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MEASURING SOCIAL BENEFITS OF MEDIA COVERAGE: HOW COVERAGE OF CLIMATE CHANGE AFFECTS BEHAVIOUR*

Graham Beattie

It has been well documented that beliefs and actions can be affected by media coverage. In this paper, I study the effect of newspaper coverage of climate change on individual driving behaviour. I construct a measure of the tone of coverage based on comparisons between environmental and sceptical texts. I then use this measure, along with detailed information about driving patterns, to test whether households' travel decisions are affected by the coverage that they have recently received. I find that coverage of climate change that uses an environmental tone causes households to make environmentally friendly travel decisions, particularly when good substitutes are available. Since driving is a major source of carbon emissions, these results illustrate a potential externality of media coverage.

Media is a primary source of information about important political, social and scientific issues and plays a crucial role in informing the decision-making of their consumers. For example, viewers' and readers' voting behaviours are affected by the political slant of the media they consume (DellaVigna and Kaplan, 2007; Gerber *et al.*, 2009). Entertainment media can also affect decision-making by modelling behaviour to be emulated or avoided (La Ferrara *et al.*, 2012; Kearney and Levine, 2015).

The influence that media has over behaviour has motivated concerns about the content of media coverage, ranging from concerns about moral panics to objections to partisan biases and 'fake news' (Allcott and Gentzkow, 2017). By choosing which information to present, which experts to quote and what language to use, media outlets influence, not only the information that consumers receive, but also how it is framed. Given that media coverage has real effects on political opinions, voting patterns and pro-social behaviours, these choices may have substantial social benefits or costs. The potential for media coverage to inform actions is particularly important in the case of climate change since it is a case where the sum of individual actions can have catastrophic consequences.

Media coverage is the primary lens through which the general public learns about environmental issues. Thus, the fact that a sceptical viewpoint is prevalent—only 53% of Americans believe

* Corresponding address: Graham Beattie, Loyola Marymount University, 1 LMU Drive, Los Angeles, CA 90045, USA. Email: graham.beattie@lmu.edu

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The data and codes for this paper are available on the Journal repository. They were checked for their ability to reproduce the results presented in the paper. The author was granted an exemption to publish parts of their data because access to these data is restricted. However, the author provided the Journal with temporary access to the data, which enabled the Journal to run their codes. The codes for the parts subject to exemption are also available on the Journal repository. The restricted access data and these codes were also checked for their ability to reproduce the results presented in the paper. The replication package for this paper is available at the following address: https://doi.org/10.5281/zenodo.11376471.

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in anthropogenic climate change[1]—raises the possibility that the media is not adequately informing the public. Indeed, the media is often criticised for being too sceptical of climate change (Boykoff, 2011) due to media capture by advertisers in carbon-emitting industries (Beattie, 2020) and to journalistic norms for presenting a balance between an environmental perspective that aligns with the scientific consensus and a sceptical perspective that questions the existence or importance of anthropogenic climate change (Shapiro, 2016).

In this paper, I analyse the consequences of this coverage by estimating the effects of coverage of climate change on everyday travel decisions. These decisions have a large cumulative impact on emissions—personal vehicles account for around 15% of total US greenhouse gas emissions—so reducing vehicle emissions would have substantial social benefit.[2]

For a motivating example that illustrates the relationship that this paper investigates, consider a household that is making a travel decision with environmental consequences—for example, choosing whether to use their SUV or their compact car to run errands. They are more likely to choose the compact car if they are more concerned about the environmental consequences of their behaviour. If the media coverage that they have recently consumed is one of the factors that determines their level of concern then environmental coverage can have a real effect on their choice of vehicle and the emissions they produce. On the other hand, if that media coverage ignores climate change or is biased toward a sceptical perspective about climate change, the effect on emissions may be attenuated or even positive. Given the scale of media consumption, the aggregate effects could be substantial.

One key aspect of the underlying mechanism—a role for information in decision-making about environmental issues—has been demonstrated in other contexts (Cutter and Neidell, 2009; Allcott, 2011). Consumers may be uncertain about the social cost of particular actions, so providing them with more information about this cost can affect their decisions. This is the motivation for informational and voluntary mechanisms, such as public warnings and eco-labelling programs, that serve as policy instruments to encourage environmentally friendly behaviours. These mechanisms rely on information and persuasion to induce more environmental behaviour. This can occur either if there is a set of consumers who would prefer to make 'greener' choices, but who find that the necessary information to do this is too costly to acquire, or if there is a set of consumers who can be persuaded to increase the weight they give to environmental issues in decision-making.

My empirical analysis tests whether news coverage can fill a role similar to these informational policy interventions. I test the hypothesis that individuals and households will choose lower-emission modes of travel if they have recently received environmental coverage of climate change, particularly if they have better low-emission substitutes available. To do this, I use a dataset containing households' driving decisions as well as a measure capturing the tone and quantity of media coverage of climate change that they are likely to have received.

