Does the Media Respond to Political Messaging? Evidence from Local Newspaper Coverage of Climate Change[*]

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Abstract

Despite the scientific consensus around climate change, skepticism among the general public remains an obstacle for policy. Because the media is the primary channel of information dissemination, media coverage of climate change plays a crucial role in public perceptions. We identify an important factor shaping this coverage – influence of political leaders. Using a regression discontinuity analysis around narrow election victories, we find that a Republican governor causes local newspapers in their state to use a more skeptical tone when discussing climate change.

Keywords: climate change; belief formation; media bias; elections; public opinion

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1 Introduction

Despite the scientific consensus that anthropogenic climate change is real, many continue to believe that climate change is not real or not a concern (Funk and Kennedy, 2016). Given that public opinion plays an important role in determining the feasibility of climate mitigation policies, considerable attention has been paid in the economics, political science, sociology, psychology, and communications literature to analyzing how people form and act upon their beliefs about climate change. Two of the major factors that have been identified are politics and media.

It is well documented that in the US politically liberal voters and supporters of the Democratic party are more concerned about climate change than politically conservative voters and supporters of the Republican party (Egan and Mullin, 2017). Shao (2017) finds that identifying as a Republican, a political conservative, and a supporter of the Tea Party political movement are the among the strongest predictors of skepticism of the scientific consensus about the existence, causes of, and impacts of climate change even after controlling for other factors that influence opinion such demographics, religiosity, and local weather patterns. This pattern is replicated around the world – Hornsey et al. (2016) argues that this phenomenon is not simply a function of the peculiarities of American politics and that general inferences can be drawn from the American context.

The political science literature attributes much of this polarization to politicians and political elites, as polarization among politicians precedes polarization among the general population. Bisgaard and Slothuus (2018) demonstrate that political partisans respond strongly to cues from the political elites. The timing of environmental polarization suggests that climate change and other environmental issues do not appear to be an exception to this phenomenon. Significant differences between Democratic and Republican legislators' voting behavior on environmental issues began emerging in the early 1970's (Shipan and Lowry, 2001) but this was this was not reflected in public opinion until the 1990's (McCright et al., 2014). Guber (2013) shows that this polarization is larger among those who are more

politically active and are more aware of cues from politicians, providing further evidence of a causal relationship between politicians and partisan beliefs about climate change.

If political elites are able to shape popular opinions about climate change, then politicians who achieve more prominence should have a larger impact on opinion. Meyer (2019) tests this proposition by showing that political leaders affect the climate beliefs of their constituents – the election of a Republican governor significantly decreases the probability of a Republican constituent believing in climate change relative to the election of a Democratic governor. This effect is particularly pronounced for constituents who share a party identification with the governor.

This paper attempts to identify the mechanism by which politicians affect public opinion about climate change. If it is purely a function of political tribalism, we would expect that people would seek out signals from political leaders they support and ignore signals from political leaders they do not. Democratic or liberal voters would be affected by the statements of the most prominent Democratic politicians, independent of the electoral success of those politicians. Another possibility is that politicians who care more about the environment pass more environmental legislation, and thus push environmental issues into the front of the minds of their constituents. Finally, it is possible that successful politicians are able to affect public opinion through their influence over media coverage. Given that the primary source about climate change for most people is the media (Leiserowitz et al., 2010) and that it is well documented that media coverage can influence public opinion (DellaVigna and Kaplan, 2007; Gerber et al., 2009; Chiang and Knight, 2011), influence over media coverage should lead to an influence over public opinion.

It is this last hypothesis – that elected officials have an influence over media coverage of climate change – that this paper investigates. We use a regression discontinuity design using close gubernatorial elections where the outcome of interest is the tone of coverage in local newspapers. This empirical strategy addresses the obvious endogeneity problems that would arise from simply comparing media coverage in Democratic and Republican states – states

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with a more Democratic electorate are more likely to elect a Democratic governor and have media coverage that appeals to more liberal or Democratic sensibilities about climate change. Instead we analyze whether narrow Republican gubernatorial victories lead to significantly different coverage than narrow Democratic victories. The underlying political preferences of the population are very similar between these narrow victories, but the electoral outcome is very different. Therefore this represents an ideal quasi-experiment to study the effect of governors on media coverage.

Our measure of tone of coverage about climate change is based on Beattie (2020) and Beattie (2024), which develop a method to measure tone based on frequency of phrase usage and comparisons to known pro-environmental and skeptical tests. Articles which more closely match the language of known pro-environmental texts are classified as pro-environmental, while articles that more closely match the tone of known skeptical texts are classified as skeptical. We apply this textual analysis algorithm to a searchable database (Newslibrary), containing archives from thousands of US newspapers over the period 2000-2019 to assemble a large novel panel data set on coverage of climate change. We then match newspaper articles to zip codes using circulation data to create a geographical measure of each article's influence.

We find that the results of gubernatorial elections matter. Our baseline results show that the close election of a Republican governor increases the probability an article about climate change is skeptical by 6 percentage points, relative to the counterfactual of a close Democratic victory. The main relationship appears to be driven by both a reduction in the pro-environmental content of coverage and an increase in the skeptical content.

In addition to these baseline results, we also find evidence of asymmetric treatment effects based on the partisan slant of newspapers (as measured by 1996 Presidential endorsements). Republican leaning papers become significantly more skeptical in their climate change coverage in response to a close Republican gubernatorial victory, relative to the counterfactual of a close Democratic gubernatorial victory. In contrast, there is little, if any, treatment effect

for Democratic leaning papers.

Finally, we propose several potential mechanisms that could explain our main results and present evidence for or against them. These mechanisms include: stenography – by quoting a governor's statements or interviews the language that media use reflects the governor's position; 'bully pulpit' – governors are able to use their platform to advocate for their position, including through the media; legislation – governors' priorities are reflected in state legislation and thus in media coverage of this legislation; and access journalism – journalists provide favorable coverage of governors and their priorities in exchange for access. Of these possible mechanisms, we are able to reject the stenography mechanism as a major factor and find evidence consistent with bully pulpit but not with legislation or access journalism.

The relationship between electoral outcomes and media coverage of climate change has significant implications because, as prior research shows, media coverage affects behavior. Markets and political institutions can only work efficiently if individuals' beliefs are accurate.[1] Climate change will impose substantial economic costs on society if we continue our current trajectory of greenhouse gas emissions (Auffhammer, 2018) but a public that is skeptical of climate change reduces the chances of passing climate change policy to mitigate damages. Our results show that aside from affecting climate outcomes directly through mitigation policies, political leaders can also influence public opinion through media coverage and thus effect the political viability of future policy solutions.

2   Background and related literature

This paper makes contributions in multiple areas that have received considerable attention in the literature: the influence of politicians on environmental beliefs; the influence of politicians on media coverage; and the determinants of media coverage of climate change.

As we documented in the introduction, there is a considerable amount of evidence that politicians play a role in forming the beliefs of their constituents. However, this literature is

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[1]For a recent example of inaccurate beliefs preventing climate policy, see Douenne and Fabre (2022).

fairly silent on the mechanism through which this influence exists – it is just assumed that partisans respond to signals sent by political elites. This paper provides evidence that media coverage is one of the primary channels through which these signals are disseminated.

Previous theoretical literature has proposed mechanisms for politicians' influence over media coverage. Media outlets may collude with politicians to present favorable coverage, because of bribes (Besley and Prat, 2006), editorial policies imposed by governments (Gehlbach and Sonin, 2014), or in order to secure access in future periods (Ozerturk, 2022). Alternatively, politicians may influence coverage simply by using the "bully pulpit" to direct media attention towards issues or framing more favorable to them (Puglisi, 2004; Miles, 2014).

The influence of politicians over media coverage has also been documented empirically. Di Tella and Franceschelli (2011) and Szeidl and Szucs (2021) test versions of this type of model in the Argentinian and Hungarian contexts, respectively, by demonstrating that governments and media exchange favorable coverage for advertising. McMillan and Zoido (2004) and Qin et al. (2018) provide evidence of more direct media capture in more authoritarian states in Peru and China, respectively. Durante and Knight (2012) find that the tone of coverage of Italian public broadcasters is affected by the party which is in power and thus controls the public broadcasters.

Even absent any causal relationship between politicians and media, coverage may be affected by which politicians are in power. Media coverage may be influenced by the audience preferences (Gentzkow and Shapiro, 2010), advertisers (Beattie et al., 2021), or journalists (Baron, 2006). These interests may have different influences on coverage depending on who is in power. For example, Larcinese et al. (2011) show that the amount of coverage negative economic news receives depends on whether the party a media outlet generally supports is in power and Puglisi and Snyder (2011) show a similar result for political scandals.

The context studied in this paper is distinct from much of the previous literature about the relationship between politicians and the media. We study the impact of politicians on

media coverage of broader public policy issues, which can be seen as an economically important downstream consequence of the relationships between politicians and media analyzed in the existing literature.

Media bias caused by government capture or other factors can still affect readers or viewers. Theoretical models demonstrate that consumers may consume media that shares their own biases, either because of a taste for having their beliefs confirmed (Mullainathan and Shleifer, 2005) or because they perceive coverage that aligns with their prior beliefs to be more accurate (Gentzkow and Shapiro, 2006). Chopra et al. (2024) finds experimental evidence of both of these factors. Simonov and Rao (2022) uses the Russian context to show that consumers may consume media even if they are aware of its biases – although consumers attach negative value to propagandistic coverage, persistence in their consumption patterns mean that they continue to consume captured outlets.

It is also worth noting that previous papers search for a relationship between politicians and media coverage and find null effects. In particular, two papers study the same context as this paper – gubernatorial elections in the US and local newspapers. Gentzkow and Shapiro (2010), who identify a relationship between consumer preferences and the political slant of 2005 newspaper coverage, do not find a significant relationship between gubernatorial party and slant after controlling for consumer ideology. Gentzkow et al. (2015) analyze the period from 1869-1928, when newspapers were more explicitly partisan, and find that gubernatorial party has no effect on the relative circulation of partisan newspapers or their tone of coverage, as measured by the number of mentions of political candidates.

