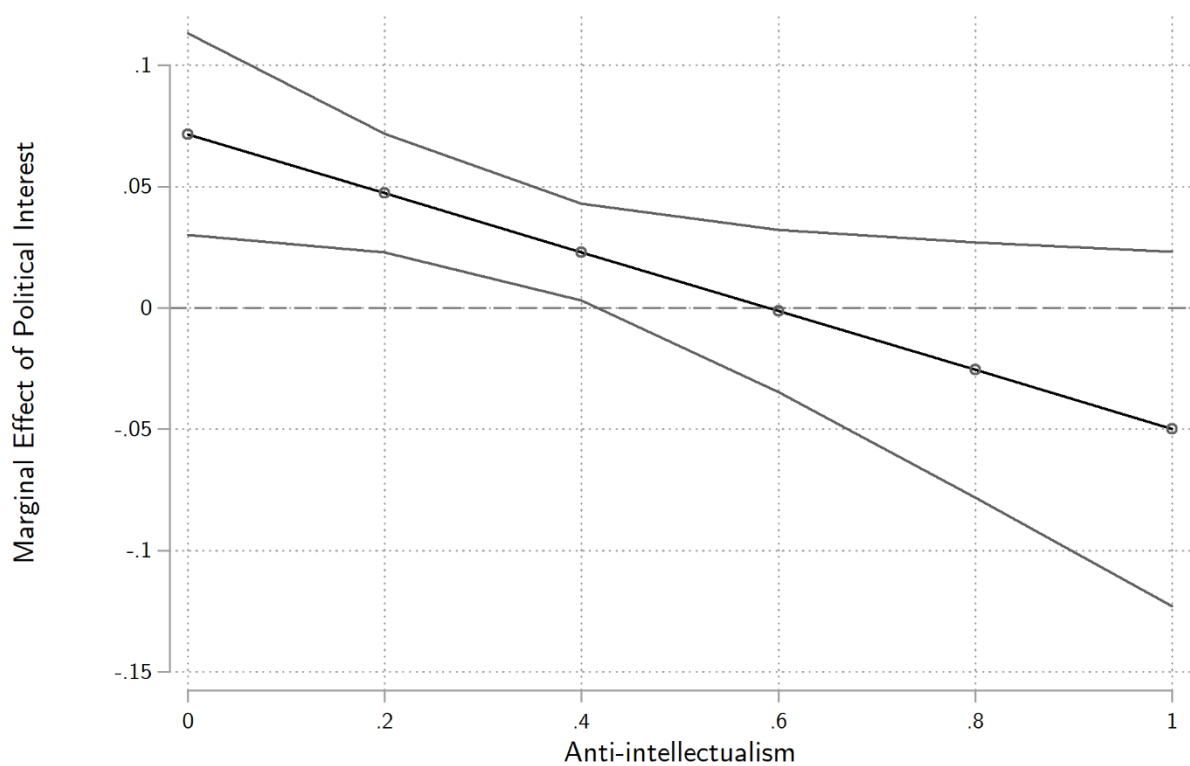


Figure M.1 Marginal effect of political interest across anti-intellectualism. Note: 90% confidence intervals.

	Lack of Confidence in Science (GSS)	Scientist Mistrust (MTurk)		Anti-intellectualism (MTurk)	
	1	2	3	4	5
Lack of Confidence in Institutions	0.36*** (0.03)	0.17*** (0.03)		0.20*** (0.02)	
Populism			0.14*** (0.03)		0.22*** (0.02)
Ideology	0.05 (0.03)	0.19*** (0.03)	0.18*** (0.03)	0.14*** (0.03)	0.13*** (0.02)
PID	0.05* (0.03)	0.10*** (0.03)	0.09*** (0.03)	0.07*** (0.02)	0.06*** (0.02)
Male	-0.06*** (0.01)	0.00 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Employed	0.04*** (0.02)	0.01 (0.01)	-0.00 (0.01)	-0.00 (0.01)	-0.01 (0.01)
White	-0.06*** (0.02)	-0.02 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.00 (0.01)
Age	0.00*** (0.00)	0.00 (0.00)	0.00 (0.00)	0.00*** (0.00)	0.00*** (0.00)
Income	0.00 (0.00)	-0.01** (0.00)	-0.01** (0.00)	-0.01*** (0.00)	-0.01** (0.00)
Education	-0.04*** (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.01** (0.01)	-0.01* (0.01)
Church Attendance	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.00*** (0.00)	0.00** (0.00)
Trust	0.03*** (0.01)	-0.02** (0.01)	-0.01* (0.01)	-0.02*** (0.01)	-0.02*** (0.01)
Political Interest		-0.02** (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.00 (0.01)
Constant	0.06	0.05	0.08*	0.14***	0.13***
R ²	0.17	0.20	0.19	0.24	0.25
N	1455	1062	1083	1027	1044