The measure of tone relies on a comparison between environmental and sceptical texts of climate change. I compare phrase frequency in two scientific documents concerning climate change, one environmental and one sceptical, as well as two texts aimed at a non-scientific audience. This generates two sets of phrases, one containing phrases used more often in environmental documents and the other containing phrases used more often in sceptical documents. I then search for these phrases in articles mentioning climate change in the Newslibrary database, which contains

[1] *Source:* http://climatecommunication.yale.edu/visualizations-data/ycom-us/.
[2] *Source:* https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions.

a complete set of articles from hundreds of local US newspapers. Articles that contain more environmental phrases than sceptical phrases are classified as environmental and articles that use more sceptical phrases are classified as sceptical. I then match these articles to zip codes using zip-code-level circulation data.

I match these coverage data to the National Household Travel Survey (NHTS) (Federal Highway Administration, 2009), which provides detailed travel data for a sample of over 150,000 households. For each household, data are collected for one day between March 2008 to April 2009. For that day, the data contain detailed information about each trip taken by members of the household, including time, distance and mode of travel, as well as demographics and information about household vehicles.

In the main empirical analysis, I investigate whether a household's travel decisions are a function of environmental coverage in newspapers delivered to their zip code. In this analysis, it is crucial to overcome selection bias in order to establish causality. It is clear that finding that consumers who read environmental coverage make more environmentally friendly decisions is not sufficient evidence that the coverage causes the decisions—consumers who are more concerned about the environment may choose both to read about it and act upon it. To ensure that results are not driven by this selection effect or by individual heterogeneity, I use a full set of fixed effects at the zip code level—the level at which the newspaper coverage variable is measured. The main empirical analysis effectively creates a panel at the zip-code–day level, so results reflect within zip code variation and show whether a household in a particular zip code that has recently received environmental coverage of climate change travels in a more environmentally friendly way than households in the same zip code at other times. Since consumers are matched to newspaper coverage at the zip code level, individual or household newspaper consumption choices do not bias the analysis.

Figure 1 previews some of the main findings. Recent environmental coverage of climate change causes people to make more environmentally friendly decisions, such as using their household's most fuel-efficient vehicle, increasing the number of people on a given trip or carpooling to work. These are examples of behaviours with good substitutes, so the choice has a smaller cost. On the other hand, there is no effect on a more costly behaviour with larger welfare effects—avoiding driving altogether—unless the sample is restricted to a subsample with better substitutes for driving such as those in urban areas when the weather is nice. Similarly, there is only a detectable effect on a measure of overall welfare—overall fuel use—for households that have good substitutes for driving. This result highlights the importance of available substitutes for high-emission activities.

The effect sizes in the main analysis are non-trivial. For instance, I find that the persuasion rate for one environmental article on a household choosing their most fuel-efficient vehicle is 2%. This means that after an environmental article appears in a newspaper delivered to a household 2% of trips that would otherwise have been taken in another vehicle are taken in a household's most fuel-efficient vehicle.

The analysis focuses on only one category of behaviours with environmental consequences—day-to-day travel. The importance of personal vehicles as a source of carbon emissions motivates this choice. Furthermore, by limiting the scope, I am able to exploit the detailed nature of the data to paint a more complete picture of the relationship between media coverage and behaviour than previous studies do. I am also able to show that the timing of the relationship and heterogeneity in factors such as tone of coverage and type of travel behaviour are consistent with a causal effect

