Jenny McCarthy or Jim Inhofe?
Understanding the Media’s Role in Supporting Pseudo-Scientific Public Attitudes

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The increase in salience of the issue of climate change over the past decade, coupled with the fact that belief in climate change seems to be determined by one’s political stripes instead of the work of climate scientists, has brought to the forefront the issue of communication of scientific knowledge. Though climate change is the most popular example, it is by no means the only issue where American public opinion is not in line with mainstream scientific consensus.

On the issue of vaccinations, for example, a 2011 poll has found that 18% of Americans believe that childhood vaccinations can cause autism, while 30% were not sure.\textsuperscript{1} And although a recent study by the Pew Research Center\textsuperscript{2} shows that the vast majority of Americans believe that vaccinations are safe, there is a growing number of communities around the country where vaccination rates are dangerously low, leading to a growing risk of epidemics of serious diseases like measles or whooping cough.\textsuperscript{3}

Another topic that has ebbed and flowed in salience is the safety of genetically modified organisms (GMOs) in food. Recent polling shows that although 88% of scientists believe that GMO foods are safe to eat, only 37% of the public shares that view. This 51-point gap is the largest of any scientific issue that the Pew Research Center asked about. Furthermore, national polls show consistently that over 90% of the public believes that the GMO foods should be labeled, even though many scientists agree that its bad policy.\textsuperscript{4}

Public opinion, in short, seems easily confused on scientific issues. Americans mostly follow the scientific consensus on vaccines (for the time being, at least), are sharply against it on GMOs, and are polarized on climate change.

Commentators, perplexed about this state of affairs, have suggested that these troubling public opinion trends are due to false equivalency in media coverage that gives undue credence to pseudo-scientific beliefs (see, for example, Follows 2013). In other words, by giving the pseudo-scientific side an equal voice in these debates, for example through spokespeople like

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\item \url{http://www.pewinternet.org/2015/01/29/public-and-scientists-views-on-science-and-society/} \textsuperscript{(link)}
\item \url{http://www.hollywoodreporter.com/features/los-angeles-vaccination-rates/} \textsuperscript{(link)}
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Jenny McCarthy on vaccines, the media increase the prevalence of such beliefs in the general public because people view these arguments as legitimate and equivalent to the scientific evidence.

We argue that this view is incomplete, and that the media provide only a part of the story behind these problematic, and often harmful, beliefs. In this paper, we examine the nature of media coverage on climate change, GMOs, and vaccinations. In the case of climate change, we show that the proliferation of partisan cues in the media caused increases in skepticism in the American public. For GMO and childhood vaccination coverage, we do not find evidence of polarization, nor a link between either false equivalence or party cues and public opinion. However, our findings on climate change should be seen as a warning that the potential for polarization on these issues via partisan cues is real. We do all this by analyzing 35 years of coverage of these issues in three major newspapers: The New York Times, The Washington Post, and the USA Today.

The Media, Scientific Communication, and False Equivalence

There is vast literature on the role that the mass media play in shaping public opinion on a variety of issues. This is because the media has a virtual monopoly on the presentation of many kinds of important information, especially non-salient, specialist information that the public does not have in depth knowledge about (Nisbet & Myers 2007). Since most people don’t have a copy of the New England Journal of Medicine on their nightstand and don’t dedicate their life to conducting rigorous scientific research, the media play a big role in educating the public and shaping opinions on difficult, science-based issues, like climate change, GMOs, and childhood vaccinations.

There has been a fair amount of work confirming that the media matter for scientific issues. On the issue of climate change, the media have been found to be an important agent of learning about the issue (Kahlor & Rosenthal 2009; O’Neill & Nicholson-Cole 2009) and news attention has been found to have significant and positive effects on knowledge about climate change (Jang 2014; Ho et al 2008; Lee & Scheufele 2006; Zhao et al 2011). Feldman et al. (2012), also found
that the content of the news matter as well. The dismissive tone of climate change coverage presented on Fox News was negatively associated with the viewers’ acceptance of climate change. In short, the media clearly pay a role in shaping attitudes on climate change.

The case is similar with other difficult scientific issues, like childhood vaccinations, where media also shape opinions and behaviors. As Jefferson (2000) and Offit and Coffin (2003) point out, the explosion of coverage of the now discredited Wakefield study linking the MMR vaccine to autism led to a steady decline in vaccination rates in parts of the United Kingdom (although no such links have been found in the US, as Smith et al. 2008 show). Adverse media coverage of the MMR vaccine also affected vaccination rates in Denmark in the early 1990s (Begg et al. 1998). The media’s irresponsible treatment of any controversies surrounding vaccines also contributed to serious misinformation of the public on the safety of the MMR vaccine (Lewis & Speers 2003; Speers & Lewis 2004). The media clearly play a role in shaping attitudes about this issue, even though most people likely get their information about vaccinations from their trusted family physicians.

Much is the same with GMOs. There is research highlighting the role of the media in attitudes about the safety of GMO foods. Viella-Vila and Costa-Fort (2008) have found that the media in Britain and Spain highlighted risks and potential hazards of public health associated with GMOs, framing GMO foods as a majorly controversial issue, ignoring the benefits of the new technology, affecting negative public attitudes towards GMOs. Other work also found a link between GMO coverage and public beliefs about GMO safety (Ceccoli & Hixon 2011; Marques et al 2015, Ten Eyck 2005; Gaskell et al 2003). Several scholars also attempted to focus on the nature of coverage of GMO foods, assuming that coverage influences public attitudes on the topic, finding the coverage mostly negative (Augoustinos et al 2010; Nucci & Kubey 2007).

In short, there is a vast body of work suggesting that the media play an important role in shaping beliefs about scientific topics like climate change, GMOs, and vaccinations. What we are interested in, however, is a more specific question of how do the media influence public opinion. That requires us to investigate two specific mechanisms through which the media might play a role in public opinion on these issues. Both of these mechanisms ultimately deal with the
nature of the media coverage of these topics, though they focus on two distinct features of coverage: false equivalency and partisan cues.

The idea of false equivalency has been gaining ground in academia, particularly on the topic of climate change, as well as in the world of journalism, where it’s been used as a critique of modern reporting (with James Fallows, of The Atlantic, leading the way). In general, the idea is that journalists frequently treat topics as debates in which they present “both sides” in order to adhere to the important journalistic norm of objectivity. There are several reasons for why that might be the case. For example, in political coverage, this technique is employed to prevent being labeled as biased. And in more general reporting, there has been a trend of focusing on conflict and disagreement (Bennett 2007), which false equivalence also helps to satisfy.

These themes have been analyzed in the context of climate change news coverage. As Zehr (2000) argues, the media routinely resort to frame climate change as uncertain, frequently through emphasizing controversy or disagreement among scientists. This disagreement, under the guise of objectivity, allows voices not aligned with scientific consensus to be heard, often creating an impression that scientific opinion on the topic is divided or unsettled (Antilla 2005; Ward 2008). This generates false equivalence in the coverage by giving comparable credence to both scientific and pseudoscientific arguments.

Anecdotal evidence, especially coming from cable news coverage, seems to support the notion that false balance dominates climate change coverage, as well as potentially other science-based issues. For example, Jenny McCarthy has frequently appeared on television questioning the safety of childhood vaccinations and highlighting its (nonexistent) link to autism. Often, her appearance would be as one of two guests, the other being a scientist specializing in vaccine safety. Similarly, climate change deniers would frequently appear on television debating climatologists on climate change. Yet, as far as rigorous treatment of the false equivalence hypothesis is concerned, it has only been researched to a limited extent (Boykoff 2007; Boykoff & Boykoff 2004, 2007).

5 http://www.theatlantic.com/politics/archive/2013/10/a-bountiful-harvest-of false-equivalence-analyses/280452/ (link)
The findings suggest that the media coverage of climate change has improved markedly in the last decade. Coverage of climate change in the 1990s and early 2000s was characterized by scientific inaccuracy and uncertainty, which was driven by an adherence to a balanced reporting and resistance to a growing body of clear scientific evidence. More recently, starting in the early 2000s, the balance nearly disappeared and the public has been getting more accurate information about the issue (Boykoff 2007; Boykoff & Boykoff 2004, 2007).

These findings are limited, however, in a sense that they rely on a relatively small number of articles and don’t extend to other scientific issues. In this paper, we will build on this approach, analyzing the false equivalence in the coverage of climate change, vaccinations, and climate change, in the three major US dailies, for the period of 1980-2014, substantively increasing temporal length of coverage, the issues of interest, and the number of articles the analysis is based on.

**A Role for Party Cues?**

Of course, there is reason to expect that the public may not be pushed around so easily by the specific arguments found in media coverage of political issues, but may be instead more influenced by the source of those arguments. Early scholars in political behavior associated with the Columbia School argued that the media did not exercise a direct effect on the opinions of citizens, but rather the information carried in the media was filtered to the public as part of a “two-step flow” by the social networks (Katz & Lazarsfeld 1955).

Building on that insight, Downs (1957) highlighted the importance of cues in the information and social environment that allow citizens to determine which information they process to make a decision, and which information they avoid or reject, since processing information about politics was a costly endeavor to an average citizen. The implications are that citizens will pay attention to easily accessed information, like cues from elites and opinion leaders, and they will pay attention to information that minimizes the risk of a costly mistake. To do the latter, citizens pay attention to sources they trust, which to a large degree is based on
whether there are perceived common interests, and to sources they perceive as knowledgeable on a particular topic (Lupia & McCubbins 1998: 55-9).