Table M.4 Determinants of anti-intellectualism, GSS and MTurk. Note: standard errors in parentheses, *p<0.1, **p<0.05, ***p<0.01

	Climate 1	Nuclear 2	GMO 3	Fluoride 4	Combined 5
Anti-intellectualism	-0.36*** (0.04)	-0.09* (0.05)	-0.23*** (0.05)	-0.29*** (0.04)	-0.24*** (0.03)
Cue * Anti-intellectualism	-0.10** (0.05)	-0.19*** (0.07)	-0.11 (0.07)	-0.20*** (0.06)	-0.15*** (0.04)
Ideology	-0.32*** (0.03)	-0.00 (0.04)	-0.15*** (0.05)	-0.12*** (0.04)	-0.15*** (0.03)
Cue * Ideology	-0.03 (0.05)	0.01 (0.06)	-0.03 (0.06)	0.11** (0.06)	0.02 (0.04)
PID	-0.13*** (0.03)	0.06* (0.04)	0.05 (0.04)	0.02 (0.03)	0.00 (0.02)
Cue * PID	-0.04 (0.04)	-0.02 (0.05)	-0.02 (0.05)	-0.07 (0.05)	-0.04 (0.03)
Trust	0.01 (0.01)	0.05*** (0.01)	0.05*** (0.01)	0.04*** (0.01)	0.04*** (0.01)
Cue * Trust	-0.02* (0.01)	-0.03** (0.01)	-0.02 (0.01)	-0.01 (0.01)	-0.02** (0.01)
Political Interest	0.01 (0.01)	0.05*** (0.01)	0.05*** (0.01)	0.05*** (0.01)	0.04*** (0.01)
Cue * Political Interest	-0.03** (0.01)	-0.00 (0.02)	-0.03 (0.02)	-0.03* (0.01)	-0.02** (0.01)
Consensus Cue	0.13*** (0.04)	0.12*** (0.05)	0.12** (0.05)	0.15*** (0.04)	0.13*** (0.03)
Constant	1.02***	0.34***	0.44***	0.53***	0.59***
R ²	0.37	0.04	0.07	0.10	0.19
N	3213	3213	3213	3213	3213

Table M.5 Consensus cue treatment moderated by anti-intellectualism. Note: standard errors in parentheses, *p<0.1, **p<0.05, ***p<0.01

	Climate 1	Nuclear 2	GMO 3	Fluoride 4	Combined 5
Consensus Cue	-0.01 (0.04)	0.03 (0.04)	0.04 (0.04)	0.10*** (0.04)	0.04 (0.03)
Anti-intellectualism	-0.62*** (0.06)	-0.30*** (0.07)	-0.43*** (0.08)	-0.40*** (0.07)	-0.44*** (0.05)
Cue * Anti-intellectualism	0.02 (0.09)	-0.02 (0.10)	-0.08 (0.11)	-0.15 (0.10)	-0.06 (0.07)
Rhetoric	-0.01 (0.03)	-0.10*** (0.03)	-0.03 (0.04)	0.00 (0.03)	-0.03 (0.02)
Cue * Rhetoric	0.03 (0.04)	0.09* (0.05)	-0.00 (0.05)	-0.01 (0.05)	0.03 (0.03)
Rhetoric * Anti-intellectualism	0.03 (0.08)	0.29*** (0.09)	0.17* (0.10)	0.03 (0.08)	0.13** (0.06)
Cue * Rhetoric * Anti-intellectualism	-0.15 (0.11)	-0.26** (0.13)	-0.10 (0.14)	-0.02 (0.12)	-0.13 (0.09)
Constant	0.95***	0.59***	0.60***	0.66***	0.70***
R ²	0.14	0.04	0.08	0.10	0.12
N	3440	3440	3440	3440	3440

Table M.6 Consensus cue treatment moderated by anti-intellectualism and rhetoric.