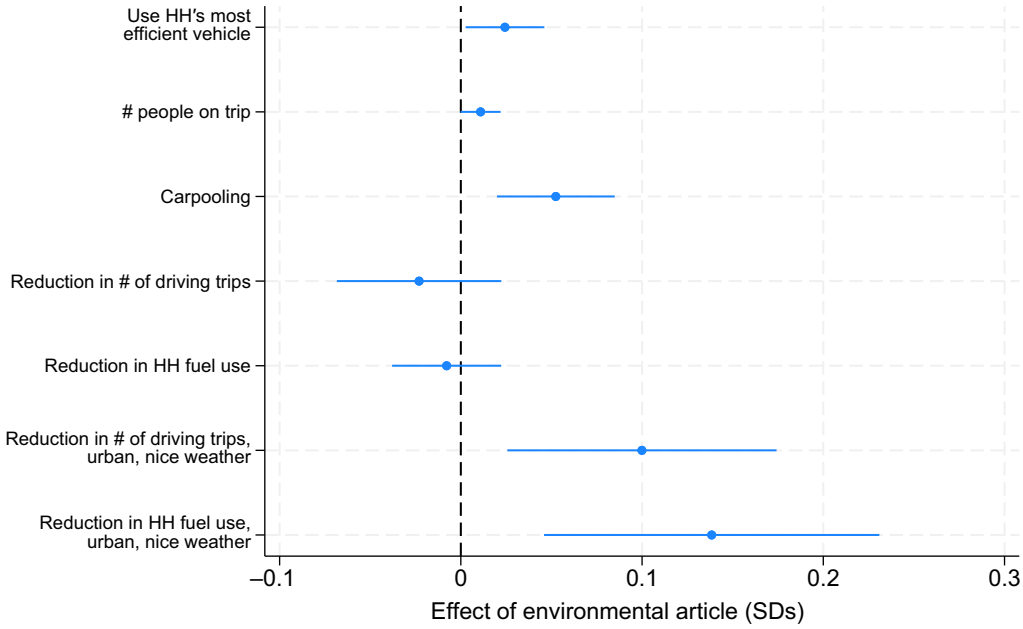


Fig. 1. *Effect of an Environmental Article in the Past Week.*
Notes: Each row represents the effect of one environmental article about climate change a household received in the previous week (∼ 3 SDs) in a regression with the listed variable as the dependent variable. Control variables include fixed effects for month, zip code and day of week as well as weather, air quality, gas price and household income. For individual-level regressions, age, sex and education are also included. The error bars represent the 95% confidence interval using SEs clustered by county by month. Regression tables are shown in Section 5.

of environmental coverage on behaviour. This provides further evidence that the main results are not spurious.

For example, I find the intuitive result that the largest effects of coverage are on actions for which an individual has available substitutes—trips in urban areas on temperate days or choosing a more fuel-efficient vehicle from among household vehicles. Concern over the environment reduces the utility provided by high-emission travel, but only causes a change in behaviour if there are available lower-emission substitutes that provide similar levels of utility.

I also compare the effect of environmental coverage with the effect of sceptical coverage and find that sceptical coverage has no effect on behaviour. This suggests that the content of media coverage is relevant and that the effect is not solely due to increasing salience. It also provides insight into the consequences of biased coverage of climate change—if newspapers bias coverage either by omitting environmental coverage or by replacing it with sceptical coverage then consumers will take fewer environmental actions than if the newspaper printed the environmental coverage. If the counterfactual for a sceptical article is an environmental article then this represents a social cost of climate change scepticism in the media.

Lastly, I find that the effect of coverage only lasts one or two weeks. This has implications for policies such as environmental nudges. In order to maximise the probability that consumers voluntarily choose environmentally friendly actions, they must be reminded regularly about the consequences of their actions.

1. Related Literature

This paper examines the consequences of media bias in terms of its effect on environmental behaviour. By addressing this question, it contributes to the literature in two areas: the analysis of the effects of media coverage and the analysis of information mechanisms in environmental contexts.

Previous work studying media coverage of environmental issues has shown how coverage, in particular about climate change, is biased by journalistic norms for balance (Boykoff and Boykoff, 2007; Shapiro, 2016) and by media capture by firms in carbon-emitting industries (Beattie, 2020). While this is a particularly important case of media bias, it is also consistent with other analyses of media coverage, which show that media coverage may be biased by journalists' interests (Baron, 2006) or by media outlets catering to consumers (Gentzkow and Shapiro, 2010) or advertisers (Reuter and Zitzewitz, 2006; Beattie *et al.*, 2021).

There is a substantial literature that shows that media coverage can affect voting. For example, DellaVigna and Kaplan (2007) and Martin and Yurukoglu (2017) showed that exposure to Fox News increases Republican vote share; Gerber *et al.* (2009) performed a field experiment by distributing the *Washington Post* and *Washington Times* to a random group of voters and showed that receiving the *Washington Post* increased support for Democrats; and Chiang and Knight (2011) used the timing of newspaper endorsements of presidential candidates to show that endorsements do persuade voters. On the other hand, media has not been uniformly shown to affect behaviour in the way journalists might hope or expect: Barrera *et al.* (2020) showed that while fact-checking does increase voter knowledge, it does not affect candidate or policy preferences.

Other work has shown that entertainment media can have an effect on behaviour. For instance, exposure to television decreases domestic violence in India (Jensen and Oster, 2009), watching soap operas lowers fertility (La Ferrara *et al.*, 2012) and increases divorce rates (Chong and La Ferrara, 2009) in Brazil, and exposure to the MTV reality show *16 and Pregnant* reduces teen pregnancy rates (Kearney and Levine, 2015).[3]

The COVID-19 pandemic has directed attention to the role of media in encouraging or discouraging behaviours that might mitigate the spread of infection. Viewers of Fox News were less likely to buy hand sanitizer or masks and travelled more outside their house (Ananyev *et al.*, 2021; Simonov *et al.*, 2022; Ash *et al.*, 2024). Furthermore, there was considerable heterogeneity between viewers of different Fox News programs (Bursztyn *et al.*, 2020).

There has been little research examining the effect of media on environmental behaviour, a notable exception being Jacobsen (2011), who showed that exposure to Al Gore's film *An Inconvenient Truth* increased purchases of carbon offsets. There is also little research into the effect of newspapers on behaviour other than voting. News media play a fundamentally different role from television shows or films since the primary goal is to provide information as opposed to entertainment. In addition, newspapers bundle information about the environment with information about politics, sports and current events, thus providing environmental content to consumers who are not specifically seeking it. Given these differences, this paper identifies a different mechanism than has previously been studied.