Finally, our paper contributes to the literature that studies media coverage of climate change. This coverage has often been criticized for providing too much space to climate change skepticism (Boykoff and Boykoff, 2004, 2007; Boykoff, 2011). Shapiro (2016) presents a model where journalistic norms for balance create incentives for media to cover all sides of an issue to increase credibility. In the case of issues like climate change, where skeptical scientists are a small minority (Anderegg et al., 2010), providing attention to climate

skepticism as an alternative viewpoint is likely to elevate it beyond its role in the scientific literature. Further, if media coverage provides a considerable amount of attention to climate skepticism, there is scope for this amount to be influenced by factors like advertising from carbon emitting industries (Beattie, 2020) or, in the case of this paper, elected politicians.

3   Data

For our empirical analysis, we combine data on gubernatorial election results with data on local newspaper coverage during the period 2000 to 2019.

The election data is taken from Leip's Atlas of US Presidential Elections (Leip, 2024). We collect the vote share for the two major parties in both regular and special elections from all 50 states between 2000 and 2019. Regular gubernatorial elections are held every 4 years (except in the case of Vermont and New Hampshire which are every two years), but the years are staggered across states. 11 states hold their elections simultaneously with presidential elections (every 4 years including 2000, 2004, etc.), 2 states hold their elections 1 year after presidential elections, 36 states hold their elections 2 years after presidential elections,[2] and 3 states hold their elections 3 years after presidential elections. In every state except Louisiana, gubernatorial elections are held on the first Tuesday of November.[3] If a governor does not complete their full term, a state constitution can specify someone from the line of succession to complete their term or call for a special election. A special election can also occur based on an attempt to recall a governor. During the time period of our dataset, there were 3 special elections (Utah in 2010, West Virginia in 2011, and Oregon in 2016) and 2 recall elections (California in 2003 and Wisconsin in 2012).

We use the news aggregator Newslibrary as the source for our newspaper coverage data. Newslibrary is a searchable archive of almost 1000 local newspapers in the US that allows us to extract the bibliographic information from all articles that satisfy a given search criteria.

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[2]New Hampshire and Vermont have gubernatorial elections simultaneously with both presidential elections and two years afterward

[3]Louisiana holds its election in late October and holds a runoff (if necessary) in late November.

Simply counting the number of articles that mention climate change would miss an important component of coverage. Each of these articles could be written in a pro-environmental tone that draws attention and concern towards climate change, but they could also be written in a tone that is skeptical of climate change and discourages or downplays concern or action. Grouping both of these types of articles together is a source of measurement error, particularly since skeptical articles can reasonably be construed as serving the opposite purpose as pro-environmental articles.

To address this issue, we construct a measure of the tone of coverage about climate change, based on a measure developed in Beattie (2020) and Beattie (2024) which in turn are based on Gentzkow and Shapiro (2010). This measure uses a bag-of-words model of text, which assumes authors discussing a similar topic from a similar perspective will use many of the same words and phrases. Specifically, in a bag-of-words model authors draw words or phrases from a distribution specific to the topic and perspective the author is using. Texts with unknown perspective can be classified by comparing their language use to the language use in different texts with known perspective. If the text with unknown perspective shares more in common with one known text over others, it is more likely to be drawn from the same 'bag' with that text and thus share a perspective.

To implement this model in our context, we begin by finding two-word phrases that are particularly indicative of the pro-environmental or skeptical perspectives about climate change by comparing texts that are known to be pro-environmental or skeptical.[4]

The pro-environmental texts are the 2007 Intergovernmental Panel on Climate Change (IPCC) report (Pachauri and Reisinger, 2007; Solomon et al., 2007; Parry et al., 2007; Metz et al., 2007) and James Hansen's book *Storms of My Grandchildren: The Truth About the Coming Climate Catastrophe and Our Last Chance to Save Humanity* (Hansen, 2010). The IPCC report is a United Nations panel that attempts to assemble reports on the state of

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[4]Choosing the length of phrases involves a trade-off. Longer phrases are more meaningful, but are rarer and thus create a more sparse dataset. Previous work using these techniques tends to find that a phrase length of two or three words is optimal.

consensus climate science. We use the 2007 report since it is closest to the midpoint of our analysis period. Hansen's book represents a particularly concerned perspective on climate change aimed at a general audience.

The skeptical texts are the 2009 Nongovernmental International Panel on Climate Change (NIPCC) report (Singer and Idso, 2009) and Roy Spencer's book *The Great Global Warming Blunder: How Mother Nature Fooled the World's Top Scientists* (Spencer, 2012). The NIPCC reports are designed to be a skeptical response to the IPCC reports and Spencer's book is written to present the skeptical perspective to a general audience.

In order to focus on meaningful words and phrases, the texts are stemmed by removing morphemes that indicate plural nouns or verb tenses, so that a set of words such as 'change', 'changes', 'changing', and 'changed' are treated as different instances of a single word. In addition we remove stop-words, which are short words such as articles and prepositions.

Next, the texts are split into a pair of scientific texts (the IPCC and NIPCC reports) and a pair of books for a general audience (the Hansen and Spencer books). For each two word phrase, we calculate a Pearson's chi-squared statistic for each pair of texts using the following formula.

$$\chi_p^2 = \frac{(f_{pe} + f_{ps} + f_{\sim pe} + f_{\sim ps}) * (f_{pe} f_{\sim ps} - f_{ps} f_{\sim pe})^2}{(f_{pe} + f_{ps}) * (f_{pe} + f_{\sim pe}) * (f_{ps} + f_{\sim ps}) * (f_{\sim pe} + f_{\sim ps})}$$

where f_{pe} and f_{ps} are the number of occurrences of phrase p in the pro-environmental text and the skeptical text respectively, and $f_{\sim pe}$ and $f_{\sim ps}$ are the number of concurrences of all other phrases in each text. This statistic measures whether the frequency of the phrase is significantly different in the two texts.

Phrases that occur with frequencies significantly different at the 95% level in both pairs of texts are classified as indicative of either the pro-environmental or skeptical perspective. Focusing on these indicative phrases has multiple advantages. First, it ignores phrases that are used with a similarly high frequency in all texts. These phrases are likely to be either

everyday common phrases or phrases that are used to discuss climate change in any context and thus would have limited value for classifying the tone of texts. Second, because the Newslibrary is a searchable database and we do not have the full text of the newspaper articles, we need to identify a reasonably sized set of search terms. Finally, by selecting only phrases that are significantly different in both pairs of texts we reduce noise, ensure we are identifying phrases that are indicative in texts with different levels of scientific rigor, and ensure we are not identifying phrases that are simply a function of a particular authorial or editorial style.

Table 1 contains a list of the phrases with the highest Pearson's chi-squared values for each perspective. The pro-environmental phrases consist of phrases used to discuss the causes of (fossil fuel, carbon emission, air pollution, carbon cycle), consequences of (sea level, level rise, climate sensitivity), and solutions to (emission reduction, energy efficiency, renewable energy, Kyoto protocol) climate change. The skeptical phrases are used in common arguments against climate change, such as historical temperature fluctuations (little ice (age), medieval warm, warm period, tree ring), uncertainty in modeling, (computer model, negative feedback), and the hockey stick controversy (hockey stick).[5]

The next stage of constructing measures of tone of coverage is to search the Newslibrary database for newspaper articles written between 2000 and 2019 that contain the phrase "climate change" along with one or more of the indicative phrases. This database contains the bibliographic information for all articles that satisfy given search parameters for a set of approximately 1000 local newspapers. The text classification model assumes that the more pro-environmental phrases that an article contains, the more likely it is to be written from a pro-environmental perspective, and the more skeptical phrases an article contains, the more likely it is to be written from a skeptical perspective. Table 2 illustrates what type of articles are selected by showing the articles that have the biggest difference between

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[5]The hockey stick controversy refers to a graph produced in Mann et al. (1998, 1999) and reproduced in many places that shows global temperatures following a hockey stick shape – increasing rapidly after a long period of stability. The assumptions used to construct historical temperature patterns were a subject of considerable controversy.

Table 1: Indicative phrases

Most pro-environmental phrases	Most skeptical phrases
develop country	dioxide concentration
sea level	twentieth century
level rise	little ice
emission reduction	warm period
fossil fuel	dioxide content
energy efficiency	medieval warm
climate sensitivity	tree ring
renewable energy	extra carbon
carbon cycle	computer model
kyoto protocol	during twentieth
carbon emission	hockey stick
air pollution	negative feedback

skeptical and pro-environmental phrases in each year of the dataset. Most of the articles that use many more pro-environmental phrases express a strong level of concern about climate change and discuss policy solutions. On the other hand, most of the articles that use many more skeptical phrases present climate science as a more controversial topic, often coming down on the skeptical side.