As a result, in the case of science-based policy, like climate change, GMOs and vaccines, we should expect rational citizens to weigh cues from experts heavily because of their knowledge of the issue. However, they may not perceive there to be a common interest with experts from the medical community, universities, or the biotechnology sector. This leaves an opening for political parties to influence the public attitudes towards science-based policy if they so choose.

We know that many citizens have strong attachments to political parties which form an important part of their identity, and colors their processing of political information (Green et al. 2002; Bartels 2002). Citizens can thus be expected to weight cues from fellow party elites due to a perceived common interest. To the extent that the importance of this perceived common interest is weighted more heavily than the importance of the knowledge advantage of experts, we might expect party cues to weigh more heavily than those from experts.

Of course, citizen use of cues may not be a particularly rational process. Perceived knowledge or common interests of sources can be colored by affect. An important experiment by Kuklinski and Hurley (1994) showed that certain characteristics of sources, like their race, can dominate the processing of a cue, rather than more important characteristics like ideology. We still don’t entirely understand when affect dominates the processing of source cues. Nonetheless, we should expect party cues to matter in changing public attitudes whether cues are used in a cognitive or affect-driven manner.

A rich literature has explored the degree to which public opinion follows elite opinion. The first systematic attempt to use observational research to demonstrate how the public changes in response to elite opinion was Zaller’s (1992) work on the Vietnam War. Zaller’s two-message model of mass persuasion posited the probability an individual resists a message, once it’s received, increases with the distance between the individual’s predispositions and the message. The reception of the message is dependent on political sophistication. Thus, we would expect party cues in the media to not affect the least sophisticated – who aren’t exposed to the cues. In-group cues should matter for the most sophisticated because they can tie their predispositions
to the cue from a fellow party elite, with a caveat that the previous link of an issue to a citizen’s predisposition was obscure (very likely for GMOs and very unlikely at this stage for climate change), but resist cues from the opposing party (Zaller 1992: 42-8). The modestly sophisticated will be influenced by the balance of the cues in the environment. In the case of the Vietnam War, Zaller (1992) showed that liberal or “dove” opinion on Vietnam was indistinguishable from conservatives or “hawks” among the least sophisticated, but the gap began to widen among the most sophisticated only as liberal elite opinion turned against the war (202-11).

Berinsky (2009) followed up on Zaller’s effort by broadening the scope of analysis to include the Second World War and the Iraq War. He argued that understanding public opinion shifts cannot rest only on the messages present in discourse by elites, but rather as simple cues in the environment that serve as a referent point for citizens to decide whether to support or oppose a policy. Here, party cues can serve to mobilize citizens with opposing party attachments regardless of the vocalized cues coming from their own party leaders – which was seen in the case of the Iraq War. Both in-group and out-group party cues matter in shifting public opinion, conditional on them having reasonably weak priors.

Zaller and Berinsky’s work, however, was observational in nature, and was limited in its ability to tease out dynamics in how citizens process party cues, and potential mediating factors. Here experimental research has shown promise. Cohen (2003) showed that processing of party cues has the potential to dominate substantive policy information and the ideological beliefs of respondents. Work by Nicholson (2012) demonstrated in an experimental setting that in-party leader cues did not persuade, but that out-party leader cues polarized the public on the issues of housing and immigration policy. He also found that party leader cues were more polarizing than party label cues, suggesting that in an era of polarized politics, opinion change might come from processing the cues coming from the other party and not one’s own.

Research by Kam (2005), closer in spirit to the research of this paper, reached more nuanced conclusions. She exposed citizens to a news story on food irradiation, and manipulated the presence of party cues. She found that low sophisticates leaned on the party cues to form an opinion on the issue, while high sophisticates linked their opinion to their attitudes towards
science. Other studies have been less supportive of party cue theory – Bullock (2011) found party cues were typically dominated by policy considerations when respondents were exposed to stories about health care and welfare.

What to make of the contradictory findings? It seems likely that processing of party cues is no straightforward matter. It is likely mediated by factors like sophistication and need for cognition. It also likely varies depending on the strength of a citizen’s prior attitudes on a particular issue. The former observation is close in spirit to Zaller’s research, and a broader research agenda on heuristics that have been shown to be used more as a crutch by the less politically sophisticated. The latter explains why party cues have been shown to matter in foreign policy and on complex science-based topics like food irradiation where priors are weak. It also helps explain why party cues may matter less in domestic policy areas that anchor the left-right ideological divide, like welfare. We expect them to matter a great deal in structuring attitudes towards complex, science-based policies.

In this paper, we take a preliminary look at the relationship between the media coverage and public attitudes on science-based issues like climate change, vaccinations, and GMO foods. We examine several decades of coverage of each topic in three widely circulated daily newspapers: The New York Times, The Washington Post and USA Today. We focus on the presence of false equivalence in media representations of each issue as well as in the presence of political and expert cues. We then examine the case of climate change with more rigor, by examine the potential causal influence that the media coverage might play on climate change skepticism. We will end with some concluding remarks about the implications of our findings and the possibilities for future research.

**Pseudo-Scientific Beliefs in the American Public**

Despite a seeming abundance of public opinion polling, the state of American opinion on a whole host of issues is woefully understudied. In large part, this is a data problem. Polls on a lot of issues are scarce, and when they are finally put in the field during a high period of salience, it leaves researchers unable to see the important opinion dynamics over a long time period. For
this reason, many studies that want to look at long-term opinion dynamics and how they feed into public policy focus on macro policy indicators like policy mood (Stimson 1999; Erikson, MacKuen, and Stimson 2002). Somewhat surprisingly, even polling on a salient issue of climate change lacks reliable time series opinion measures that extend through most of the time frame of concern. Of course, that doesn’t get us very far for our specific focus on public attitudes towards other science-based issues, as there is practically no polling on GMOs and vaccinations.

Fortunately for us, the Roper Centre at the University of Connecticut had a wide selection of polls addressing climate change attitudes since 1992. Unfortunately for us, many of these polls use hopelessly different question wording and focus on different aspects of the issue (climate change exists vs doesn’t exist, climate change is man-made vs is not man-made, what is the level of risk that it poses, etc.). We selected polls with the wording available over the longest time period possible – from 1992 to 2014, which approximated the following:

Do you feel that climate change is a very serious problem, a somewhat serious problem, not too serious a problem, or not a serious problem at all?

In all there are 58 polls that have a question similar to the above in the Roper database or ask about whether climate change is happening or not. We use these questions to extract a latent measure of public skepticism on climate change based on the proportion of respondents who believe climate change is not a serious problem or thought climate change was not happening using WCalc, which is software designed by James Stimson to construct the policy mood. In his work, Stimson was interested in combining results from disparate survey questions to capture 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. We use the same approach here. We code all of the questions in the same direction to extract the latent measure of climate change skepticism. 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 what we are interested in are the changes in public opinion on climate change over time and not levels of skepticism at specific points in time.
The results are presented in the left panel of Figure 1 below. As is evident, public skepticism towards climate change has been on the rise since 1992. In fact, it has approximately doubled despite the fact climate scientists have become increasingly confident that climate change presents a growing threat. Skepticism rose gradually in the 1990s, stayed relatively constant in the early half of the 2000s, and spiked after 2007, and again after 2013.

*Figure 1. Climate Skepticism in the American Public, 1992-2014*

Unfortunately, we do not have partisan breakdowns of the polls in the Roper dataset, so this does not give us a lot of leverage in answering the question who exactly is becoming more skeptical that climate change presents a threat. A Gallup series starting in 2001 with the following question helps us answer this:

I’m going to read you a list of environmental problems. As I read each one, please tell me if you personally worry about this problem, a great deal, a fair amount, only a little, or not at all. First, how much do you worry about climate change?
The series shows a decrease in the number of Republican’s worrying about climate change starting in 2001, hitting a floor in 2004, rising until 2007 before dropping again. There is evidence of increasing polarization on the issue, but the process likely started well before 2001 judging by our climate skepticism measure. Our skepticism measure can help us estimate how much the public polarized before 2001. We know that skepticism is some function of Republican, Democratic and Independent attitudes towards climate change. We can regress Republican and Democratic concern over climate change on public mood and use the estimated relationship to generate predictions of Democratic and Republican attitudes towards climate change going back to 1992. The combined Gallup series and pre-2001 predictions are plotted in the right panel of Figure 1 above. The series suggests that Republican concern over climate change was as high as 64 percent in 1992, falling to the mid-30s by 2014, while Democratic attitudes more or less remained constant. In other words, the gap between Democrats and Republicans may have tripled since 1992.

This is by no means a bullet-proof attempt to estimate Republican attitudes towards climate change back in the early 1990s. We do not have actual data on Republican attitudes before 2001, nor do we have questions explicitly about the science of climate change over a long enough series. But the findings are highly suggestive. It suggests that not only has polarization on climate change rapidly increased over the 23 years, but that the opinions on this issue polarized before the Bush Administration, let alone before the rise of Tea Party radicalism and overt climate change denial. It begs the question of why the public became increasingly skeptical about climate change, and Republican voters in particular. Are journalistic norms of balance to blame for elevating climate change denial arguments, or does the media evoke climate skepticism by providing party cues to Republican voters to oppose efforts to combat climate change?