The environmental context of the analysis places it within the literature examining the use of non-price mechanisms to reduce energy consumption and pollution. These mechanisms, which can be seen as complements or alternatives to politically challenging policies like Pigouvian taxes, have been shown to be effective in several different contexts.

[3] For a more comprehensive overview of this literature, see DellaVigna and La Ferrara (2015).

Previous work shows that environmental information treatments can affect individuals' consumption decisions. For example, when provided with information about the social cost of energy use by government (Reiss and White, 2008) or researchers (Ito *et al.*, 2018), individuals consume less electricity. Energy consumption is also sensitive to detailed information about a household's energy use (Jessoe and Rapson, 2014) and energy use by peers (Allcott, 2011; Costa and Kahn, 2013). It has also been demonstrated that policies aimed at changing driving behaviour can be successful, as Cutter and Neidell (2009) showed that there are fewer cars on the road on days when local authorities ask residents to reduce their driving to avoid particularly high levels of air pollution.

This paper contributes to the literature examining information treatments in environmental economics in three major ways. First, by studying the effect of media coverage I consider a much more widespread channel for disseminating information or persuasive messages. Second, unlike previous studies, the information treatment in this paper is not specifically crafted and targeted to induce pro-social behaviour: I examine the provision and dissemination of information in a 'market' setting. Finally, the richness of the NHTS dataset allows for a more detailed analysis of travel behaviour: instead of simply observing a single outcome variable, such as electricity used or the number of vehicles on the road, I am able to analyse substitution patterns between trips, modes of travel and vehicles.

2. Conceptual Framework

The model underlying the empirical analysis is straightforward and intuitive. While a more formal version is available in the Online Appendix, the basic framework is as follows.

Consumers choose whether or not to take a trip. If they take the trip, they also choose among modes of travel. Each option provides intrinsic utility and may also cause emissions that impose a cost on the environment.

Consumers have preferences for cleaner air and lower risks from climate change and therefore for lower emissions. Although any individual consumer's impact on major environmental issues is negligible, previous research has shown that imposing an externality on others by contributing to climate change may result in utility costs, as consumers receive a 'cold-prickle' or negative warm-glow cost from their action (Kotchen and Moore, 2008; Costa and Kahn, 2013). Furthermore, since travel decisions are often publicly visible, consumers may react to the possibility of a social penalty for conspicuously imposing a negative externality on others or a social reward for making choices perceived as virtuous.

The main prediction of this framework is that, since guilt and social sanction from imposing a negative externality increase with the perceived magnitude of the externality, information that increases this perceived magnitude or makes it more salient will deter consumers from high-emission travel.

A second prediction is that consumers are more likely to switch to an alternative choice if it provides similar utility independent of emissions. The most likely cases to find effects of coverage on travel behaviour are those where better substitutes are available.

3. Data

In order to evaluate the hypotheses proposed in the previous section, it is necessary to have valid measures of both environmental newspaper coverage and environmental driving behaviour. In

this section, I describe how each of these measures is constructed as well as other data sources that provide control variables.

3.1. *Newspaper Coverage*

3.1.1. *Construction of the measure of coverage*

The main source of data on newspaper coverage is the Newslibrary database. This database contains a searchable archive of articles from thousands of US newspapers, allowing the user to access bibliographical information from all articles that match chosen search terms.[4] For example, it is possible to extract bibliographical information from all articles mentioning 'climate change' within the time frame of the NHTS data (March 2008 to April 2009). The Newslibrary database includes many local or regional newspapers, but does not include national newspapers such as the *New York Times, Wall Street Journal* or *Washington Post*. These national newspapers operate in a fundamentally different media market than local newspapers as they focus primarily on national or international issues of interest to the entire country. Local newspapers are more readily comparable with each other and are more representative of the media coverage individuals consume since they cover both the major national news that national newspapers cover and the more local news of interest only to people in a particular geographic area.

A simple count of the number of articles mentioning 'climate change' would provide some information about the quantity of coverage devoted to climate change, but it would not distinguish among the many possible contexts in which climate change might be mentioned. For instance, many articles present a sceptical perspective about climate change that argues against the scientific consensus. Other articles only refer to climate change tangentially. To separate different types of coverage, I construct an index of the tone of coverage of climate change using sentiment analysis based on the methodology of Gentzkow and Shapiro (2010). Specifically, I create a set of search terms that, when used in an article mentioning 'climate change', suggest that the article is more likely to be written from an environmental perspective. These search terms are phrases used more often in environmental texts about climate change relative to sceptical texts.