Figures 1, 2, and 3 illustrate how language use in newspaper articles about climate change varies geographically and over time. Figure 1 shows the monthly percentage of indicative phrases used in all newspapers in the sample that are skeptical. There is some indication that skepticism about climate change is diminishing over time as the percentage of skeptical phrases decreases at a rate of about 0.3% per year. Figure 2 shows a county level measure of the climate coverage that households receive by weighting the average annual number of articles mentioning climate change and one of the indicative phrases that a newspaper prints by the proportion of households in each county subscribed to that newspaper. Households in and around urban areas receive the most climate coverage, as they are most likely to be subscribed to major urban or regional newspapers which have more pages and thus more articles about many topics, including climate change. Figure 3 shows the distribution of the percentage of skeptical articles by county, using the same circulation weighted measure of

Table 2: Articles with the most pro-environmental and skeptical phrases

Year	Most pro-environmental	Most skeptical
2000	Tax Energy Production at Beginning of the Pipeline to Fix a Market Fault	If Global Warming is, Indeed, Upon Us, Why is the Arctic Ice Pack so Huge?
2001	Bush Does About Face, Global Warming Finds Home in Energy Policy	Bush is Right on Global Warming
2002	Global-Warming Deadlock Spurs States to Act Locally	The Reality of Global Warming
2003	U.S. Energy Policy Must Include Nuclear Power	1,000 Years Ago, It was Warmer than it is Today
2004	The Real Clear and Present Danger: While We're off Fighting Terror, the Planet's Crumbling	Warming Case Uses Overheated Evidence
2005	A New Approach to CO_2 Planet-Heating Gas Could be Stored, for a Price	Look Ahead To the End of this Century and Climate Change Could Dramatically Alter the State's Signature Rockies
2006	Budgets Falling in Race to Fight Global Warming	Hot Debate Over Hurricanes, Global Warming Gaining Credence as Factor in Storms
2007	A War on Warming, Document Calls for Politically Risky Steps	Cooling on Global Warming
2008	Trapping Carbon Dioxide Could Fight Climate Change	Recent Research Points to Cooling
2009	Should We Bury Carbon Dioxide? Or Bury the Idea?	Matalin Claims the Earth is Cooling
2010	Environmentalists Question Coal's Place in Obama Policy	The Global Warming/Carbon Dioxide Controversy
2011	Reactions to Earthquake in Japan	The Phony 'Consensus' on Climate Change
2012	World Must Slash Carbon Dioxide Emissions	Fraud Question Looms in Global Warming Research
2013	U.S. Must Capitalize on Coal, Nuclear Knowledge for Climate Change	NIPCC Report Disputes the Conventional Wisdom About Climate Change
2014	U.S., China Announce Pact to Cut Greenhouse Gas	Figure is Flawed
2015	2015: The Year of Climate Action	Correlation, Causation and the Climate Summit 'Farce'
2016	Should the U.S. Rely More on Nuclear Power?	A Warming Lull
2017	Trump's Efforts to Roll Back Climate Progress Will Fail	An Alternative Perspective on Climate Change
2018	The Challenge of Our Time	How to Talk Climate Change With Skeptical Relatives During the Holidays
2019	Can Colorado Help in the Climate Crisis?	Many Appalachian Residents Don't Believe Climate Change is Real

The most environmental articles are those with the highest difference between pro-environmental and skeptical phrases. The most skeptical articles are those with the most negative difference.

coverage. This variable does not display as clear of a pattern.

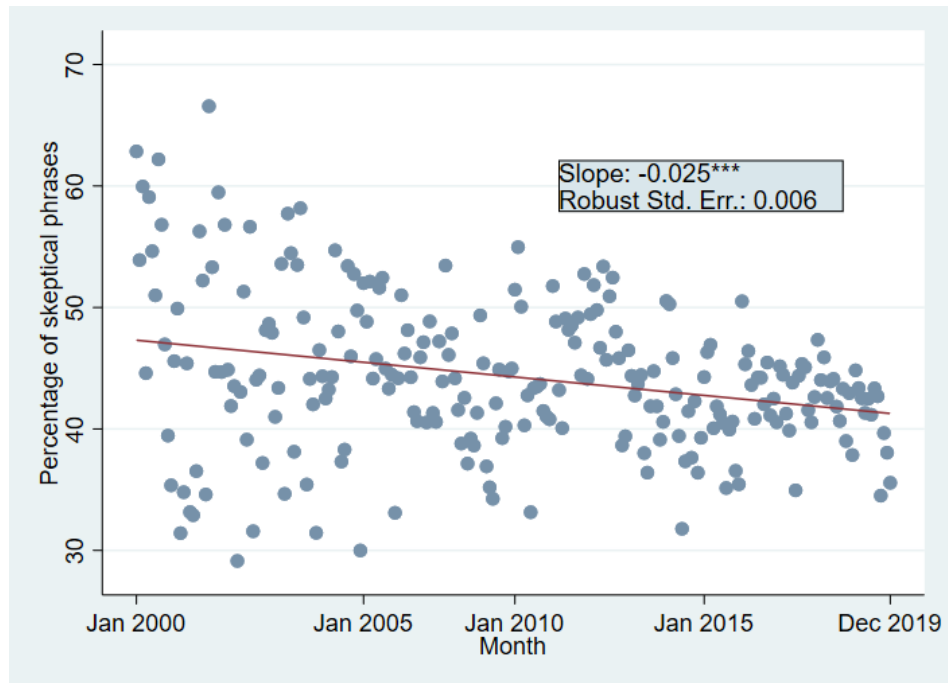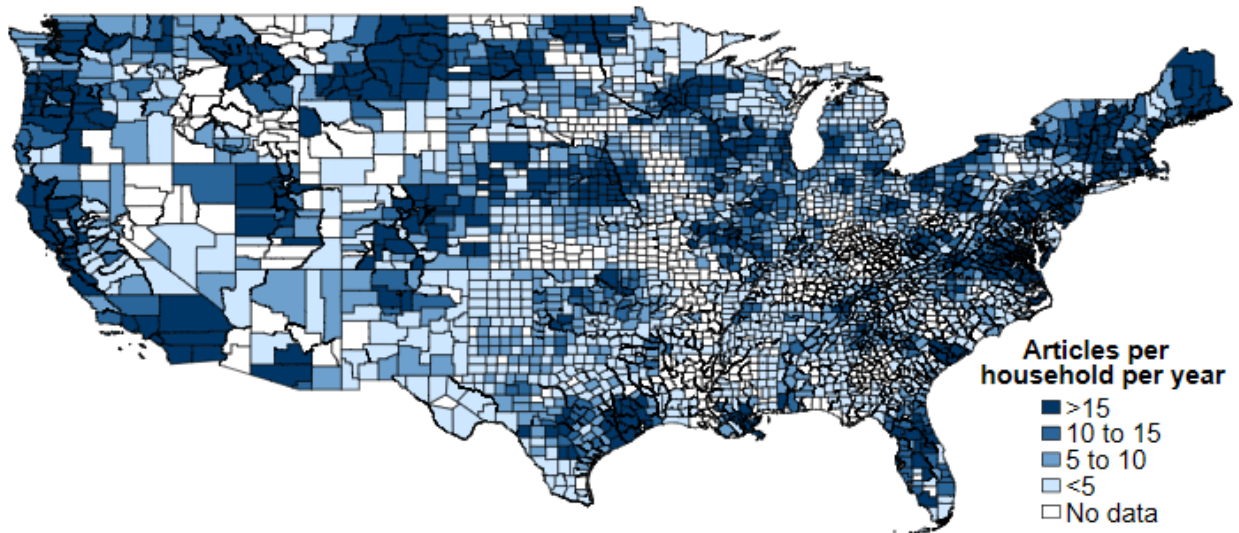Figure 1: Use of climate skeptical language over time

Figure 2: Articles mentioning climate change per household per year

We use the distinction between skeptical and environmental phrases to create two primary measures of tone for our dependent variable. $Skept_{Extensive}$ and $Skept_{Intensive}$. Both these measures are evaluated at the article level. $Skept_{Extensive}$ is a dichotomous variable

Figure 3: Share of indicative phrases that are skeptical
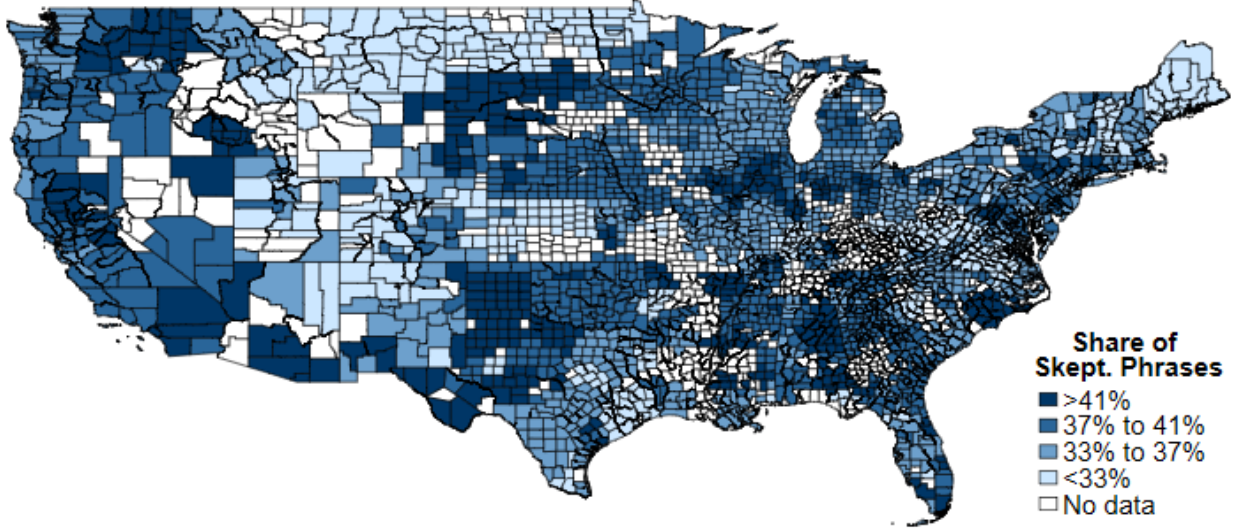
that measures whether or not an article is more likely to use a skeptical tone than a pro-environmental tone. $Skept_{Extensive}$ takes a value of 1 if there are more skeptical phrases than pro-environmental phrases in an article. $Skept_{Intensive}$ is a continuous variable that measures the intensive margin of skepticism. $Skept_{Intensive}$ measures the share of all indicative phrases that are skeptical, so a value of 0 indicates an article that contains 1 or more pro-environmental phrases and no skeptical phrases, a value of 0.5 indicates that an article uses an equal number of pro-environmental and skeptical phrases, and a value of 1 indicates an article that contains 1 or more skeptical phrases and no pro-environmental phrases.

Since gubernatorial election data is at the state level, it is useful to aggregate this article level data to the state level measure of coverage that takes into account the relative size and influence of different newspapers. To do this, we use 2009 zip code level newspaper circulation data purchased from the Alliance for Audited Media. We collapse the article-level dependent variables to the state-year level, weighting each article by the circulation of the newspaper in which it appeared. Therefore, at the state-year level, $Skept_{Extensive}$ captures the percentage of all circulation-weighted articles that have a skeptical tone and $Skept_{Intensive}$ measures the overall intensity of circulation-weighted skeptical tone.