Unlike on the issue of climate change, we have no long-term data on American attitudes towards GMOs. Polls have suggested that large majorities of the public are skeptical about the safety of GMO. One survey by the Pew Research Centre showed that a full 57 percent of the public believes GMOs are generally unsafe to eat, compared to 11 percent of scientists
from the American Association for the Advancement of Science (AAAS). The gap between the number of citizens who think GMOs are generally safe to eat, and scientists who think the same (57 points) is wider than a similar gap on whether climate change is primarily due to human activity (37 points) and even on human evolution (33 points). A recent ABC News poll also shows the overwhelming distrust of GMOs among the American public. 52% of the public believes that GMOs are unsafe to eat, and additional 13% are unsure. A near unanimous 93% believed that the federal government should require foods containing GMOs to be labeled. Republicans were evenly split on the safety of GMOs, while the Democrats rated them as unsafe by a 26 point margin. Interestingly, the recent Pew poll found no partisan difference on the GMO safety issue. The consensus is, however, that GMOs are unsafe and should be labeled. Although we cannot track these attitudes over time, it is clear that the public is skeptical of the science, and very likely this has not changed appreciably since their introduction into the food supply in the mid-1990s.

This poses a dilemma. How do we assess the effect of the media on GMO attitudes if we have no historical data on said attitudes? To this end we will turn our attention to GMO labelling initiatives with some accessible polling data broken down by party identification. There are two we can make use of: Proposition 37 in California in 2012 and Proposition 105 in Colorado in 2014. In both cases, large majorities of the public favored the labeling initiative only to turn around and reject it at the end of the campaign. Opinion polling was found in September at the beginning of the campaign, and October towards the end. Polling for the California initiative was conducted by the University of Southern California, and for the Colorado initiative by Suffolk University. The results are presented in Table 1 below.

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6 http://abcnews.go.com/Technology/story?id=97567 (link)
Table 1. GMO Labelling Referendum Polling, California (2012) and Colorado (2014)

<table>
<thead>
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<th>Panel A</th>
<th>Total</th>
<th>Republican</th>
<th>Democratic</th>
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<td></td>
<td>Yes</td>
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<tr>
<td>California, Prop 37</td>
<td>September 17-23, 2012</td>
<td>61 25</td>
<td>51 35</td>
</tr>
<tr>
<td></td>
<td>October 15-21, 2012</td>
<td>44 42</td>
<td>31 58</td>
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<tr>
<td></td>
<td>Change</td>
<td>-17 +17</td>
<td>-20 +23</td>
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| Colorado, Prop 105 | September 17, 2014 | 52 27 | 46 32 | 58 21 |
|                    | October 22, 2014   | 30 49 | 23 60 | 43 33 |
|                    | Change             | -22 +22 | -23 +28 | -15 +12 |

Panel B

<table>
<thead>
<tr>
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<th>Sept</th>
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<th>Gap</th>
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<tr>
<td>California</td>
<td>Net Dem – Net GOP</td>
<td>34 49</td>
<td>+15</td>
<td>44%</td>
</tr>
<tr>
<td>Colorado</td>
<td>Net Dem – Net GOP</td>
<td>23 47</td>
<td>+24</td>
<td>104%</td>
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Panel A shows the results for the polls in both propositions. Support for the ballot initiative dropped by 17 percentage points between September and October. Both Republicans and Democrats turned against the initiative, but Republicans did more so, increasing 23 points in their opposition to 14 points for Democratic supporters. Panel B shows the difference in net Democratic support and net Republican support in September and October. The gap between the parties increased by 15 points, or almost 44 percent in just one month of the campaign. At the start of the campaign both parties supported the initiative with a majority. By the end, only Democratic voters did.

A very similar story is told with polling from the Colorado initiative. As Panel A shows, Republican opposition increased 28 points, compared to only 12 points for Democratic voters. A gap in net support between the parties increased from 23 points to 47 points – over 100 percent by the end of the campaign. In fact, the partisan gap between California and Colorado end up being essentially the same. The only difference was California voters were more polarized in September than in Colorado.

How does one interpret these results? There seem to be two distinct dynamics. First, all voters to some degree turned against the labelling initiative. This is likely due to the fact the ‘No’ side massively outspent proponents in both cases, and placed heavy emphasis on the
possibility that GMO labelling would increase food prices. Second, there was a dynamic in the initiative campaign that caused polarization. It is not clear at face value why advertisements by Monsanto and other agro-chemical companies would produce this result. One possibility is that state parties divided on the ballot initiative, and cues from the parties were carried in the media that limited the effectiveness of the anti-labelling advertisement onslaught for Democratic voters, and accelerated it for Republicans. It is indeed the case that the state Republican and Democratic parties polarized on the initiative to some degree, particularly in California (see Appendix A). It is also possible that the media covered anti-GMO arguments less throughout the campaign, and reduced overwhelmingly negative coverage that is typical in the media according to scholars. These possibilities will be explored below.

The issue of childhood vaccines poses the biggest obstacles to studying public opinion dynamics. There have been no ballot initiatives on the topic, and there is no overtime polling on the issue. The Pew Research Center survey cited earlier suggests over two thirds of Americans think MMR vaccinations should be mandatory, while 86 percent of AAAS scientists think the same – a relatively narrow gap that no doubt understates the degree to which both groups believe in the efficacy of the MMR vaccine. There are slight partisan differences on that issue. In the 2014 Pew survey, 74% of Democrats said vaccines should be required, compared with 64% of Republicans. In the 2009 Pew study, there was no difference in views on vaccinations along party lines. Another indication of the American public’s relative support for childhood vaccinations is the vaccination rates for MMR. The Centre for Disease Control has data on this going back to 1995. Although with the much publicized rise of the anti-vaxxer movement after Andrew Wakefield’s bogus study linking vaccines to autism, this largely hasn’t affected vaccination rates at the aggregate level. National vaccination rates have hovered above the 90 percent level recommended by the CDC to ensure herd immunity without a clear trend.

It is likely, however, that the aggregate data is concealing important differences at lower levels. The anti-vaxxer movement has made gains in affluent neighborhoods in states like California, Washington, and Oregon. They have done so by taking advantage of personal belief exemptions present in many states. Illinois, Michigan, Oregon and Vermont have the highest
rates of exemptions in the country, while California and Washington, which have suffered increasing measles outbreaks, are not too far behind. Figure 2 below plots their vaccination rates along with the national average between 1995 and 2014.

*Figure 2. Measles, Mumps, and Rubella Vaccination Rates, 1995-2013*

In all cases but Vermont, there is no notable trend downward. Vaccination rates have also decreased in Washington only for them to rebound after 2012, likely in response to measles outbreaks. This is not to say that rates are not decreasing in certain areas of these states. In all likelihood, aggregate data is masking two important countervailing trends. On the one hand, the federal government, particularly since the passage of the Vaccines for Children Act in 1993, has made important efforts to ensure children of the disadvantaged are vaccinated and that ability to pay isn’t a barrier. On the other hand, the anti-vaxxer movement is spreading among the wealthier and more educated, in places such as Marin County, California in the Bay Area. The two processes likely cancel each other out to some extent. Regardless, it is clear there is no
nation-wide pattern to resisting the science of vaccines. This should be reflected in the media coverage.

**Media Coverage of Science-Based Issues**

We are interested in two primary features of the media’s coverage of science-based issues: the degree to which coverage is saturated by the journalistic norm of balance, and the presence of partisan cues from opposing parties. We have clear predictions about climate change coverage. If false balance is facilitating climate skepticism, it should be increasing over time. We would expect the same for party cues. The case of GMOs and vaccines is less clear. The majority of the American public is skeptical about the safety of GMOs, which likely hasn’t changed much since their introduction to the market in the mid-1990s. Media will likely reflect that skepticism with a substantial degree of false equivalence or outright negative coverage. The low salience of GMOs at the national level means we would expect parties to avoid the issue entirely. Similarly, we expect the media to adopt the American consensus in favor of vaccines, and parties to either be absent from coverage or in consensus on vaccines. We expect differences to emerge in the dynamics of the local labelling referenda in California and Colorado. If carriage of anti-GMO arguments facilitates skepticism, we should expect such coverage to decline over the course of the campaign. If parties are to blame, we should expect those cues to be present in the media coverage during the campaign.

We gathered coverage on climate change and childhood vaccines between 1980 and 2014, and GMOs between 1992 and 2014, in three of the top circulating newspapers available for download on LexisNexis: *The New York Times, The Washington Post,* and *USA Today.* The GMO series starts in 1992 because they only became a focus of media attention after the approval of the first GM food, a tomato, in 1992. GM foods only began to enter the market in 1994. Local coverage of GMOs in California and Colorado was acquired from the *San Jose Mercury News* and the *Denver Post.* Articles were downloaded based on simple pairs of words in the body of the text along with further restrictions on the subject categories attached to each
The result was 17,854 articles for climate change, 1,461 articles for GMO foods, and 3,418 articles for childhood vaccinations. The number of articles is plotted over time in Figure 3 below.

**Figure 3. Volume of Coverage for Climate Change, GMOs, and Childhood Vaccines**

The first panel on the top of Figure 1 shows the amount of coverage on climate change over time. There is a notable increase in coverage between the late 1980s and 1992 when the framework for Kyoto was established. There are additional spikes for the signing of Kyoto in 1997.