The index is based on a 'bag-of-words' model of text (Gentzkow *et al.*, 2019). In this type of model an author constructs a document by drawing phrases from a distribution that is determined by the topic that they are writing about and the perspective that they take. This implies that a document can be classified by comparing its use of phrases to usage in base texts, which are documents with a known perspective. If a document shares many phrases with a base text, it is likely that the distribution it is drawn from is close to the distribution that the base text is drawn from and thus that it shares a similar perspective. Since the base texts are documents with known perspectives, this technique can be used to classify documents of unknown perspectives.

I use two pairs of base texts. Each pair is written with a similar level of technicality and contains one document presenting an environmental perspective about climate change and one document presenting a sceptical perspective. The first pair is the 2007 Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) and *Climate Change Reconsidered*, a report produced in 2009 by the Nongovernmental International Panel on Climate Change (NIPCC).[5] The IPCC, which shared the 2007 Nobel Peace Prize with Al Gore, is affiliated with the United

[4] The total of number of newspapers that appear in both the Newslibrary database and the separately purchased subscription data is 516. A complete list is available in the Online Appendix.

[5] Both organisations have produced subsequent reports. These reports were chosen because they are closest in time to the period of analysis.

Nations. Its reports are written by thousands of climate scientists and reflect the consensus scientific perspective—that climate change is caused by human activity and is a serious threat (Intergovernmental Panel on Climate Change, 2007). The NIPCC is supported by a number of conservative think tanks, in particular the Heartland Institute. Its reports are written by scientists sceptical of the scientific consensus and are intended to present a scientific argument against the conclusions of the IPCC (Idso and Singer, 2009).

As a second set of base texts, I use the books *Storms of My Grandchildren: The Truth about the Coming Climate Catastrophe and Our Last Chance to Save Humanity*, which was written by James Hansen and published in 2009 (Hansen, 2009), and *The Great Global Warming Blunder: How Mother Nature Fooled the World's Top Scientists*, which was written by Roy Spencer and published in 2010 (Spencer, 2010). Hansen is a prominent climate scientist who argues that climate change is an even more severe problem than the IPCC presents, while Spencer is a prominent climate sceptic and one of the lead authors of the NIPCC report. Each of these books is an attempt to present the author's perspective to a non-scientific audience and each was published close to the time of the NHTS survey.

The publication date of three of the four base texts was shortly after the time period being studied. This is an advantage as, given the time period necessary to produce books or major scientific reports, they were written and edited shortly before or contemporaneously with the newspaper articles being classified. This suggests that any significant variation over time in language use should not bias the results. The one exception is the IPCC report, which was published in 2007. In Section 5 below, I use the 2014 IPCC report as a robustness check and find that it identifies a similar set of words and yields virtually identical results.

To compare each set of base texts, I begin by cleaning the text in four steps. First, I remove all punctuation and change all capital letters to lowercase letters. Second, I remove stop words—short words such as 'and' and 'the'. These words appear in high frequencies in all documents, but are generally not indicative of a particular perspective. Third, I stem each word by removing grammatical suffixes such as plural and verb tense markers. This ensures that the classification of phrases is not driven by grammatical context. Finally, I sort the text into two-word phrases. There is a trade-off between analysing single words, which are more frequent, but less meaningful, and longer phrases, which are sparser, but more meaningful. Two-word phrases provide some context for a word and common phrases will repeat numerous times across documents.

After cleaning the text, I use a Pearson's chi-squared test to identify phrases used significantly more often in environmental documents. Specifically, for each phrase p that appears at least once, I calculate the following formula for each pair of base texts:

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

with f_{pe} and f_{ps} the numbers of occurrences of phrase p in the environmental text and the sceptical text, respectively, and $f_{\sim pe}$ and $f_{\sim ps}$ the numbers of occurrences of all other phrases in each text.

There are two values of χ_p^2 for each phrase. One tests whether the phrase is used with a different frequency in the IPCC report relative to the NIPCC report and the other compares frequencies in Hansen's and Spencer's books. I define environmental phrases as those that are used significantly more frequently (with 95% confidence) in the environmental base text in both pairs of base texts. A similar pair of tests identifies sceptical phrases. Using both pairs of base texts ensures that

Table 1. *Indicative Phrases.*

Most environmental phrases	Most sceptical 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

the indicative phrases are used in both more scientific and less scientific treatments of climate change and are not based on writing idiosyncrasies.

Table 1 lists the twelve most environmental and sceptical phrases, in their cleaned form.[6] The most environmental phrases are commonly used to discuss the causes of, consequences of and solutions to climate change. The most sceptical phrases are used to present arguments against concern about climate change; for example, that carbon dioxide exists only in small concentrations in the atmosphere or that there are natural variations in climate over time.

To construct the measure of coverage, I perform a series of searches within the Newslibrary database, searching for articles that contain the phrase 'climate change' along with each of the indicative phrases in turn[7] and collecting basic bibliographic information for each article that satisfies a search query.

An article is classified as environmental if it uses more environmental phrases than sceptical phrases and as sceptical if it uses more sceptical phrases then environmental phrases. This binary classification has advantages—it is simple and intuitive and will provide easily quantifiable results—and disadvantages—it ignores finer distinctions between articles with many environmental phrases and articles with fewer. To counteract this disadvantage, I use a more continuous measure—the number of environmental phrases—in an alternative specification.