Table 3 describes our two key dependent variables and the percentage of state-year ob-

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servations in which a Republican governor is in power. Panel A includes all observations with a Republican or Democratic governor and Panel B includes only observations from close elections.[6] Focusing on the close election sample, slightly more than one-third of state-years experience an overall skeptical tone. Additionally, the average overall intensity of climate skepticism is 0.43. This indicates that, on average, newspaper articles in our close election sample use slightly more pro-environmental phrases than skeptical phrases. Republicans win approximately 50 percent of close gubernatorial elections in our sample.

Table 3: Summary statistics for primary analysis samples

	Mean	SD	Min	Max
Panel A. All Elections				
Extensive skepticism	0.363	0.110	0.0004	0.996
Intensive skepticism	0.436	0.097	0.0004	0.996
Republican governor	0.562	0.496	0	1
Observations		982		
Panel B. Only Close Elections				
Extensive skepticism	0.356	0.107	0.0004	0.995
Intensive skepticism	0.430	0.094	0.0004	0.995
Republican governor	0.496	0.501	0	1
Observations		448		

Notes: Summary statistics are at the state-year level. Panel A includes all observations with a Republican or Democratic governor and Panel B includes only observations from close elections (optimal bandwidth for $Skept_{Extensive}$ of 10.353). All state-year level observations on $Skept_{Extensive}$ and $Skept_{Intensive}$ are the circulation-weighted averages of article-level observations.

4   Empirical strategy

In this section, we describe our empirical framework to estimate the impact of the governor's political party on the tone of newspaper coverage of climate change. Unobserved state level characteristics likely correlate with gubernatorial partisan affiliation and our outcomes of interest. For example, states with more conservative electorates are more likely to elect Republican governors and newspapers in these states may be more likely to publish skeptical

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[6]We define close election using the optimal bandwidth for our baseline specification for the outcome of $Skept_{Extensive}$. This corresponds to column 1 of Table 7.

articles about climate change as a result of having more conservative readers, journalists, or owners. A naïve OLS regression of climate change tone on the governor's partisan affiliation would therefore likely suffer from omitted variables bias. Consequently, we use a regression discontinuity (RD) design to identify the effects of the governor's partisan affiliation on the tone of climate change coverage. The close election RD design originates with Lee (2001) and Lee (2008) and is now widely applied in the economics and political science literatures.[7]

In our RD design, gubernatorial election vote margin is the running variable that determines treatment status. We define the Republican vote margin in state s in year t as M_{st}, so that the RD threshold occurs at $M_{st} = 0$, a positive value indicates a Republican candidate won the election, and a negative value indicates a Democratic candidate won the election. Our baseline RD estimator with linear controls is:[8] :

$$Y_{st} = \alpha + \beta * R_{st} + \gamma * M_{st} + \delta * R_{st} * M_{st} + \mu_t + \pi_s + \epsilon_{st} \tag{1}$$

where Y_{st} is the outcome of interest for state s during year t, R_{st} is an indicator for a Republican winning the gubernatorial election, M_{st} is the vote margin in favor of the Republican candidate, μ_t are year fixed effects, and π_s are state fixed effects. In the baseline specification, we use a uniform kernel, which equally weights all observations within the bandwidth. To demonstrate the stability of the results, we also present specifications that 1) use a triangular kernel to weight more heavily the observations near the RD threshold and 2) use local quadratic, rather than local linear controls.

The main parameter of interest is β, which is the RD treatment effect. The RD treatment effect is the difference between the expected outcome given a Republican gubernatorial win (treated group) and the expected outcome given a Democratic gubernatorial win (control

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[7]Examples of studies applying the RD design to close gubernatorial elections include Beland (2015), Beland and Boucher (2015), Beland and Oloomi (2017), Beland and Unel (2018), Hill and Jones (2017), Keita and Mandon (2018), Leigh (2008), and Meyer (2019).

[8]Our baseline analysis is at the state-year level, consistent with variation in election data. In an online appendix, we replicate our main specifications where we instead conduct all analysis at the paper-state-year level.

group) at the RD threshold. There are no observations falling exactly at the RD threshold, so local linear RD instead relies on linear regressions using observations close to the RD threshold. Thus, our estimate of β is a local estimate of the causal effect of a Republican gubernatorial victory, relative to a counterfactual Democratic gubernatorial victory. Because polynomial methods use only data near the RD threshold, one must select the estimation bandwidth – the maximum margin of victory for an election to be included in the analysis. In general, there is a tradeoff between smoothing bias of the local polynomial approximation and the variance of the estimated RD coefficient. We use the optimal bandwidth calculations proposed in Calonico et al. (2019), which minimizes the mean squared error of the local polynomial point estimator, to formalize this tradeoff.[9] This bandwidth selector allows for the inclusion of baseline covariates such as year fixed effects and facilitates clustering at the state level.[10] We refer to the estimates from the Calonico et al. (2019) optimal bandwidth as our baseline estimates, but also show results from other bandwidths to demonstrate the stability of the results.

5   Results

5.1   Validity tests

Before presenting the main regression results, we include several classes of RD validity tests as recommended by the literature. First, we examine the distribution of vote margin to test for possible manipulation in the running variable. We then conduct falsification tests where we test for treatment effects on predetermined covariates and placebo outcomes. Finally, we test for correlation of election results over time.

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[9]The mean squared error of the local polynomial point estimator is the sum of its squared bias and variance. Other optimal bandwidth calculations include Imbens and Kalyanaraman (2012) and Calonico et al. (2014)

[10]We provide power calculations for our RD design in an online appendix.

5.1.1 Density of vote margin

First introduced by McCrary (2008) in the context of RD designs, manipulation testing formally tests for evidence of a discontinuous density at the RD threshold. A discontinuous density in the running variable can suggest nonrandom sorting into treatment, so the literature suggests manipulation testing as an important RD design falsification test. In the context of close elections, discontinuous density could suggest that one party can better organize and influence vote totals for close gubernatorial elections. We use the manipulation test of Cattaneo et al. (2020), which are based on a local polynomial density estimator. As seen in Figure 4, we do not find evidence of a discontinuity in vote margin at the RD threshold.

Figure 4: RD density plot
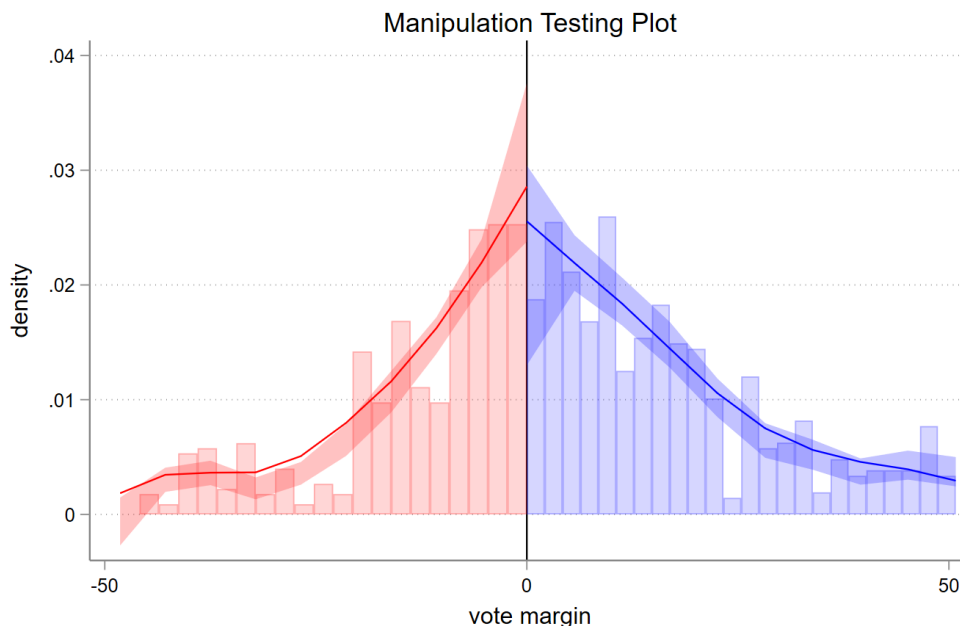
5.1.2 Treatment effect on predetermined covariates and placebo outcomes

Next, we conduct falsification tests on variables that are determined prior to the gubernatorial election (predetermined covariates), and on variables that are determined after the gubernatorial election but unlikely to be affected by the RD treatment (placebo outcomes).

Our main identifying assumption for the RD design is that the potential outcome functions for climate skeptical newspaper coverage are continuous at the RD threshold. Evidence of discontinuities in predetermined covariates or placebo outcomes at the threshold could suggest that the potential outcome functions are also discontinuous at the threshold. Therefore, as recommended by Cattaneo et al. (2019a), we separately estimate our RD specification on each predetermined covariate and placebo outcome, each time using a new optimal bandwidth for the specific outcome.

We first test for a treatment effect of a close Republican win in year t on demographic variables in year $t-4$. We separately estimate equation (1) for the following lagged state-year level demographic variables: unemployment rate, poverty rate, and income per capita.[11] We also test for persistence in gubernatorial election outcomes with an outcome variable that is a 4 year lagged indicator for a Republican governor.[12] Table 4 shows RD results for each of the predetermined covariates. We do not find evidence that a close Republican gubernatorial victory has an effect on any of the lagged demographic variables nor on the probability of a Republican winning the previous gubernatorial election.

We next test for discontinuities in variables that are determined at the same time as the gubernatorial election but unlikely to be affected by a close Republican win. We use the following placebo outcomes: Republican majority in the state senate, Republican majority in the state house of representatives, Republican majority in the state's US senate delegation, and Republican majority in the state's US house delegation.[13] Table 5 shows RD results for each of the placebo outcomes. In each case, we fail to reject the null that a close Republican win has no discontinuous effect on the placebo outcome. Moreover, most of the point estimates on the RD treatment effects for the placebo outcomes are small in magnitude.