Note: standard errors in parentheses, *p<0.1, **p<0.05, ***p<0.01

Appendix N – Treatment and control mock news articles

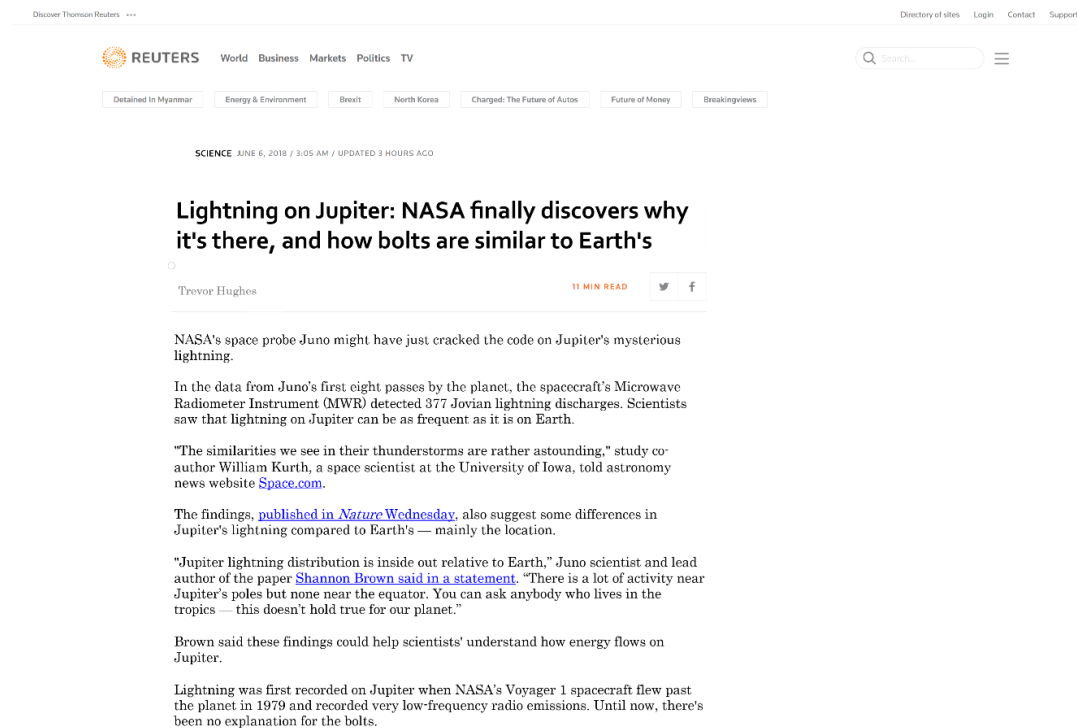


Figure N.1 Control condition article

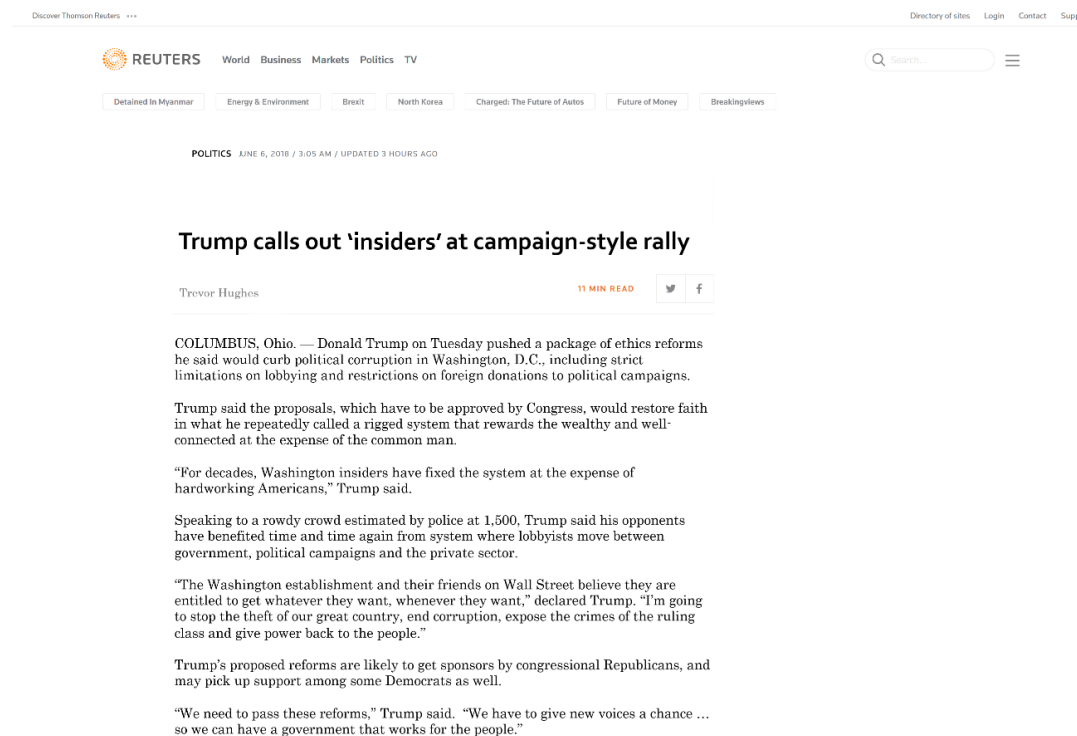


Figure N.2 Partisan rhetoric condition, Trump version

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POLITICS
JUNE 6, 2018 / 3:05 AM / UPDATED 3 HOURS AGO

Sanders calls out 'insiders' at campaign-style rally

Trevor Hughes
11 MIN READ

COLUMBUS, Ohio. — Bernie Sanders on Tuesday pushed a package of ethics reforms he said would curb political corruption in Washington, D.C., including strict limitations on lobbying and restrictions on foreign donations to political campaigns.

Sanders said the proposals, which have to be approved by Congress, would restore faith in what he repeatedly called a rigged system that rewards the wealthy and well-connected at the expense of the common man.

"For decades, Washington insiders have fixed the system at the expense of hardworking Americans," Sanders said.

Speaking to a rowdy crowd estimated by police at 1,500, Sanders said his opponents have benefited time and time again from system where lobbyists move between government, political campaigns and the private sector.

"The Washington establishment and their friends on Wall Street believe they are entitled to get whatever they want, whenever they want," declared Sanders. "I'm going to stop the theft of our great country, end corruption, expose the crimes of the ruling class and give power back to the people."

Sanders' proposed reforms are likely to get sponsors by congressional Republicans, and may pick up support among some Democrats as well.

"We need to pass these reforms," Sanders said. "We have to give new voices a chance ... so we can have a government that works for the people."