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7 “Global warming” or “climate change” had to appear in both the body of the article and among the subject delimiters in order for it to be included in the sample of climate change articles. “Vaccines” or “vaccinations” had to appear in the body of the text, in order to enter the vaccine article sample, while “children” had to appear in the subject delimiters to restrict the sample to stories on childhood vaccinations. Restricting the sample to articles about GMO foods proved to be trickier. The following had to be found in the body of the text: “GMOs OR GMO OR genetically modified organisms OR genetically modified organism OR genetic engineering AND food OR genetically engineered AND food.” Food also had to appear in the subject delimiters to weed out stories on genetically engineered drugs.
1997 and when Kyoto was a hot topic before Congress between 1999 and 2001. The volume of coverage on climate change quadrupled until 2008 before falling again. GMO coverage is in the middle panel. The salience of the issue is obviously far less than that of climate change, but it did increase substantially after GMOs began to enter the market in full force in the late 1990s. This also coincided with a study that implicated GMOs in the decline of monarch butterfly populations in 1999, controversy about GMO brought on by the Battle in Seattle, and a massive recall of tortillas that were found to have trace amounts of a GM corn that was unapproved by the FDA due to a worry about its potential as an allergen. Coverage declined since that peak, but has picked up recently with the rise of labeling initiatives. Coverage of vaccines was modest until the fraudulent Wakefield study in 1998 and has been on the rise since – a potential sign the media may be fueling anti-vaccine sentiment.

We are interested in two dimensions of media coverage. First, we are interested in the slant of coverage towards the science. We measured it using R-based ReadMe software (Hopkins & King 2010). The software uses machine learning to estimate a proportion of coverage belonging to each category based on imputed manual coding results. The software reduces bias by estimating the proportion of the articles that fall within each category instead of attempting to classify each document individually, as is the case with other machine learning approaches. We had two coders code a random sample of 200 articles for climate change, and 100 articles for GMOs and vaccines as either pro-science, balanced, anti-science. Articles were coded as irrelevant if they only made passing reference to the issue at hand. They were deemed pro-science if they overwhelmingly explicitly or implicitly accepted the scientific consensus on the issue, anti-science if they decidedly did not, and balanced if the journalist gave weight to both sides of the issue. We had between 70 and 75 percent agreement between coders on the first round. Remaining disagreement was resolved by a third coder. Readme then estimates proportions of articles in each category for every year where we have more than 20 articles based on these inputs.

Measuring cues in coverage was a simpler matter. A dictionary was built to capture the mention of experts and parties in stories, and the data was extracted using the dictionary based
content analysis tool *Lexicoder*, developed by Stuart Soroka. Expert cues can comprise of climate scientists in the case of climate change, plant scientists for GMOs, and doctors and immunologists for vaccines. They can also include professors and researchers on all three issues. Party cues can be shown with explicit references to the Democratic and Republican Parties, or to major figures, like presidents, Senate majority and minority leaders, speakers of the House, House minority leaders, senators, and representatives in Congress and at the state level. We have three categories. A catch-all category of party cues includes all references to the above. We also have separate Republican and Democratic categories where there is explicit reference to the parties or their major leaders. The full dictionary can be found in Appendix B. All told, we have measures for the proportions and number of articles that have any party cues, and cues specifically from the Democratic and Republican Party.

**Climate Change**

The media has been criticized for its coverage of climate change from those frustrated with the slow pace of policy change in the United States. According to this view, the press is keeping alive pseudo-scientific attitudes by giving undue attention to climate change deniers. The media is influenced by a strong desire to present balanced coverage, and in doing so elevates the arguments of climate change opponents to an equivalent status of climate scientists. The extent to which this is true is an empirical question. We coded articles as pro-climate, balanced, and anti-climate, and used the input for Readme to construct over time estimates. A trivial amount of climate change denial stories were present, so categories were collapsed to facilitate more precise estimation. For all intents and purposes, the false equivalence and anti-climate change stories serve the same purpose. The results are shown below in Figure 4.
It is clear that false equivalence in the press has gone down over time as scientific uncertainty has increased. The amount of false equivalence in the press is approximately half as much as it was in the early 1990s. It is also worth asking whether we should even really be calling this false equivalence. In the early 1990s scientists were more divided, and uncertainty about the magnitude of the human-effect was substantial. In 1990, the Intergovernmental Panel on Climate Change (IPCC) noted that increases in warming were still at the high end of what would be expected with natural variability. Yet, a full 70 percent of coverage explicitly or implicitly endorsed anthropomorphic climate change and minimized uncertainty. As scientific consensus increased, and uncertainty decreased (now to 95 percent confidence), media coverage followed in a responsible manner. In the course of human coding it became evident that explicit questioning of climate science was relatively rare, even in the presence of Republican cues, who focused more on the costs of climate action. Further, there were next to no explicit references to common arguments from skeptics, such as the importance of solar cycles, and mention of the

medieval warm period. Where balance was found, it was typically made in expression about potential uncertainty in the science – a fair point to be made at the beginning of the series when the science truly wasn’t settled.

These findings both support and contradict Boykoff & Boykoff (2004, 2007). On the one hand, we find that false balance has been decreasing over time in media coverage in spite of the increased politicized nature of the coverage as shown below. On the other hand, we found balance to be relatively uncommon even at the beginning of the series. In a sense, despite conventional wisdom, the coverage of climate change was never dominated by false equivalence or flat out denial, and it has certainly been improving over the recent years. If journalistic norms of balance are important, it surely doesn’t come through in their coverage of climate change, at least at the fairly high profile daily newspapers that we have looked at.

The media has presented arguments about climate change in relative proportion to the actual scientific consensus that exists on the issue. However, they have also increasingly loaded their coverage of climate change with party cues. The left panel shows the balance of expert and party cues in coverage. In the 1980s experts dominated coverage. Ever since, coverage of parties has been on the rise, stabilizing at about 50 percent of total coverage after 2000. This is not the only story, however. The sharp increase in salience after 2008 carried more cues to the public on climate change than ever before. The right side panel breaks cues down by party. They tend to rise and fall in cycles, with the Democrats trending upwards more so than Republicans over time. It’s also worth noting that Democratic dominance in the media post-2008 has been magnified by the rapidly increasing salience of the topic. It certainly seems plausible that cues are causing climate skepticism, but these plots can’t give us a sense of whether there is a statistically significant relationship, nor can it address the possibility of endogeneity – that skepticism is causing the proliferation of cues. A stronger case for causality will be tested in the last section of the paper.
On the surface climate change appears to be a pure example of party cues influencing public opinion. It might also help us understand attitudes towards GMOs. We expect the balance of coverage to be decidedly negative – reflecting widespread public skepticism towards the technology. We also anticipate an absence of party cues in the press, which is a common signal of polarization and high salience. Figure 6 below shows the nature of coverage of this issue by displaying ReadMe’s estimate of pro-GMO, balanced, and anti-GMO articles out of those deemed to be relevant.
As is obvious from the figure above, the media coverage of GMOs is nothing short of terrible. Pro-GMO articles are in the decided minority. They hover around 25 percent of coverage and do not change much over the period of the sample. False equivalence, and outright hostility towards GMOs is comparatively more common. Anti-GMO coverage reached its peak upon first approval of GM products for human consumption in the early 1990s, in the late 1990s and early 2000s during the large increase in salience, and towards the end of the series with the rise of labeling initiatives. It would be a mistake to believe that this coverage is fundamentally shaping public opinion. The salience is low on this issue for most of the period of study. More likely, the media is reflecting the opinion of its news consumers, which, as we highlighted previously, is overwhelmingly negative.
Figure 7 above plots the cues present in GMO coverage. The first panel shows the degree to which party cues and expert cues are present. Expert cues clearly dominate, while party cues hover steady around the 15 percent mark for the whole series. One puzzle is obvious. How can coverage be so bad if experts are cited in over 80 percent of cases? There are three reasons. First, the majority of articles contain some pro-GMO arguments. Second, our expert dictionary is picking up more generic “experts” that don’t necessarily specialize in GMO science, many of whom are quoted in opposition to GMOs. Third, human coding revealed that references to the scientific consensus could be made without explicitly referencing pro-GMO arguments.

The second panel shows the number of explicit party cues in GMO coverage. It is nonexistent for Republicans through most of the series, and only reaches as high as 5 percent for Democrats. The discrepancy between these figures and the general party cues measure is that the latter is better able to pick up on state-level party activity of legislators. Regardless of which measure is used, however, it is clear that GMO coverage is decidedly non-politicized at the
national level (although, as of this writing, the issue has been widely covered in the media as Congress passed legislation preventing states from requiring GMO labelling).

Polarization has occurred at the local level however – the result of closely fought ballot initiatives on mandatory GMO labelling. As noted above, state parties polarized in both California and Colorado, and so did voters over the course of the campaign. Manual coding was done on GMO coverage in the San Jose Mercury News in 2012, and the Denver Post in 2014. The results are shown below in Table 2.