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[11]We obtain data for these demographic variables from the University of Kentucky Center for Poverty Research National Welfare Data (https://ukcpr.org/resources/national-welfare-data).

[12]We use the 2 year lagged values for each predetermined covariate for New Hampshire and Vermont since these states have 2 year gubernatorial terms.

[13]We gather data for Republican majority in the state's US senate delegation and Republican majority in the state's US house delegation from the Biographical Directory of the United States Congress (https://bioguide.congress.gov/) and from the US Census Bureau's 2010 Statistical Abstract of the United States.

Table 4: RD regression results for predetermined covariates

	(1) Unemployment Rate$_{t-4}$	(2) Poverty Rate$_{t-4}$	(3) Income per Capita$_{t-4}$	(4) Republican Governor$_{t-4}$
Republican	0.212	0.519	0.102	-0.189
Governor	(0.473)	(0.750)	(0.655)	(0.244)
State FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Bandwidth	10.54	8.512	10.888	7.223
No. of Clusters	44	40	44	39
Observations	364	302	365	315

Notes: Each column represents a separate estimation of equation 1.
Each column uses a uniform kernel and linear polynomial controls.
Standard errors clustered by state are shown in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Overall, these falsification tests therefore give support to the validity of the RD design.

Table 5: RD regression results for placebo outcomes

	(1) State Senate Rep. Maj.	(2) State House Rep. Maj.	(3) US Senate Delegation Rep. Maj.	(4) US House Delegation Rep. Maj.
Republican	-0.0472	0.278	-0.0424	0.0204
Governor	(0.119)	(0.188)	(0.152)	(0.109)
State FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Bandwidth	9.507	9.095	8.627	9.898
No. of Clusters	44	43	42	45
Observations	404	400	378	425

Notes: Each column represents a separate estimation of equation 1.
Each column uses a uniform kernel and linear polynomial controls.
Standard errors clustered by state are shown in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

5.1.3 Correlation over time

A final potential issue is that election results within states may be correlated over time; if the governor in the previous term is in the same party as the current governor and the

previous governor affected current climate skepticism, we could misattribute current climate skepticism to current gubernatorial control. Similarly, a future governor should not be able to affect current climate skepticism. We therefore conduct falsification tests where we create placebo treatments from either past or future gubernatorial election results. We estimate specifications that link the outcome variables for the true year with the RD treatment and vote margin from four years earlier or four years later. The results of this test are shown in Table 6. Past and future elections do not have a significant effect on either extensive or intensive climate change skepticism, suggesting that our analysis passes this placebo test. The absence of an effect of past elections also shows that any effect of a governor on newspaper coverage does not last beyond the their term.

Table 6: RD regression results for past and future placebo gubernatorial treatments

| | (1) | (2) | (3) | (4) |
	Extensive skepticism		Intensive skepticism	
Republican Governor 4 years prior	-0.00545 (0.00994)		-0.00420 (0.0107)	
Republican Governor 4 years in future		-0.0140 (0.0143)		-0.0139 (0.0138)
State FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Bandwidth	9.332	8.601	9.665	9.336
No. of Clusters	45	42	45	45
Observations	393	354	409	380

Notes: Each column represents a separate estimation of equation 1.
Each column uses a uniform kernel and linear polynomial controls.
Standard errors clustered by state are shown in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

5.2   Main results

Figures 5 and 6 show RD plots of the discontinuities identified in estimates of equation (1). For both outcomes, $Skept_{Extensive}$ and $Skept_{Intensive}$, we use the MSE optimal bandwidths

from Calonico et al. (2019) to select the observations for the plots.[14] We include year and state fixed effects as covariates, and use a uniform kernel, a linear regression fit, and the IMSE-optimal number of bins.

Figure 5: RD plot for percentage of skeptical articles (extensive outcome)
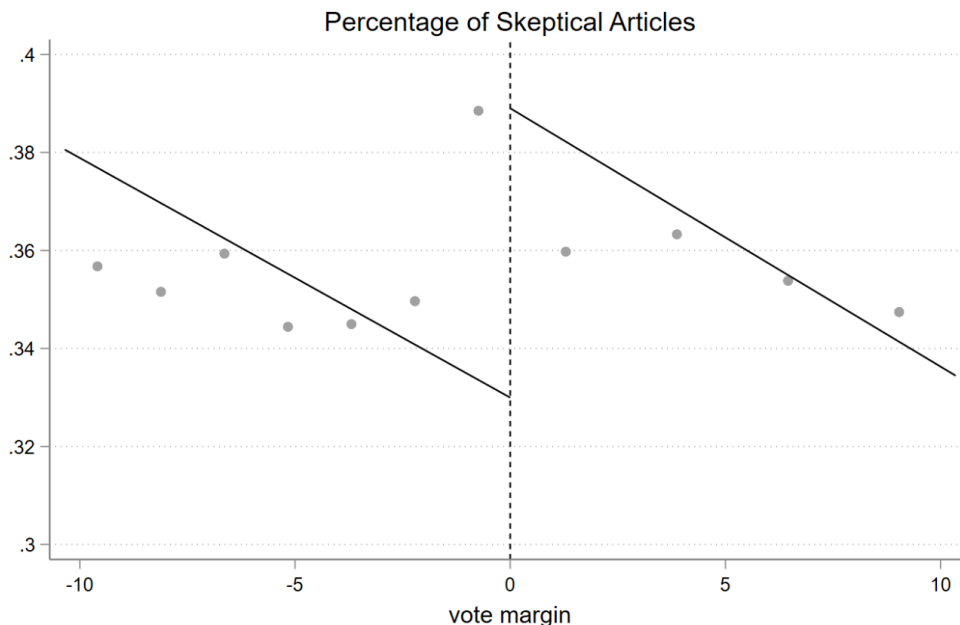

Figure 5 shows an RD plot where the percentage of skeptical articles is the dependent variable. This figure plots binned averages of $Skept_{Extensive}$ within narrow margins of victory. Each bin to the left of 0 represents averages from a Democratic victory and each bin to the right of 0 represents averages from a Republican victory. There appears to be a discontinuous increase in the probability of a skeptical article as we cross the RD threshold. The vertical difference between the linear regression fits at 0 visually represents the RD treatment effect. Relative to the counterfactual of a close Democratic gubernatorial election victory, a close Republican gubernatorial election victory increases the probability of a skeptical article by around 6 percentage points. Figure 6 shows an analogous RD plot for the proportion of skeptical phrases, and hence plots binned averages of $Skept_{Intensive}$. Once again, we see

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[14]The MSE optimal bandwidth is the default option in the Calonico et al. (2019) rdbwselect command. We include year fixed effects as covariates for the bandwidth calculations.

Figure 6: RD plot for proportion of skeptical phrases (intensive outcome)
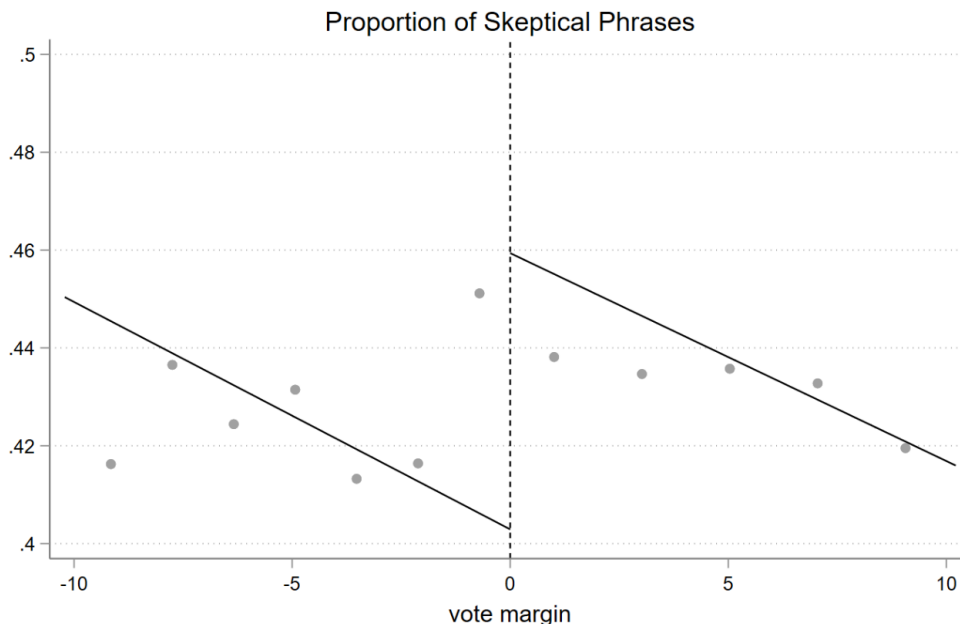
a discontinuous increase in the skeptical tone of climate change articles as we move from a close Democratic gubernatorial victory to a close Republican gubernatorial victory. A close Republican win appears to increase the proportion of skeptical phrases by around 5.5 percentage points, relative to a counterfactual close Democratic win. Lastly, we note that linear regressions fit the binned averages reasonably well in both Figures 5 and 6. The only noticeable outliers appear in the first bin to the left of 0, which represents very close Democratic victories. These outliers serve to decrease the magnitude of the estimated RD treatment effect. If not for the outliers, the estimated effect of a Republican gubernatorial win would be larger.

Table 7 shows our baseline RD results. In column (1), we see that a close Republican gubernatorial win increases the probability of a skeptical article by approximately 5.9 percentage points relative to the counterfactual of a close Democratic gubernatorial win. Furthermore, the estimated effect is stable across the alternative specifications in columns (2) and (3). Column (2) uses a triangular kernel in place of the baseline uniform kernel and

column (3) uses local quadratic controls in place of the baseline linear controls.[15]

Next, in column (4), we estimate that a close Republican win increases the proportion of skeptical phrases relative to pro-environmental phrases in articles mentioning climate change by approximately 5.7 percentage points. Once again, the results remain stable for alternative specifications with a triangular kernel (column (5)) and with local quadratic controls (column (6)).