Table 2 demonstrates that the measure can successfully identify environmental and sceptical articles. It lists the articles of each type that have the biggest difference between the number of environmental phrases and the number of sceptical phrases. The titles demonstrate that the articles with many more environmental phrases take a very different perspective about climate change than the articles with many more sceptical phrases.

Once classified, articles are matched to zip codes using circulation data purchased from the Alliance for Audited Media (Alliance for Audited Media, 2008). This third-party verified data provides the share of households in each zip code that subscribe to each local newspaper. I use the last audited circulation value before the start of the data, which usually occurred between March

[6] For the purposes of choosing the phrases to be included in Table 1, I define the most indicative phrases as those with the highest mean chi-square values for both base text comparisons. Complete lists of indicative phrases are given in the Online Appendix.

[7] The phrases are put through the inverse of the cleaning process before the search. For example, the search for 'develop country' includes the permutations 'developed country', 'developing country', 'developed countries' and 'developing countries' and the search for 'China India' includes 'China and India'.

Table 2. *Articles with the Most Environmental and Sceptical Phrases.*

Rank	Most environmental articles	Most sceptical articles
1	Diversifying our energy supply and confronting climate change	Planet has cooled since Bush took office Scientists continue dissenting Gore admits I've failed badly Global sea ice grows
2	Green energy: will it break or make the economy?	Earth's fever breaks: global cooling under way
3	Containing climate change: an opportunity for US leadership	Will media expose global warming con job?
4	Going climate neutral: it's possible to adopt an earth-friendly lifestyle	Global warming will stop new peer-reviewed study says
5	Will nations build on climate change momentum of 2007?	Nature not human activity rules the climate
6	What unchecked climate change will mean and what we need to do about it	US Senate report debunks polar bear extinction fears
7	Carbon goes to market	Globe may be cooling on global warming
8	Sea change under way: cities including Buffalo must address the growing problem of climate change	Recent research points to cooling
9	Global climate change response can spur 7 trillion in clean energy investment by 2030	Out of gas
10	With election an assured shift in climate policy	Planet chilling out

Notes: The most environmental articles are the articles with the highest difference between environmental and sceptical phrases, with the number of environmental phrases acting as a tiebreaker. The most sceptical articles are the articles with the highest difference between sceptical and environmental phrases, with the number of sceptical phrases acting as a tiebreaker.

2007 and March 2008.[8] I then create a circulation-weighted measure of coverage—the number of environmental articles in each newspaper delivered to a zip code weighted by the proportion of households in the zip code that subscribe to each newspaper. This measure represents the expected number of environmental articles that a household in the zip code receives.

3.1.2. *Verifying the measure of coverage*

The measure of newspaper coverage is closely related to that used by Beattie (2020), who showed that advertising from car manufacturers causes more sceptical coverage of climate change, and is identical to that used by Beattie and Meyer (2022), who showed that newspapers in a state use more environmental language about climate change if there is a Democratic governor. In order to provide a clearer picture of the correlates of the measure of coverage and demonstrate that it measures something meaningful, Figures 2 and 3 and Table 3 show a simplified version of the analyses in these papers.

For each county, Figures 2 and 3, respectively, show the average numbers of environmental and sceptical articles delivered to each household each day.[9] In general, people in more Democratic and urban areas are more likely to subscribe to newspapers and have newspapers with more pages and thus more articles about climate change. Therefore, they receive both more environmental and more sceptical coverage. Columns (1) and (2) of Table 3 show regression results at the zip code level. The number of environmental and sceptical articles is strongly correlated with both whether the zip code is in a county that voted Democratic in the 2008 presidential election and

[8] A map showing a county-level distribution of subscriptions is shown in the Online Appendix. Subscription rates are highest in urban areas and in the Northeast and on the West Coast, and lowest in the South.

[9] Most of the subsequent analysis is at the zip code level. Maps are aggregated to the county level for the sake of legibility. For the same reason, Alaska and Hawaii are included in the analysis, but are not shown in these maps.