**Table 2. GMO Coverage during Labeling Initiative Campaigns**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>% Pro-GMO</td>
<td>12 (6)</td>
<td>18 (3)</td>
</tr>
<tr>
<td>% False Equivalence</td>
<td>21 (10)</td>
<td>35 (6)</td>
</tr>
<tr>
<td>% Anti-GMO</td>
<td>67 (32)</td>
<td>47 (8)</td>
</tr>
<tr>
<td>% Party Cues</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Number of articles in parentheses

The first thing to note is that the campaign did not generate any meaningful increase in pro-GMO coverage. If anything, coverage became more slanted against GMO science. The media did not take it upon itself to present a more reasonable approximation of the scientific consensus. The debate in the media was essentially covered as being anti-GMO and anti-labelling. Anti-labeling arguments carried in the media were related to the possible effects of the proposition on food prices, farm costs, and “big government” regulation. The fact that the scientific consensus is that GMO foods are safe took a back seat, or, more accurately, were hidden in the trunk, particularly in Colorado.

The more surprising finding is that there were no explicit partisan cues in local GMO coverage. Not a single one. Although the state parties, and sub-state parties (e.g. the Democratic Party of Denver) generally took opposing sides, this was not communicated in the media to potential voters, at least in the local media that we had access to. Whatever the cause of polarization, it was not brought on by the coverage of party cues by media sources. Sufficed to say, we did not expect such a decisive finding.
What, then, explains polarization in the context of labelling campaigns? Nationally there isn’t a large divide between Democratic and Republican attitudes towards GMO labelling. Such division emerged starkly during labelling campaigns, particularly in the case of Colorado. There are two possibilities. First, it is possible that we are missing important channels of communication that exposes party cues to voters. One possible culprit is social media. However, none of the state parties made a single reference to the labelling initiative during the campaign period in California or Colorado. Another are the ads that bombarded the state. Advertisements posted online by the YES campaign are devoid of partisan content. We cannot find the advertisements for the NO campaign, as they appear to have been removed from YouTube and other services, but given the content of their websites, it seems unlikely that the story would be different.

Second, it is possible that ground organization for the campaign targeted endorsements at Republican voters with phone banks or mailings. This cannot be ruled out, but it seems unlikely. The more likely explanation is that NO campaign messages resonated more with Republican voters than Democrats. In this scenario, the average Republican sympathetic to labelling hasn’t been exposed to conservative messages on the issue. The NO campaign primed them to think about “big government” regulation, which drive them into the NO camp. One indication that this may be the case is provided by a poll during the Washington GMO labelling referendum that inquires as to reason why Democrats and Republicans oppose the initiative. These are shown in Table 3 below.

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10 We scrapped the Twitter feeds of Denver Democrats, Colorado Republicans and Democrats, and California Republicans (California Democrats tweets from that time period were unavailable). There were no mentions at all of the initiatives, GMO labelling, or GMO food safety. It was effectively a non-issue for the local parties during the election.
Table 3. Reasons for Opposition, Prop. 522

<table>
<thead>
<tr>
<th>Reason</th>
<th>Democratic</th>
<th>GOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs will Rise</td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td>Against GM</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Will hurt farmers</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>GM food safe</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Uniform labelling</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Anti-government</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>Not needed</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Won't work</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>General positive</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>Not sure</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Don't know</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

Source: Elway Group, Oct. 15-17, 2013

As is clear, Democratic and Republican voters had different reasons for rejecting labeling. Only Democratic voters turned against it because of the science. Republicans were largely convinced by “anti-government” messaging. It is very likely that this was a novel consideration for Republicans at the start of the campaign, as media coverage is almost entirely about the science and efficacy of GM foods. It is clear that party cues likely played no role in the labelling campaigns as we expected. Parties did polarize, and party voters did as well, but communication streams to link party cues to voters were non-existent. Republican voters shifted their opinions due to ideological considerations. That is not to say that party elites can’t move opinion on GMOs with cues. They just chose not to do so here. In all likelihood parties were pre-occupied with House, Senate and state-level races to be concerned with a labelling initiative all observers were sure was going to pass.

Childhood Vaccinations

The case of vaccines had ambiguous predictions for media coverage. On the one hand, vaccination rates are largely high and stable. This leads us to expect consistently favorable coverage over time with potentially little false equivalence. We also might expect low levels of party cues. On the other hand, the aggregate stability in vaccination rates is masking
heterogeneity. The anti-vaxxer movement has led to decreases in vaccination rates, while rates have been rising among the poor. Potentially media coverage is facilitating the former, with increasing false equivalence. It’s also possible parties are getting involved – at least more so than in the past. Figure 8 below plots the estimated false equivalence in vaccine coverage since 1980. Both anti-vaccine and false equivalence were collapsed into a single category for estimation because stories for the former were essentially non-existent. In contrast to the expectations of false equivalence theory, balance is low, and actually on a noticeable decrease. The amount of false equivalence in the press has been cut in half.

Figure 8. False Equivalence in Vaccine Coverage, 1980-2014

Figure 9 below shows that party cues also seem to play no role in the rise of the anti-vaxxer movement. Party presence in vaccine articles has also been decreasing over time despite the large increase in salience in the latter half of the period. Explicit references to parties or their leadership in particular has declined to a near trivial amount at present, despite the growing concern of the anti-vaxxer movement. Politicians are, by-in-large, staying out of it. It deserves some attention why there are so many cues at the beginning of the series, however. First, the 1980s featured concern about compensation for vaccine injuries. This resulted in the National
Childhood Injury Act of 1986, which received bi-partisan support. It is notable at this time of legislative active surround vaccine injury, false balance was at its peak. The early 1990s saw concern about declining vaccination rates in poor neighborhoods because of affordability. This was spurred by widespread measles outbreaks between 1989 and 1991. Democratic lawmakers took the lead in an all-party consensus to provide no-cost vaccines to children who lack health insurance, resulting in the Vaccines for Children Program in 1993. Party cues in vaccine coverage have been declining ever since. In contrast to party cues, experts continue to overwhelmingly dominate vaccine coverage.

**Figure 9. Cues in Vaccine Coverage, 1980-2014**

Cues from parties have to oppose one another in order to generate opinion change. This was clearly not the case for vaccines. The rise of the anti-vaxxer movement unsurprisingly cannot be attributed to any national level patterns in the media. The movement’s dynamics are found at the local level, and the cues they receive from non-mainstream sources. More research needs to be done to understand what exactly is behind the rise of these beliefs. All of this is not to say
that party cues may not one day polarize the public on childhood vaccinations. This will be returned to later in the discussion.

**Do Party Cues Cause Polarization?**

Thus far, we have told a story about the effect party cues may have on changing attitudes towards science-based policy. In doing so, we cast doubt on the popular alternative that journalistic norms of balance have given undue attention to pseudo-scientific coverage, which in turn increases public skepticism towards science. However, we have not been able to present a convincing test for a causal relationship. Unfortunately, opinion data for GMOs and vaccines is scarce to non-existent and any causal test must turn to experimental work to uncover potential relationships. We are, however, in a better position to do such an analysis on the issue of climate change with the mood measure of climate skepticism acting as our dependent variable. We can do a rather simple time series analysis as a preliminary test for a causal relationship between cues and public opinion. Although up until this point we have largely focused on proportions of articles with false equivalence or party cues, ultimately it is likely the total number in the media environment that matters. The ability for citizens, particularly those that are less than highly informed, to be influenced by cues requires that they be easily accessible in the information environment (Zaller 1992). It is likely that proportions of Republican and Democratic cues in the mainstream press only matter insofar as that it suggests a high number of these cues are accessible. Thus we will focus on the total number of stories with false equivalence, and the total number of stories with either Republican or Democratic cues.\(^\text{11}\)

We expect the level of public skepticism to be a function of the number of stories featuring false equivalence (balance) and the total number of Democratic (dem) and Republican (gop) cues in the mainstream press. We also expect the salience of the issue to have some effect on skepticism, but the direction of the effect is ambiguous because media coverage will carry cues from both experts and parties.

\(^{11}\) Models were run using proportions of stories with false equivalence and party cues. They showed substantially similar results, but with poorer model fit. These are presented in Appendix C.
The independent variables used in the analysis are all trend stationary according to Dickey-Fuller unit root tests. However, we cannot reject a unit root process for our climate mood measure. This makes theoretical sense. We expect polarization on climate change to be very persistent. Shocks that polarize the public on the issue are likely to stick, especially as salience increases. The fact that our independent variables are stationary means the data is not co-integrated. The only proper way to estimate the model is to difference the variables. Each variable will be entered as a lag in order to give time for the media coverage to change attitudes. It also helps (partially) deal with potential endogeneity. Thus our basic theoretical model will look like the following:

$$\Delta \text{skepticism}_t = \Delta \text{balance}_{t-1} + \Delta \text{gop}_{t-1} + \Delta \text{dem}_{t-1} + \Delta \text{salience}_{t-1} + \varepsilon$$

The persistence of the mood measure suggests that shocks that increase polarization may “stick.” This suggests we may find an asymmetrical effect, in that increases in cues may lead to more skepticism, while decreases in said cues have no effect at all. In the above model the party cues can be entered as both upward changes and downward changes. The model is presented below in Table 5. Model 1 shows the effect of false equivalence on skepticism. The descriptive statistics presented earlier cast strong doubt on false equivalence affecting climate change skepticism. The trend in equivalence is downward, while skepticism is on the rise. This intuition is supported below. Although significant, balance has the wrong sign, which means it is likely picking up on other factors that are likewise trending downward in our period of analysis. The positive coefficient on salience suggests it increases skepticism. As is shown in Model 2 this is because party cues have not been accounted for. Once this is controlled, the amount of coverage on climate change is negatively related to skepticism. This confirms earlier findings that, when not communicating party cues, coverage of climate science decreases skepticism. An increase in 500 articles (approximately one standard deviation) is expected to decrease skepticism by 2 points – almost half the variable’s range.
Table 4. Climate Skepticism and Total Coverage, First Differences