Table 7: Baseline gubernatorial RD regression results

	(1)	(2)	(3)	(4)	(5)	(6)
		Extensive skepticism			Intensive skepticism	
Republican	0.0591**	0.0553**	0.0544*	0.0565**	0.0574**	0.0650**
Governor	(0.0274)	(0.0264)	(0.0301)	(0.0279)	(0.0268)	(0.0304)
State FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Kernel	Uniform	Triangular	Uniform	Uniform	Triangular	Uniform
Polynomial	Linear	Linear	Quadratic	Linear	Linear	Quadratic
Bandwidth	10.353	12.183	15.248	10.215	12.458	15.371
No. of Clusters	46	46	50	46	46	50
Observations	446	479	594	439	495	594

Notes: Each column represents a separate estimation of equation 1.
Notes: Standard errors clustered by state are shown in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

These results demonstrate the effect that governors can have over newspaper coverage of climate change in their state. If a state elects a Republican instead of a Democratic governor, there will be 5-6% increase in both the share of language used in articles about climate change that is skeptical and the proportion of articles that use more skeptical phrases than environmental phrases. The RD framework isolates a causal effect, so this represents the influence that governors are able to exert over newspaper coverage of climate change. Given the effect that media can have in shaping public opinion, this result has important consequences for the understanding of public perceptions of climate change and can explain the effects of politicians on public opinion shown in Meyer (2019).

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[15]In an appendix table, we show that results are stable across alternative bandwidths.

5.3 Heterogeneity

The measures of tone of coverage in Table 7 are a function of both usage of skeptical language and usage of pro-environmental language. The shift in tone towards skepticism that occurs when a Republican governor is elected could be caused by newspapers using more skeptical language, less pro-environmental language, or both. Columns (1) and (2) of Table 8 separate these by using the number of skeptical phrases and the number of pro-environmental phrases per article as dependent variables. There is more evidence for an increase in the use of skeptical language when a Republican governor is elected than there is for a decrease in the use of pro-environmental language.

Columns (3) to (6) of Table 8 test how the relationship evolves over time. The media landscape in the second half of the analysis period (2010-2019) was substantially different than in the first half (2000-2009) as news consumption shifted online and social media played an increasingly important role in disseminating news. The results are suggestive that the effect may have been weaker in 2010-2019 than it was in the previous decade, but the estimates are insignificant so cannot be interpreted conclusively.

Another potential dimension of heterogeneity relates to the partisan slant of newspapers. Journalists may react differently to a Republican gubernatorial win depending on whether they work at a Republican leaning newspaper or a Democratic leaning newspaper. Although it is uncommon for newspapers to explicitly state a partisan affiliation during our sample period, we can measure newspapers' historical partisan slant using political endorsements. Gentzkow et al. (2011) compile a panel of US daily newspapers and track presidential endorsements, and we are able to match 90% of newspapers in our sample to their endorsement history.[16] Governors in our sample period could feasibly affect any newspaper endorsements from 2000 or later, so we use the party endorsed by each newspaper in the 1996 presidential election.[17]

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[16]We obtain the publicly available data from Gentzkow et al. (2014).

[17]Ideally, we could identify the party endorsed in the 1996 presidential election for each of our sample newspapers. One challenge is that Gentzkow et al. (2011) use various newspaper directories (such as Editor

Table 8: RD Results: Heterogeneous effects on skeptical/pro-environmental phrases and by time period

	(1) Skept. Phrases	(2) Env. Phrases	(3) Ext. Skept. 2000-2009	(4) Ext. Skept. 2010-2009	(5) Int. Skept. 2000-2009	(6) Int. Skept. 2010-2009
Republican	0.105*	-0.025	0.078	0.030	0.083	0.023
Governor	(0.058)	(0.086)	(0.062)	(0.019)	(0.062)	(0.019)
State FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Bandwidth	8.767	12.944	11.490	9.525	11.127	9.821
No. of Clusters	43	47	45	31	46	32
Observations	387	514	248	190	248	197

Notes: Each column represents a separate estimation of equation 1.
Each column uses a uniform kernel and linear polynomial controls.
Standard errors clustered by state are shown in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Since we investigate heterogeneity at the newspaper level we conduct the analysis at the paper-state-year level (as in Appendix A.2), rather than conduct the analysis at the state-year level (as in the baseline estimations). We create indicators for Republican presidential endorsements and Democratic presidential endorsements.[18] In separate specifications, we then interact these indicators with the RD treatment variable (Republican win) and the RD controls. For example, the estimating equation for Republican presidential newspaper endorsements becomes:

and Publisher Yearbook), in which newspaper names do not necessarily exactly match to the names we have from Newslibrary. Thus, we rely on a fuzzy merge to link newspaper names, ultimately matching over 90 percent of our base Newslibrary newspapers to their 1996 presidential election endorsements. We use the user-written reclink (Blasnik, 2007) module to probabilistically match newspaper names, requiring the newspapers' states to match from both data sources. Of the 560 titles in our Newslibrary sample, 153 exactly match to (Gentzkow et al., 2014) and another 377 have match scores between 0.6 and 1. After manual clerical review to remove false positives, our final sample has 506 newspapers with reliably matched 1996 presidential endorsement data.

[18]Approximately 31 percent of sample newspapers endorsed the Democratic candidate (Bill Clinton) and 61 percent of sample newspapers endorsed the Republican candidate (Bob Dole).

$$Y_{jst} = \alpha_0 + \alpha_1 RPE_{jst} + \beta_1 R_{st} + \beta_2 R_{st} * RPE_{jst} + \gamma_1 * M_{st} + \gamma_2 M_{st} * RPE_{jst} \qquad (2)$$

$$+ \delta_1 R_{st} * M_{st} + \delta_2 R_{st} * M_{st} * RPE_{jst} + \mu_t + \pi_s + \epsilon_{jst}$$

where RPE_{jst} is an indicator for a newspaper j endorsing a Republican candidate in the 1996 presidential election, and all other notation is analogous to that in equation 1. Table 9 shows estimates of equation 2 for both extensive skepticism (columns (1) and (2)) and intensive skepticism (columns (3) and (4)).

Table 9: RD Results: Heterogeneity in treatment by newspaper presidential endorsements

	(1)	(2)	(3)	(4)
	Extensive skepticism		Intensive skepticism	
RepGov	0.00954	0.0705**	0.00210	0.0528**
	(0.0215)	(0.0286)	(0.0201)	(0.0228)
RepGov*RPE	0.0528		0.0547*	
	(0.0450)		(0.0322)	
RepGov*DPE		-0.0766*		-0.0596**
		(0.0397)		(0.0285)
RPE	-0.0278		-0.0114	
	(0.0370)		(0.0275)	
DPE		0.0492*		0.0286
		(0.0268)		(0.0223)
State FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Bandwidth	8.711	8.802	9.480	9.669
No. of Clusters	45	45	47	47
Observations	4,341	4,403	4,884	5,041

Notes: Each column represents a separate estimation of equation 2,
weighting each paper-state-year observation by its circulation.
Each column uses a uniform kernel and linear polynomial controls.
Standard errors clustered by state are shown in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Columns (1) and (3) include the variable RPE, which indicates the newspaper endorsed the Republican candidate in the 1996 presidential election. Thus, the coefficients on RepGov (β_1) in these columns represent effect of a close Republican gubernatorial win on climate

skepticism for a newspaper that did not endorse the Republican candidate, relative to the counterfactual of a close Democratic gubernatorial win. The sum of this coefficient and the coefficient on the interaction between RepGov and RPE ($\beta_1 + \beta_2$) represents the effect of a close Republican gubernatorial win on climate skepticism for a newspaper that did endorse the Republican candidate. Qualitatively, results for the extensive and intensive skepticism outcomes agree – a Republican gubernatorial win only affects skepticism in newspapers that endorsed the Republican candidate for president in 1996. However, the differential effect of a close Republican win on climate skepticism is only statistically significant at conventional levels for the intensive skepticism outcome.

Analogously, columns (2) and (4) include the variable DPE, which indicates the newspaper endorsed the Democratic candidate in the 1996 presidential election. Here, the coefficients on RepGov represent the effect of a close Republican gubernatorial win on climate skepticism for a newspaper that did not endorse the Democratic candidate, relative to the counterfactual of a close Democratic gubernatorial win. The sum of this coefficient and the coefficient on the interaction between RepGov and DPE captures the effect of a close Republican gubernatorial win on climate skepticism for a newspaper that did endorse the Democratic candidate. A close Republican gubernatorial win increases climate skepticism for newspapers that did not endorse the 1996 Democratic presidential candidate (a 7 percentage point increase in the probability of a skeptical article, and a 5 percentage point increase in the proportion of skeptical phrases). These effects are essentially canceled out for newspapers that did endorse the 1996 Democratic presidential candidate. Adding the coefficient on RepGov with the coefficient on RepGov*DPE, we see an effect on climate skepticism in these newspapers that is close to 0.

Collectively, these results from Table 9 show that the historical political leaning of newspapers matters. The partisan affiliation of the governor affects newspaper climate skepticism differently for "Democratic" versus "Republican" papers. Papers that endorsed the 1996 Republican presidential candidate appear substantially more responsive to the political party

of the governor than papers that endorsed the 1996 Democratic presidential candidate.

This asymmetric effect is consistent with Meyer (2019), who finds that Republican voters' perceptions of climate change are affected by the party of their governor, but Democratic voters' perceptions are not. There are several possible explanations for this asymmetry. First, previous research finds partisan contrasts in the effects of communicating about climate change with different frames, where the frame of communication matters more for Republicans than it does for Democrats (Egan and Mullin, 2017). Additionally, some studies find evidence of directional motivated reasoning among Republicans, in which partisans look for information that confirms their prior skeptical climate change beliefs (Brulle et al., 2012; Tesler, 2018). Hence, more skeptical messaging from political elites, as may happen with a Republican gubernatorial win, can move Republicans to an even more skeptical position. As noted by Bayes and Druckman (2021) and Druckman and McGrath (2019), this is also observationally equivalent to behavior predicted by a model of accuracy-driven Republicans seeking information from sources that they deem credible. While directional motivated reasoning or accuracy-motivation could also theoretically affect climate change beliefs of Democrats, most recent polls find that over 90 percent of Democrats believe that climate change is happening. Thus, nearly all Democrats believe the science is a settled issue and left-leaning media may therefore be less malleable in their tone.