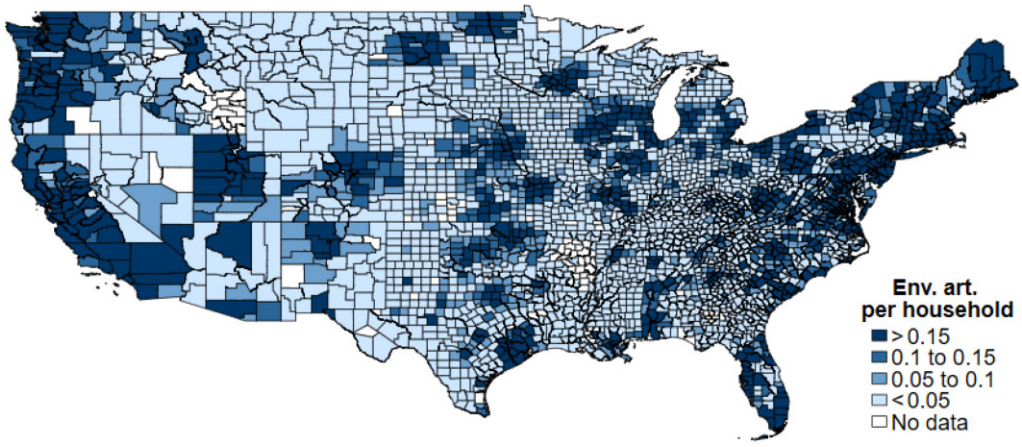


Fig. 2. *Average Number of Environmental Articles.*

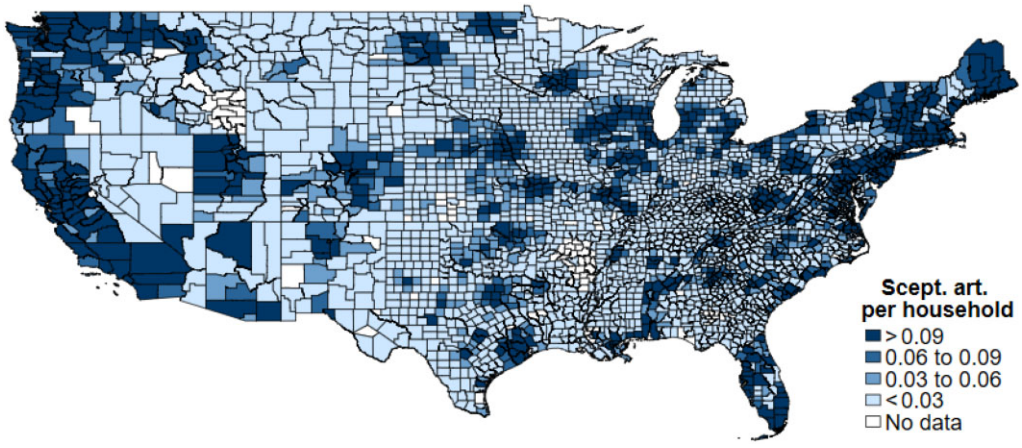


Fig. 3. *Average Number of Sceptical Articles.*

whether the zip code is in an urban area.[10] The relationship with overall tone of coverage is more ambiguous. Column (3) of Table 3 shows that there is no clear relationship between voting preferences in a county and the share of articles delivered in that county that are environmental.

Finally, column (4) of Table 3 shows that the number of environmental articles in a particular newspaper and month is negatively correlated with the amount of advertising for trucks that the newspaper received in that particular month.[11] Column (5) shows a negative point estimate for

[10] Voting data are taken from Congressional Quarterly data. The urban/rural classification for zip codes is taken from University of Michigan Population Studies Center Social Research (2023). Zip-code-level data are matched to county-level data using US Department of Housing and Urban Development (2020).

[11] Advertising data were purchased from the Ad$pender database produced by Kantar Media (Kantar Media, 2009).

Table 3. *Tests of the Measure of Coverage.*

Dep. variable:	(1) Circ.-weighted env. articles (average)	(2) Circ.-weighted scept. articles (average)	(3) Env. articles share (average)	(4) Environmental articles	(5) Sceptical articles
Democrat win	0.0091***	0.0038***	0.0126		
	(0.002)	(0.0018)	(0.0104)		
Urban	0.0083***	0.0043***	−0.0226**		
	(0.0015)	(0.0006)	(0.0097)		
Democrat win	0.0030	0.0015	0.0003		
× urban	(0.0021)	(0.0010)	(0.0128)		
Truck advertising (thousands of $)				−0.0061***	−0.0017
				(0.0016)	(0.0011)
State FEs	Yes	Yes	Yes	No	No
Newspaper FEs	No	No	No	Yes	Yes
Observations	21,503	21,503	21,503	1,509	1,509
Mean of dep. variable	0.022	0.011	0.640	7.36	3.47

Notes: SEs clustered by state (columns (1)–(3)) or newspaper (columns (4)–(5)) are reported in parentheses. *** $p < .01$, ** $p < .05$. In columns (1) and (2) the dependent variables are the average number of circulation-weighted environmental and sceptical articles, by zip code. In column (3), the dependent variable is the average circulation weighted environmental articles as a share of circulation-weighted environmental and sceptical articles. In columns (4) and (5), the dependent variable is the number of environmental or sceptical articles at the newspaper-month level.

the relationship between sceptical articles and truck advertising, but the coefficient is smaller in magnitude and insignificant.[12]

Taken together, Figures 2 and 3 and Table 3 illustrate the distribution of coverage of climate change. There is more coverage in urban and Democratic areas and when there is less financial pressure created by truck advertising. This is reflected in more articles classified as environmental as well as more articles that are classified as sceptical. These geographic differences are compounded by similar geographic differences in newspaper subscription rates.