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th></th>
<th>Model 2</th>
<th></th>
<th>Model 3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(\beta)</td>
<td>SE</td>
<td>(\beta)</td>
<td>SE</td>
<td>(\beta)</td>
<td>SE</td>
</tr>
<tr>
<td>Delta balance</td>
<td>(-0.019^{**})</td>
<td>0.008</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delta dem</td>
<td>(0.010^{***})</td>
<td>0.002</td>
<td></td>
<td>0.010^{***}</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>Delta gop</td>
<td>0.001</td>
<td>0.001</td>
<td>0.002</td>
<td>0.002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delta salience</td>
<td>0.003^{**}</td>
<td>0.001</td>
<td>0.004^{**}</td>
<td>0.001</td>
<td>-0.004^{**}</td>
<td>0.002</td>
</tr>
<tr>
<td>Constant</td>
<td>0.471^{**}</td>
<td>0.189</td>
<td>0.489^{***}</td>
<td>0.152</td>
<td>Constant</td>
<td>0.299</td>
</tr>
</tbody>
</table>

\(N = 22\)

\(R^2 = 0.20\)

\(R^2 = 0.56\)

\(R^2 = 0.59\)

More importantly, the effect of gop are non-existent. Democratic cues appear to be the driver of the results. The coefficient on dem suggests a one standard deviation increase in number of articles with Democratic cues – about 163 – increases skepticism by 1.63 points. This is strongly significant at the 0.01 significance level. Model 3 shows the split between upward and downward changes in cues. Both seem to matter, with upward changes in Democratic cues mattering slightly more. Since skepticism rarely decreases in the series, the practical effect of decreasing numbers of Democratic cues is to push changes in skepticism towards zero.

In estimating the effect of party cues on climate skepticism, one potentially problematic assumption was made: that lagged cues cause skepticism and not the reverse. Politicians may respond to growing climate skepticism rather than leading it. There are two reasons why this is probably not what our results are picking up. First, adding the lag of the independent variable minimizes the risk of it reflecting the influence of the dependent variable. Second, endogeneity is probably more likely in the case of Republican cues. Republican politicians may well respond to increasing skepticism from among their ranks, but it’s not clear why Democrats would be the ones to do so. Nonetheless, endogeneity cannot be ruled out. Perhaps Democratic cues increase with skepticism because they see the need to combat such attitudes, or even more likely, find an issue that can rally their base supporters. What’s more, the simple first differences models from above fail to capture potentially interesting dynamics. Not only can we imagine Democratic and
Republican cue-givers potentially leading and following opinion, but they may also respond to each other. In order to tease out these relationships, a vector autoregression estimator can be used, which treats climate skepticism, Democratic and Republican cues as endogenous to one another. This can be estimated simultaneously with a reduced form model with the following series of equations:

1) $\Delta \text{skepticism}_t = \Delta \text{skepticism}_{t-1} + \Delta \text{skepticism}_{t-2} + \Delta \text{skepticism}_{t-3} + \Delta \text{gop}_{t-1} + \Delta \text{gop}_{t-2} + \Delta \text{gop}_{t-3} + \Delta \text{dem}_{t-1} + \Delta \text{dem}_{t-2} + \Delta \text{dem}_{t-3} + \Delta \text{salience}_{t-1} + \epsilon$

2) $\Delta \text{dem}_t = \Delta \text{skepticism}_{t-1} + \Delta \text{skepticism}_{t-2} + \Delta \text{skepticism}_{t-3} + \Delta \text{gop}_{t-1} + \Delta \text{gop}_{t-2} + \Delta \text{gop}_{t-3} + \Delta \text{dem}_{t-1} + \Delta \text{dem}_{t-2} + \Delta \text{dem}_{t-3} + \Delta \text{salience}_{t-1} + \epsilon$

3) $\Delta \text{gop}_t = \Delta \text{skepticism}_{t-1} + \Delta \text{skepticism}_{t-2} + \Delta \text{skepticism}_{t-3} + \Delta \text{gop}_{t-1} + \Delta \text{gop}_{t-2} + \Delta \text{gop}_{t-3} + \Delta \text{dem}_{t-1} + \Delta \text{dem}_{t-2} + \Delta \text{dem}_{t-3} + \Delta \text{salience}_{t-1} + \epsilon$

Salience is treated as an exogenous variable. The equations will feature three lags of the endogenous variables to soak up serial correlation as determined by a Lagrange Multiplier test. The coefficients on the reduced form model cannot be interpreted as causal effects, but we can determine whether variables granger cause one another. The results are below in Table 5.

Interpreting the coefficients for a VAR model with multiple lags is tricky. Nonetheless, the left panel shows that dem at the first lag is strongly related to skepticism at the 0.05 confidence level. The middle column shows that dem is negatively related to skepticism at the second lag – an effect which is significant at the 0.01 significance level. Democratic cues also appear responsive to Republican cues. An increase in one article with a Republican cue granger causes an increase in one article with a Democratic cue. This is only significant at the 0.1 level.
Table 5. Climate Skepticism and Total Coverage, VAR Model

<table>
<thead>
<tr>
<th></th>
<th>Climate Skepticism</th>
<th>Democratic Cues</th>
<th>Republican Cues</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>SE</td>
<td>β</td>
</tr>
<tr>
<td>Δskepticism t-1</td>
<td>0.020</td>
<td>0.443</td>
<td>-14.890</td>
</tr>
<tr>
<td>Δskepticism t-2</td>
<td>0.197</td>
<td>0.745</td>
<td>-303.30***</td>
</tr>
<tr>
<td>Δskepticism t-3</td>
<td>-0.409</td>
<td>0.531</td>
<td>85.850</td>
</tr>
<tr>
<td>Δdem t-1</td>
<td>0.010***</td>
<td>0.004</td>
<td>-0.898</td>
</tr>
<tr>
<td>Δdem t-2</td>
<td>0.000</td>
<td>0.003</td>
<td>-0.442</td>
</tr>
<tr>
<td>Δdem t-3</td>
<td>-0.003</td>
<td>0.005</td>
<td>1.555**</td>
</tr>
<tr>
<td>Δgop t-1</td>
<td>-0.001</td>
<td>0.004</td>
<td>1.033*</td>
</tr>
<tr>
<td>Δgop t-2</td>
<td>0.000</td>
<td>0.003</td>
<td>-0.164</td>
</tr>
<tr>
<td>Δgop t-3</td>
<td>0.001</td>
<td>0.002</td>
<td>-0.567*</td>
</tr>
<tr>
<td>Δsalience t-1</td>
<td>-0.003*</td>
<td>0.002</td>
<td>0.028</td>
</tr>
<tr>
<td>Constant</td>
<td>0.613*</td>
<td>0.327</td>
<td>91.930*</td>
</tr>
</tbody>
</table>

R² | 0.67 | 0.65 | 0.82 |
N  | 19   | 19   | 19   |

* p<0.1, ** p<0.05, *** p<0.01

Interestingly, Republican cues appear responsive to skepticism at the first lag. An increase in skepticism of one point (about one standard deviation) increases the number of Republican cues in the media by 175, which is approaching two standard deviations. This effect disappears by the second lag. Joint granger causality tests are shown below in Table 6. Democratic cues Granger cause skepticism at the p=0.1 level. Democratic cues are, in turn, granger caused by Republican cues at a level approaching statistical significance, Republican cues are granger caused by Democratic cues, and more importantly skepticism.
The results are strongly robust to the removal of individual years and additional exogenous control variables such as the change in greenhouse gas emissions, change in global surface temperature, and GDP growth. It is notable that none of these controls were related to Democratic and Republican cues, or our climate skepticism measure. The model fit for Democratic (0.65) and Republican (0.82) cues and climate skepticism (0.67) are substantial. Our model predictions, compared to the actual data, are shown below in Figure 10.

*Figure 10. VAR Predictions*
The previous analysis is by no means definitive. In an ideal world we would have a much larger database on climate change attitudes that explicitly address attitudes towards the science. Nonetheless, a relatively simple model with three variables goes a very long way in explaining changes in skepticism over time. The findings strongly suggest that it is Democratic cues in the press that are driving growing skepticism to climate science. This is consistent with literature that suggests out-group cues may matter more than in-group cues for persuasion (Berinsky 2009; Nicholson 2012). It is not, however, consistent with the consensus view as why polarization on climate change has occurred. For many, it is extremist Republicans that are facilitating climate skepticism among their ranks. The evidence suggests, rather, that they are following the growing ranks of skeptics among their voters. This by no means exculpates Republican leaders from responsibility. At the beginning of the 1990s, Republican leaders, in particular President Bush, were partial to the concerns of environmentalists. The following profile of EPA Administrator William Reilly, which outlines his efforts to impose a cap on sulfur dioxide emissions:

On June 5, at the final White House powwow on clean air, Reilly summarized his positions. Then Darman [Director of the OMB] delivered his most damning blast. According to officials present, he argued that Bush should simply write off his pledge to be an environmental President: Bush could never make nature lovers a Republican constituency, Darman said coolly....The President took notes but said little through the 90-minute meeting. Then on Friday, June 9, he flew to Camp David to make his decisions, keeping even his closest advisers guessing. Reilly's best clue to the outcome came late that night, when he had a long talk with Bush's chief of staff, John H. Sununu, who was to receive the final decision papers from the President by helicopter the next day, and Reilly realized Sununu agreed with him. This was a surprise, for Darman and Sununu have formed an alliance as the two most powerful figures atop the President's staff. But on the matter of air pollution, Sununu, a former New Hampshire Governor, who has long favored controlling acid rain, a problem in his home state, broke with the budget director. Sununu ignored, as did the President, the advice to write off the environment on political grounds.