Figure N.3 Partisan rhetoric condition, Sanders version

Appendix O – Robustness tests

	Climate 1	Nuclear 2	GMO 3	Fluoride 4	Combined 5
Consensus Cue	-0.01 (0.04)	0.03 (0.04)	0.04 (0.04)	0.10*** (0.04)	0.04 (0.03)
Anti-intellectualism	-0.62*** (0.06)	-0.30*** (0.07)	-0.43*** (0.08)	-0.40*** (0.07)	-0.44*** (0.05)
Cue * Anti-intellectualism	0.02 (0.09)	-0.02 (0.10)	-0.08 (0.11)	-0.15 (0.10)	-0.06 (0.07)
Non-Partisan Rhetoric	-0.02 (0.03)	-0.09** (0.04)	-0.04 (0.04)	-0.01 (0.04)	-0.04 (0.03)
Partisan Rhetoric	0.01 (0.04)	-0.12*** (0.04)	-0.02 (0.04)	0.03 (0.04)	-0.03 (0.03)
Cue * Non-Partisan	0.05 (0.05)	0.06 (0.06)	0.04 (0.06)	0.02 (0.05)	0.04 (0.04)
Cue * Partisan	0.01 (0.05)	0.13** (0.06)	-0.04 (0.06)	-0.04 (0.05)	0.02 (0.04)
Non-partisan * Anti-intellectualism	0.08 (0.09)	0.24** (0.10)	0.15 (0.11)	0.04 (0.10)	0.13* (0.07)
Partisan * Anti-intellectualism	-0.04 (0.10)	0.35*** (0.11)	0.19* (0.11)	0.02 (0.10)	0.13* (0.07)
Cue * Non-partisan * Anti-intellectualism	-0.20 (0.13)	-0.15 (0.15)	-0.16 (0.16)	-0.06 (0.14)	-0.14 (0.10)
Cue * Partisan * Anti-intellectualism	-0.09 (0.13)	-0.38*** (0.15)	-0.04 (0.16)	0.02 (0.14)	-0.13 (0.10)
Constant	0.95***	0.59***	0.60***	0.66***	0.70***
R ²	0.14	0.02	0.04	0.08	0.12
N	3440	3440	3440	3440	3440

Table O.1 Non-partisan and partisan rhetoric comparison. Note: standard errors in parentheses, *p<0.1, **p<0.05, ***p<0.01

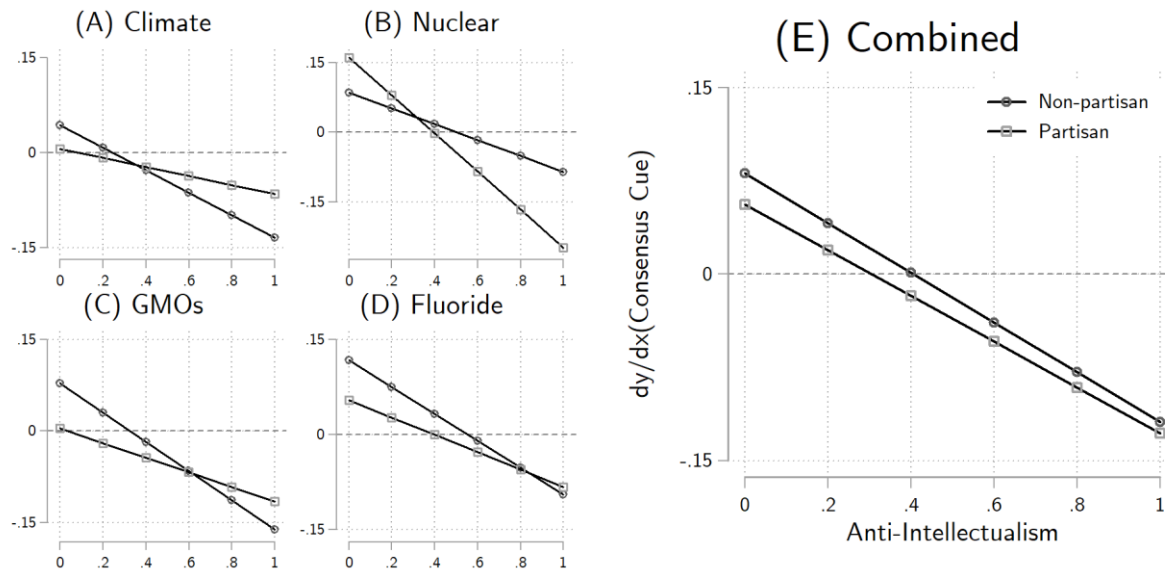


Figure O.1 Moderation effect of anti-intellectualism in non-partisan and partisan rhetoric treatment conditions. A) Climate change; B) Nuclear power; C) GMOs; D) Fluoride; E) Average across issues.

DV = Expert Mistrust Battery	
Non-Partisan Rhetoric	-0.00 (0.01)
Partisan Rhetoric	0.00 0.01
R ²	0.00
N	3440

Table O.2 Effect of rhetoric treatment on expert mistrust. Note: standard errors in parentheses, *p<0.1, **p<0.05, ***p<0.01