5.4 Mechanisms

The baseline results shown in Table 7 demonstrate that if a state elects a Republican governor, newspapers in that state will cover climate change using a more skeptical tone. There are several possible mechanisms that could underlie this relationship, including quotes from governors and their allies, the governor using a 'bully pulpit', journalists reporting on legislation or prospective legislation, and journalists practicing access journalism by developing relationships with governors and their allies. In this section, we go through each of these hypotheses in turn and present evidence for or against them. We find good evidence against

the quotes hypothesis and, among the other possibilities, the strongest evidence for the 'bully pulpit' hypothesis.

5.4.1 Stenography

One possible explanation for the main results is that because governors are important political figures their speeches and interviews will be covered extensively and journalists will frequently seek quotes from them or their office. A newspaper may more closely reflect the preferred tone of the party in power simply by including these quotes directly or indirectly in their coverage.

If this stenography hypothesis were the driving factor behind the main results, then they would represent a purely mechanical relationship that is not particularly informative about the relationship between governors and newspapers. Therefore it is useful to exclude this possibility. Table 10 divides newspaper articles into articles that use the words 'governor' or 'governors' or mention the name of a gubernatorial candidate and those that do not. The effect of a Republican governor on both the share of non-governor related articles articles that are skeptical (column (2)) and the share of indicative phrases that are skeptical in non-governor related articles (column (4)) is significant and not significantly different from the equivalent measures in governor related articles (columns (1) and (3)). We cannot rule out the possibility that quoting the governor has some effect on the tone of coverage, but we can eliminate the possibility that it is the main factor determining the difference in coverage between Republican run states and Democratic run states.

5.4.2 Bully pulpit

Another potential explanation for the relationship between governors and newspaper coverage is the 'bully pulpit'. This phrase, commonly attributed to Theodore Roosevelt, refers to the ability of a politician to use their position as a platform from which to advocate for their positions. If governors spend time, effort, and political capital advocating about an

Table 10: RD results: Tests of stenography mechanism

	(1) Ext. Skept. in Governor Articles	(2) Ext. Skept. in non-Governor Articles	(3) Int. Skept. in Governor Articles	(4) Int. Skept. in non-Governor Articles
Republican Governor	0.0225 (0.0537)	0.0517** (0.0208)	0.0625 (0.0534)	0.0503** (0.0228)
State FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Bandwidth	9.997	11.756	10.408	11.457
No. of Clusters	45	46	46	46
Observations	421	467	440	463

Notes: Each column represents a separate estimation of equation 1.
Each column uses a uniform kernel and linear polynomial controls.
Standard errors clustered by state are shown in parentheses
*** p<0.01, ** p<0.05, * p<0.1

issue, they may be able shift the tone and attention paid to the issue even when they are not directly quoted in the discussion.

If this hypothesis were true, the relationship between governors and newspaper coverage should be stronger around issues that are more politically relevant. Governors should be more willing to expend resources shaping the discussion around these issues and journalists may be more responsive to cues from governors. In Table 11, we divide states into states where climate change is more or less politically relevant along three dimensions: fossil fuel production, susceptibility to hurricanes, and vulnerability to climate change.[19] In each case, the party of the governor has a stronger effect on the tone of coverage in states where climate change is more politically relevant. While this evidence is not conclusive, it is consistent with bully pulpit explanations for the relationship between governors and newspaper coverage.

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[19]Fossil fuel production data is taken from the Energy Information Administration. A fossil fuel producing state is defined as a state where the per capita production of oil, coal, or natural gas is greater than the 75th percentile. Climate vulnerability classification taken from Moody's Analyics report. Source: https://www.moodysanalytics.com/articles/pa/2023/the-impact-of-climate-change-on-us-subnational-economies.

Table 11: RD results: Tests of bully pulpit mechanism

	(1) Less fossil fuels	(2) More fossil fuels	(3) No hurricanes	(4) Hurricanes	(5) Less vulnerable to CC	(6) More vulnerable to CC
Republican Governor	0.028 (0.032)	0.141*** (0.044)	0.042 (0.039)	0.125*** (0.025)	0.001 (0.030)	0.120*** (0.032)
State FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Bandwidth	7.375	11.293	8.362	7.696	9.008	9.180
No. of clusters	27	18	25	16	24	20
Observations	225	147	217	141	199	204

Notes: Each column represents a separate estimation of equation 1.
Each column uses a uniform kernel and linear polynomial controls.
All results shown are for extensive skepticism.
Standard errors clustered by state are shown in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5.4.3 Legislation

A third potential mechanism is that governors' priorities are reflected in the policies and legislation that are debated during their term. This would allow a governor to affect coverage through discussion of legislation or prospective legislation even if the governor is not directly mentioned or quoted in that coverage. If this were the case, we would expect that other political factors that determine legislation, such as which party controls a state's legislature, should also have an effect on coverage.

We test this hypothesis by replicating Table 7 as closely as possible using state legislature elections in place of gubernatorial elections. Unlike the gubernatorial election setting, many different elections determine majority status in a state legislature. Therefore, rather than a single vote margin, the multidimensional RD design (Feigenbaum et al., 2017) creates a distance measure to capture the closeness of a set of local election results to the threshold that results in a partisan majority status. Consistent with prior literature (Bergquist, 2019;

Caughey et al., 2017), we focus on the effect of a Republican majority in the lower house of representatives where all seats are simultaneously up for election.[20]

Klarner (2018) provides election data that cover the universe of state legislative elections from 1967-2016. We use these data and follow Feigenbaum et al. (2017) to create the RD forcing variable using the following method. Denote the number of seats needed by the minority party to attain majority status as k. Then, create a function of the loss margins in the k closest elections to obtain the multidimensional distance measure. The most common choice is the Euclidean distance, which is the square root of the sum of the squares of the loss margins from these k closest elections. The RD threshold occurs at a Euclidean distance of zero and we define the RD treatment as a Republican majority, so we multiply the distance by -1 for Democratic majorities. We then estimate our primary specification (equation (1)), replacing "Republican governor" with "Republican majority" and "vote margin" with "Euclidean distance".[21]

Table 12 shows results for the multidimensional RD where we estimate the effect of a Republican majority in the lower house on the newspaper tone outcomes of $Skept_{Extensive}$ and $Skept_{Intensive}$. Across all columns of Table 12, we find statistically insignificant effects of a Republican majority on our measures of newspaper climate skepticism. Moreover, the point estimates are all close to 0, indicating that a close Republican majority in the lower house does not cause the tone of climate change news to change, relative to a close Democratic majority.

To the extent to which a legislative majority allows a party to affect legislation, the results in Table 12 are not consistent with the effect on newspaper coverage being driven by legislation or prospective legislation. This makes it less plausible that the effect of the gubernatorial election is driven by legislation. However, it is important to add the caveat

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[20]State senate elections are typically staggered across years with many seats not up for election in a given year. Like prior studies, we limit our sample to general elections in states with single member, partisan districts.

[21]We again use a uniform kernel, the Calonico et al. (2019) optimal bandwidth, and cluster standard errors at the state level. Another distance measure is the minimum rectilinear, or Manhattan, distance (Folke, 2014). We also show results for this alternative distance measure.

Table 12: RD results: State legislature

	(1)	(2)	(3)	(4)
	Extensive skepticism		Intensive skepticism	
Republican	-0.0104	-0.000824	0.00651	0.00637
Majority	(0.0173)	(0.0157)	(0.0145)	(0.0156)
State FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Distance	Euclidean	Manhattan	Euclidean	Manhattan
Bandwidth	0.619	1.829	0.514	1.761
No. of Clusters	34	34	34	34
Observations	465	438	432	432

Notes: Each column represents a separate estimation of equation 1.
Each column uses a uniform kernel and linear polynomial controls.
Notes: Each column uses a uniform kernel and linear polynomial controls.
Standard errors clustered by state are shown in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

that a state legislative majority election is not as clean a discontinuity as a gubernatorial election in terms of political power. Unlike gubernatorial leadership where one administration controls the executive branch, a party with a narrow majority needs to work with their most centrist members. Further, winning more seats beyond a close majority may have influence over the legislature's agenda beyond the effect winning a narrow majority.

5.4.4 Access journalism

A fourth possible mechanism for the relationship between governors and coverage is professional and personal relationships between governors or their allies and journalists. Journalists may enter into an unofficial exchange of favorable coverage for interviews or insider information, a phenomenon sometimes described as 'access journalism'.

Using the assumption that governors who have previously served in statewide office or in state legislatures have had more time to build up better relationships with journalists, Columns (1)-(4) of Table 13 show tests of this hypothesis. They show that governors with no state governing experience appear to have a slightly stronger effect on coverage, a result

which is not consistent with the 'access journalism' hypothesis.

Table 13: RD results: Relationships with journalists

	(1) No previous statewide office	(2) Previous statewide office	(3) Never in state legislature	(4) Served in state legislature	(5) First 2 years	(6) Second 2 years
Republican Governor	0.142** (0.059)	0.004 (0.031)	0.096** (0.043)	0.078 (0.074)	0.053** (0.022)	0.062 (0.042)
State FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Bandwidth	10.584	9.848	10.448	7.688	11.903	9.180
No. of clusters	38	29	39	22	45	43
Observations	254	154	249	107	254	197

Notes: Each column represents a separate estimation of equation 1.
Each column uses a uniform kernel and linear polynomial controls.
All results shown are for extensive skepticism.
Standard errors clustered by state are shown in parentheses
*** p<0.01, ** p<0.05, * p<0.1

If access to politicians does have a significant effect on the tone of coverage, it is ambiguous how this effect would evolve over a governor's term. By the end of a term a governor would have had more time to build relationships with journalists, but there is less time for the favor exchange to pay off. Columns (5) and (6) of Table 13 show that there is no detectable difference in a governor's ability to influence coverage in the first half of their term relative to the second.