O'Reilly, a past president of the World Wildlife Federation was no puppet of industry interests, and he had unprecedented access to a Republican President for someone in his
position. Today, it would be shocking for a Republican president to not write off the environment on political grounds. This attitude extended to climate change. President Bush signed an agreement with six other world leaders to endorse the IPCC’s construction of a report on climate change mirroring the 1985 Vienna Convention for Protection of the Ozone Layer, much to the dismay of industry. The profile notes:

This raises an intriguing issue: In declaring himself an environmentalist, appointing Reilly and heeding his advice, has Bush shown that he is secretly a Green? Or has he mostly made a political decision to steal the environmental issue from the Democrats? Either way, the environment may reap the benefits. Politics undoubtedly plays a role, but it is also true that many of the decisions Bush and his E.P.A. chief have made have caused industry - a core Republican constituency - to howl.

Bush was by no means an environmentalist, but he, and many of his advisors tried to balance industry concerns with a need to tackle climate change, and at times spurned their industry allies. This is unheard of today. Eventually, industry pressure forced a Republican retreat from support of climate change initiatives, and Democrats were left as the only opinion leaders voicing support tackling climate change. The stage was set for polarization. Had Republican leaders continued to voice support for tackling climate change, elite consensus would have likely produced public consensus.

**Discussion and Further Research**

Public attitudes about scientific issues have serious consequences. Climate change denial is obstructing meaningful actions aimed at combating global warming. Pseudo-scientific beliefs on GMOs harbor fear and misinformation and push towards harmful policies domestically, but also negatively impact the ability of people in the developing world to avoid starvation. Questioning the science of vaccine safety leads to resurgence of long eradicated diseases, and, in most tragic cases, death. Yet, despite these important implications, very little is known about what drives public opinion on these topics. This paper is an attempt to take a preliminary look at the dynamics of how media coverage might play a role in shaping those science-based attitudes.
First, our findings suggest that the popular explanation of false equivalence in the media coverage of scientific issues being the driving force for pseudo-scientific beliefs does not hold ground. The media coverage of climate change, consistently with the findings of Boykoff & Boykoff (2004, 2007), can be characterized as improving, with false equivalence falling substantially in recent years. False equivalence in childhood vaccination coverage has also been improving. At the same time, the coverage of both climate change and vaccines has been quite good to begin with, with the majority of the articles reflecting the arguments made by scientists. That is an important finding on its own: mainstream newspapers tend to cover climate change and vaccinations in a manner that is responsible and rooted in scientific fact. It might well be that those viral Jon Stewart montages of climate change denial on Fox News are not reflected in mainstream media, nor are Jenny McCarthy’s visits to daytime talk shows to fear-monger about childhood vaccinations. Perhaps other media outlets, such as cable news channels or online sources produce dramatically different coverage, but more research needs to be done to uncover these trends empirically. Judging by these findings, the mainstream media seems to reasonably shy away from balance when it is inappropriate.

However, in the case of GMOs, coverage has been irresponsible and riddled with misinformation. A preponderance of false equivalence in media coverage would actually be preferable to what we uncovered. Anti-GMO coverage is as dominant as balanced pieces in the mainstream press, with articles that properly cover the science of GMOs trailing a distant third. It is unlikely that this negative coverage has meaningfully impacted public opinion given the issue’s generally low salience at the national level. Media coverage during high salience periods of ballot initiatives on GMO labelling is, if anything, worse, which doesn’t give us confidence that the press will correct course if GMOs are thrust onto the national agenda. Unfortunately, it is impossible to say with the data we have whether media coverage is fueling the pseudo-scientific consensus on GMOs. It is just as likely the media are reflecting the attitudes of their consumers on the issue. This deserves further exploration.

Secondly, the results shed some new light on the dynamics and sources of climate change skepticism. The findings strongly suggest that, contrary to conventional wisdom, we shouldn’t
focus our blame on Jim Inhofe’s outrageous posturing to draw attention to a supposed climate change hoax, or his Republican and Tea Party colleagues. Instead, they suggest that it is the Democrats that have driven the polarization phenomenon. This surprising finding is nonetheless consistent with literature that suggests out-group cues might matter as much or more than in-group cues in persuasion (Berinsky 2009; Nicholson 2012). It is difficult to say what the implications of this finding are going forward. This issue has been very salient for several years now, and, as a result, most minds have probably been made up in the process. Future research, however, should focus not on trying to figure out what Republicans should say about climate change but what should the Democrats say, and what kinds of appeals work best to convince the Republican electorate about the severity of the problem.

We were not able to demonstrate the same link between party cues and public opinion on GMO labelling in Colorado and Washington. Although parties and voters did polarize to some degree, there were no obvious communications channels in the campaign to link the positions of party elites and their constituents. Nonetheless, it is still possible that party cues can have the future potential, on this issue and childhood vaccinations, to polarize the public. Our findings on climate change polarization provides a cautionary tale on how party cues may affect GMO and vaccine attitudes in the future.

The general public is overwhelmingly aligned with the scientific consensus on vaccination effectiveness and safety, and, as we outlined above, the coverage of the issue has not been politicized. That, however, can easily happen. Early in 2015, during the measles epidemic that spread through 14 states, both Chris Christie and Rand Paul, aspiring Republican presidential candidates, added their voices to the vaccine debates, urging states to refrain from making childhood vaccinations mandatory.¹² Other candidates did not take the bait and the issue has not politicized, but in an era of hyperpartisan politics there seems to be less and less room for any agreement between the parties, and one can easily envision an issue like vaccinations being politicized in the future. A recent passage of SB 277 in California, which mandates childhood vaccinations and eliminates parental exceptions, has sparked a debate in that state. In

¹² http://time.com/3692701/rand-paul-vaccinations-measles-christie/ (link)
committee hearings, Republicans were against it, while Democrats favored it. Our results on climate change should give us pause. If the childhood vaccination issue continues to increase in salience over time due to outbreaks of infectious disease, and people turn to politicians to get involved, the potential for polarization is real. In such a case, the public opinion consensus on vaccinations would be in jeopardy.

A different dynamic might play out with GMO foods. On this issue, the starting position for the vast majority of the public is that of pseudo-science, though it’s the Democrats that are more committed to this position. The issue, however, is not particularly salient. As the analysis of the state initiatives showed, once the issue salience increased, people’s opposition to GMOs seems to have decreased, and the effect was particularly strong among Republicans. This indicates that on an issue like this one, where the starting point is so far out of line with scientific consensus, politicization of the issue might actually bring the public opinion closer to the opinion of scientists. If politicians get involved, and the salience increases, then the 51 point gap between the public and the scientists on GMOs will decrease substantially, primarily by shifting the position of Republicans. Recent passage of HR1599, a bill banning state efforts to ban GMO foods, suggests that the salience of the topic nationally might be increasing. The breakdown of the votes shows that, although somewhat bipartisan, the vast majority of the opposing 150 votes came from Democrats. If the salience of the issue is maintained, then future polling will likely bring the aggregate public opinion closer to the scientific consensus on GMO safety.

This paper will serve as a stepping stone to further research. We have showed tentatively, with observational data, the importance of media effects in increasing climate change skepticism through the dissemination of party cues. We have also showed false equivalence isn’t particularly common, and, if anything, has been on the decline in two of these three issues. However, we have limited ability to test causal claims in regards to their effect on public opinion.

14 https://www.govtrack.us/congress/votes/114-2015/h462 (link)
particularly at the individual level. Future work will ideally consist of two phases. First, we
want to find individual datasets over the span of our study that have questions on climate
change, partisanship, political knowledge, and ideology. We want to look for changes in the
interaction between climate change skepticism on the one hand, and political sophistication on
the other. It is possible, however, that this data simply does not exist.

More promising are two lines of experimental work. The first of these will be an examination
of the impact of false equivalence and party cues on attitudes towards GMOs and childhood
vaccinations. We have constructed mock newspaper articles that will either expose respondents
to science-driven news stories about either topic, a balanced news story featuring cues from
experts and pseudo-science activists, or an equivalent article that features an out-group cue
(based on the respondent’s reported partisanship) adopting either the science or pseudo-science
position. A second line of work will tease out the relative importance of ideological appeals and
partisan cues in pseudo-scientific attitudes, and whether there is potential for cross-ideological
appeals to overcome the effect of party cues on public opinion – in other words, is there
potential for the message to matter more than the source? Our brief exploration of GMO
labelling initiatives suggested this possibility, and it deserves further empirical exploration. We
hope, all told, this research agenda will contribute significantly to our understanding of the
dynamics behind pseudo-scientific beliefs even beyond the issue of climate change.
References


## Appendix A – GMO Labeling Endorsements

<table>
<thead>
<tr>
<th>Endorsements</th>
<th>Supporting GMO labelling</th>
<th>Opposing GMO Labelling</th>
</tr>
</thead>
</table>
| California, Prop 37 | • California Democratic Party  
                      • California Labor Federation  
                      • Organic Consumers Fund  
                      • Green Party of California  
                      • LA City Council  
                      • Berkeley City Council  
                      • San Francisco Bay Guardian  
                      • Nature's Path Foods | • California Republican Party  
                        • Grocery Manufacturers Association  
                        • Monsanto  
                        • LA Times  
                        • Sacramento Bee  
                        • Orange County Register  
                        • California Farm Bureau Federation  
                        • California Chamber of Commerce |
| Colorado, Prop 105 | • Democratic party of Denver  
                       • Alliance for Sustainable Colorado  
                       • Sierra Club - Rocky Mtn Chapter  
                       • Whole Foods Market  
                       • Consumers Union  
                       • Food Democracy Now  
                       • Natural Grocers | • Democratic party of Colorado  
                        • Denver Metro Chamber of Commerce  
                        • Colorado Corn Growers Association  
                        • Colorado Bioscience Association  
                        • Colorado Farm Bureau  
                        • Denver Post  
                        • Aurora Sentinel  
                        • Monsanto |

The list is not definitive, the above is just a sample of the supporters and donors to each side in both states. Sources: Ballotpedia.org; carighttoknow.org; coloradodems.org; noprop37.com
### Appendix B – Cue Dictionaries

<table>
<thead>
<tr>
<th>GOP</th>
<th>Democratic</th>
<th>Politician</th>
<th>Expert</th>
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<tbody>
<tr>
<td>(R-)</td>
<td>(D-)</td>
<td>Congressman</td>
<td>Doctor</td>
</tr>
<tr>
<td>Bill Frist</td>
<td>Al Gore</td>
<td>Congresswoman</td>
<td>doctor</td>
</tr>
<tr>
<td>Bob Dole</td>
<td>Barack Obama</td>
<td>Governor</td>
<td>Doctors</td>
</tr>
<tr>
<td>Bob Michel</td>
<td>Bill Clinton</td>
<td>governor</td>
<td>doctors</td>
</tr>
<tr>
<td>Dan Quayle</td>
<td>Democrat</td>
<td>Lieutenant Governor</td>
<td>Dr</td>
</tr>
<tr>
<td>Dennis Hastert</td>
<td>democrat</td>
<td>lieutenant governor</td>
<td>dr</td>
</tr>
<tr>
<td>Dick Cheney</td>
<td>Democratic</td>
<td>Lt. Governor</td>
<td>Expert</td>
</tr>
<tr>
<td>G.O.P.</td>
<td>democratic</td>
<td>Majority Leader</td>
<td>expert</td>
</tr>
<tr>
<td>George Bush</td>
<td>George Mitchell</td>
<td>Minority Leader</td>
<td>experts</td>
</tr>
<tr>
<td>George H.W. Bush</td>
<td>Gephardt</td>
<td>Rep.</td>
<td>Prof</td>
</tr>
<tr>
<td>George H.W. Bush</td>
<td>Harry Reid</td>
<td>Representative</td>
<td>prof</td>
</tr>
<tr>
<td>George H.W. Bush</td>
<td>Jim Wright</td>
<td>Sen.</td>
<td>Professor</td>
</tr>
<tr>
<td>George W. Bush</td>
<td>Joe Biden</td>
<td>Speaker</td>
<td>professor</td>
</tr>
<tr>
<td>George W. Bush</td>
<td>John Kerry</td>
<td>of the House</td>
<td>Professors</td>
</tr>
<tr>
<td>GOP</td>
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<td>state Representative</td>
<td>professors</td>
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<td>Howard Baker</td>
<td>Nancy Pelosi</td>
<td>state Representative</td>
<td>Researcher</td>
</tr>
<tr>
<td>John Boehner</td>
<td>President Clinton</td>
<td>state senator</td>
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<td>John McCain</td>
<td>President Obama</td>
<td>State Senator</td>
<td>Scientist</td>
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<td>John Rhodes</td>
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<tr>
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<td>Tip O'Neill</td>
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</tr>
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<td>Republican</td>
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<tr>
<td>republican</td>
<td>Tom Foley</td>
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<tr>
<td>Ronald Reagan</td>
<td>Vice President Biden</td>
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<tr>
<td>Speaker Boehner</td>
<td>Vice President Gore</td>
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<tr>
<td>Speaker Gingrich</td>
<td>Walter Mondale</td>
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<td>Speaker Hastert</td>
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<tr>
<td>Trent Lott</td>
<td></td>
<td></td>
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<tr>
<td>Vice President Bush</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Vice President Cheney</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Vice President Quayle</td>
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Appendix C – Alternative Model Specification

Table C1. Climate Skepticism and Coverage Proportions, First Differences

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<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
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<tr>
<td></td>
<td>$\beta$</td>
<td>SE</td>
<td>$\beta$</td>
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<tr>
<td>$\Delta%d_{\text{balance}}_{t-1}$</td>
<td>-0.105**</td>
<td>0.05</td>
<td>$\Delta%d_{\text{dem up}}_{t-1}$</td>
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<tr>
<td>$\Delta%d_{\text{dem}}_{t-1}$</td>
<td>0.050***</td>
<td>0.02</td>
<td>$\Delta%d_{\text{dem down}}_{t-1}$</td>
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<td>$\Delta%d_{\text{gop}}_{t-1}$</td>
<td>-0.002</td>
<td>0.01</td>
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<td>$\Delta%s_{\text{alience}}_{t-1}$</td>
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<td>0.00</td>
<td>$\Delta%s_{\text{alience}}_{t-1}$</td>
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<tr>
<td>Constant</td>
<td>0.443**</td>
<td></td>
<td>0.471**</td>
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<tr>
<td>N</td>
<td>22</td>
<td></td>
<td>22</td>
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<tr>
<td>$R^2$</td>
<td>0.12</td>
<td></td>
<td>0.32</td>
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* p<0.1, ** p<0.05, *** p<0.01

The models from above were also estimated using proportions of articles with false equivalence or Democratic and Republican cues. Table C1 above shows the equivalent models from Table 5. The coefficient on $%_{\text{gop}}$ suggests the proportion of Republican cues has no effect on skepticism, and in fact it is negatively signed. However, it appears cues from the Democratic Party have a strongly significant effect on skepticism (p<0.01). The coefficient on $%_{\text{dem}}$ suggests that an increase in one percentage point in Democratic cues increases skepticism by 0.05. Another way to think of this effect is that an increase in Democratic cues on the order of 33 percent, which occurred when Kyoto was being negotiated, would increase skepticism in the public by 1.7 percent – the equivalent of moving from the 25th percentile to the 90th on the differenced skepticism variable. Changes in salience appear to have no significant effect on public skepticism in either model. Model 3 separates upward and downward changes in Democratic cues. As expected upward changes in the proportion of Democratic cues almost entirely drive the result, being strongly significant at the p=0.01 threshold, while downward changes fall short of conventional levels of significance. The final model has an $R^2$ of 0.34, which
shows a relatively poor model fit in comparison with Table 5 (0.59), which suggests it is important to take into account the total number of cues in the media environment.

**Table C2. Climate Skepticism and Proportion of Coverage, VAR Model**

<table>
<thead>
<tr>
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<th>Democratic Cues</th>
<th>Republican Cues</th>
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</thead>
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<tr>
<td></td>
<td>$\beta$</td>
<td>SE</td>
<td>$\beta$</td>
</tr>
<tr>
<td>$\Delta$skepticism $t-1$</td>
<td>0.107</td>
<td>0.276</td>
<td>5.731*</td>
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<tr>
<td>$\Delta$%dem $t-1$</td>
<td>0.0475**</td>
<td>0.020</td>
<td>-0.342</td>
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<tr>
<td>$\Delta$%gop $t-1$</td>
<td>-0.005</td>
<td>0.018</td>
<td>-0.080</td>
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<tr>
<td>$\Delta$salience $t-1$</td>
<td>-0.000</td>
<td>0.001</td>
<td>-0.004</td>
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<tr>
<td>Constant</td>
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<td>0.235</td>
<td>3.005</td>
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<tr>
<td>$R^2$</td>
<td>0.31</td>
<td>0.18</td>
<td>0.24</td>
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<tr>
<td>N</td>
<td>21</td>
<td>21</td>
<td>21</td>
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* p<0.1, ** p<0.05, *** p<0.01

Table C2 above displays the results for the vector autoregression with proportions of false equivalence and party cues in coverage as independent variables. Taking account of potential endogeneity barely changes the coefficient on %dem from above. %dem appears to granger cause skepticism. The middle column suggests skepticism also impacts Democratic cues, but with a negative relationship. That is, Democratic cues decline in the press when climate skepticism rises. This is a modest relationship, however. It is only significant at the p=0.1 threshold. The coefficient suggests a one point increase in skepticism decreases the percentage of Democratic cues in coverage by 5.7 percentage points. The third column suggests that rather than Republican elites causing skepticism, growing skepticism granger causes increasing proportions of Republican cues in the media. A one point increase in skepticism granger causes a 6.3 percentage point increase in %gop. The model fit in all three cases, however, remains poor compared to the models that take into account the total number of cues in the environment.