Overall, the strongest result concerning mechanisms that we identify is evidence against the stenography hypothesis. Among the other hypotheses, we find evidence that is suggestive of the 'bully pulpit' hypothesis and fail to find evidence that is suggestive of the legislation or access journalism hypotheses.

6   Conclusion

In this paper, we attempt to identify a mechanism by which gubernatorial elections affect perceptions of climate change. Given that most people receive information about climate change primarily through media coverage and that media coverage has been shown to affect perceptions and behavior, a causal relationship between the outcome of gubernatorial elections and media coverage would have important implications.

We measure the tone of local newspaper coverage of climate change between 2000 and 2019. Our measure is based on the frequency of particularly skeptical and particularly pro-environmental phrases, which are identified by comparing texts with known perspective.

We implement a regression discontinuity design to address the endogeneity concern that would arise if we simply used the Republican vote share as the primary independent variable. States with a more Republican electorate are likely to have a population more skeptical of climate change, and newspapers may adopt a more skeptical tone to attract this more skeptical population. The regression discontinuity design addresses this concern by accounting for the vote share and testing whether coverage is different in states where the Republican candidate narrowly won than it is in states where the Democratic candidate narrowly won.

We find that coverage of climate change indeed becomes more skeptical in states with a Republican governor. This result is robust to a number of different specifications and measures of tone of coverage. Furthermore, it appears that Republican leaning newspapers primarily drive the observed treatment effect. We test several hypotheses for the mechanism behind this relationship and find evidence that suggests a governor is able to use their 'bully pulpit' to set the agenda but do not find evidence that the effect is driven by direct or indirect quotes from the governor, discussions of legislation or prospective legislation, or relationships between governors and journalists.

This paper provides some of the clearest empirical evidence of the effect of politicians on the overall media landscape in the literature to date. It thus speaks to the elite cues model of belief formation. It has been documented that partisans take cues from political leaders,

a factor which contributes to polarization on issues such as climate change. Further it has been documented that this is not entirely symmetric, and overall public opinion is affected in the direction of the party in power. The results in this paper speak to the mechanism behind this relationship – politicians who are in power are able to shape the tone of media coverage not simply because they are more likely to be cited or interviewed, but also because they have agenda setting influence over the general tone of media coverage.

Given the importance of climate change as a public policy issue, this points to the potential for crucial virtuous or vicious cycles. Politicians who are concerned about climate change may be able to not only enact climate change policy but also to generate support for further policies with media coverage as a key transmission mechanism. On the other hand, climate skeptical politicians may generate further skepticism.

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A Appendices (for online publication only)

A.1 Power analysis

In this appendix, we show power analyses for our RD design. We present graphs of the power functions for the outcomes of extensive skepticism and intensive skepticism, using the Cattaneo et al. (2019b) rdpow routine (Stata) to assess the statistical power of the RD design for a given hypothesized RD treatment effect. Consistent with the RD design of section 4, we use a uniform kernel, the CCFT optimal bandwidths, condition on year and state fixed effects, and cluster standard errors at the state level. We set bias to zero because we use conventional RD inference in our analysis. Figure A1 Panel A shows the power function for extensive skepticism and Figure A1 Panel B shows the power function for intensive skepticism. The power functions show that our design has considerable power to detect treatment effects for both outcome variables.

A.2 Alternative bandwidths and weightings

In this appendix, we replicate our main specifications with alternative bandwidths and under different weighting schemes.

First, we demonstrate the stability of our results for alternative RD bandwidths. Table A1 shows results for our two primary newspaper tone outcomes, using bandwidths ranging from 5 to 12. Panel A shows results for the extensive skepticism outcome, which reflects the proportion of articles with a skeptical tone. We find point estimates that range from 0.051 to 0.073 and coefficients are statistically significant at conventional levels for all bandwidths except for 5. Panel B shows results for the intensive skepticism outcome, which reflects the proportion of all indicative phrases that are skeptical. Again, point estimates are stable across the different bandwidths and most of the coefficients are statistically significant at conventional levels.

Next, we investigate several alternative weighting schemes. Table A2 shows results for

Figure A1: RD power functions for extensive and intensive skepticism outcomes
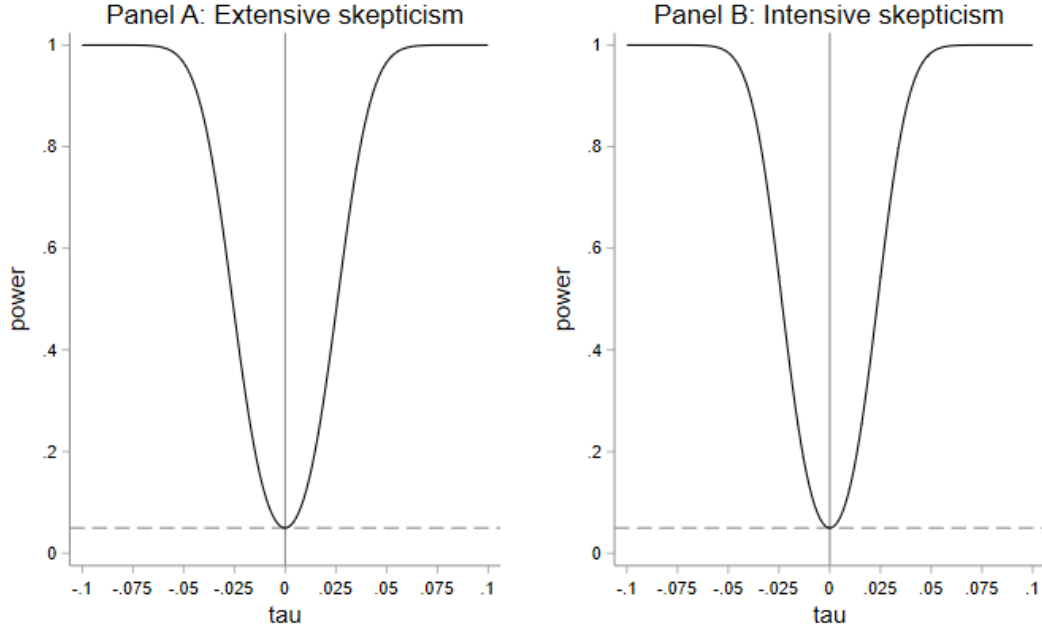
Notes: These graphs show power functions of the RD design for hypothesized RD treatment effects ranging from 0 to 0.1. Panel A is for the dependent variable of extensive skepticism and Panel B is for the dependent variable of intensive skepticism. These power functions use uniform kernels, condition on year and state fixed effects, and cluster standard errors at the state level. Significance level=0.05.

these alternative weightings.[22] Again, Panel A shows results for the extensive skepticism outcome and Panel B shows results for the intensive skepticism outcome. In column (1) of Table A2, rather than average to the state-year level, we instead conduct all analysis at the paper-state-year level and weight each paper-state-year observation by its circulation. In column (2) of Table A2, we conduct our analysis at the state-year level as in our baseline analysis, but we do not weight articles by the paper's circulation. This analysis therefore equally weights all articles within a state-year. Finally, in column (3), we link each paper to the state in which it has maximum circulation so that each article only matches to one state. Consistent with the baseline analysis, we weight each article by its circulation when collapsing to the state-year level average tone measures in column (3).

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[22]We use optimal bandwidths for each specification in this table, calculated using the same methods described in the baseline analysis.

Table A1: RD results for alternative bandwidths

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A. Extensive Skepticism							
Republican	0.0608***	0.0563**	0.0638**	0.0579**	0.0730*	0.0715*	0.0510
Governor	(0.0218)	(0.0239)	(0.0269)	(0.0269)	(0.0379)	(0.0373)	(0.0488)
Panel B. Intensive Skepticism							
Republican	0.0634***	0.0608**	0.0603**	0.0577**	0.0633	0.0649*	0.0503
Governor	(0.0234)	(0.0251)	(0.0265)	(0.0269)	(0.0383)	(0.0385)	(0.0483)
State FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Bandwidth	12	11	9	8	7	6	5
No. of clusters	46	46	44	41	39	37	34
Observations	476	458	396	363	314	284	228

Notes: Each column represents a separate estimation of equation 1. Each column uses a uniform kernel and linear polynomial controls. Standard errors clustered by state are shown in parentheses. ***$p<0.01$, ** $p<0.05$, * $p<0.1$.

Overall, results are qualitatively robust to these alternative weighting schemes. The estimated RD treatment effect decreases and becomes less precise when we conduct analysis at the paper-state-year level (column (1)). The paper-state-year analysis implicitly weights states with more papers having higher circulation more heavily because there will be more observations from states with more papers, and those observations are weighted by their corresponding circulation numbers. That is, more populous states with more extensive media markets are weighted more heavily in column (1). More populous states also tend to be lower on the list of per capita fossil fuel production. As shown in Table 11, the effect of a governor on the tone of newspaper climate change coverage is much larger in states with higher fossil fuel per capita production. Therefore, it is consistent that we find a smaller average effect in this alternative specification that weights more populous states more heavily.

Table A2: RD results for alternative weightings

	(1)	(2)	(3)
Panel A. Extensive Skepticism			
Republican Governor	0.0325*	0.0533***	0.0587**
	(0.0168)	(0.0192)	(0.0228)
Bandwidth	8.675	12.203	11.822
No. of clusters	44	46	45
Observations	4,972	479	463
Panel B. Intensive Skepticism			
Republican Governor	0.0302*	0.0519***	0.0610**
	(0.0168)	(0.0193)	(0.0238)
Bandwidth	11.032	12.446	12.121
No. of clusters	48	46	45
Observations	6,465	495	471

Notes: Column (1) represents an estimation of a specification analogous to equation 1 but at the paper-state-year level. Column (1) weights each observation by its circulation. Columns (2) and (3) represent separate estimations of equation 1 but with alternative weightings used for the construction of the dependent variable. Each column uses a uniform kernel and linear polynomial controls and includes year and state fixed effects. Standard errors clustered by state are shown in parentheses.
***p<0.01, ** p<0.05, * p<0.1.