3.2. *Travel Data*

Travel data are taken from the 2009 NHTS produced by the Federal Highway Administration division of the Department of Transportation.[13] In this survey, approximately 150,000 households were selected to complete a travel diary for one day of travel between March 2008 and April 2009. Prior to the travel day, each household member completed a demographic survey and detailed information was collected about each of the households' vehicles. The vehicle make, model, year and body type is then matched by the NHTS to EPA data that provides fuel efficiency based on 55% city driving and 45% highway driving. During the assigned travel day, each member of the household was asked to complete a travel diary to record information about each trip they took, including the purpose of the trip, the mode of travel, the length of the trip, the vehicle used and the number of the people on the trip. If the travel diary was completed, which was the case for 72% of respondents, it was relayed to interviewers over the phone during a follow-up interview

[12] The results shown in Table 3 simply show correlations, and should not be interpreted causally. For more complete analyses providing better evidence of a causal effect of advertising and political outcomes on coverage, see Beattie (2020) and Beattie and Meyer (2022).

[13] I use a restricted-access version of the NHTS to augment the public use data. These data provide information about the respondent's zip code as opposed to state, and the exact date of travel as opposed to month.

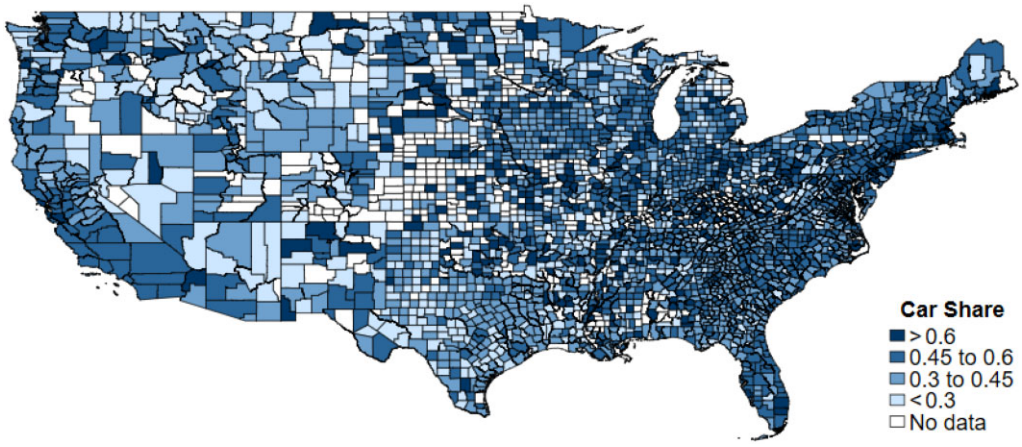


Fig. 4. *Cars as a Share of Personal Vehicles.*

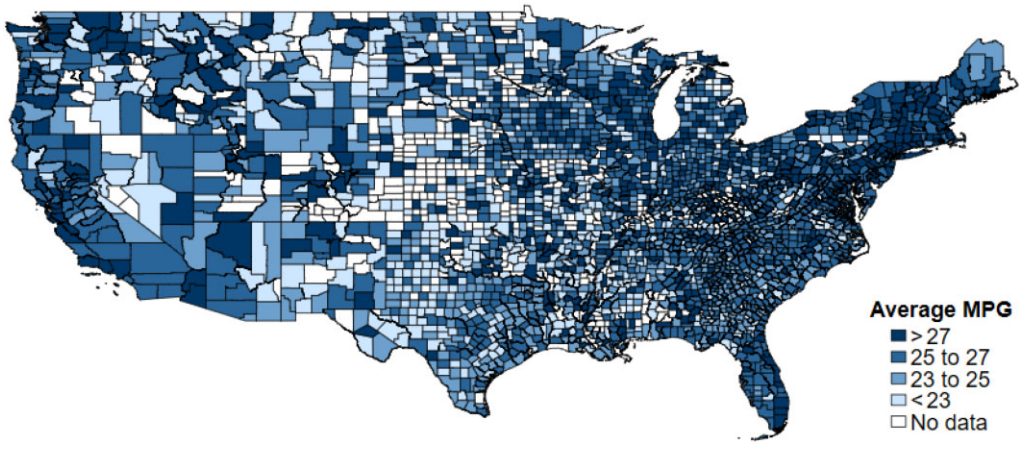


Fig. 5. *Average Miles per Gallon of Vehicles.*

within a week of the travel day. If the diary was not completed, respondents were asked to provide details of each trip from memory.

Figures 4 and 5 show the distribution of vehicles around the country by type and mileage, respectively. Urban areas, particularly in the Northeast and West Coast have the highest share of cars as opposed to larger vehicles like trucks, vans or SUVs, while the South and Mountain states have the lowest. The areas with the highest share of cars also have the highest average fuel efficiency. In general, the areas with higher fuel efficiency and more cars are the areas with more newspaper subscriptions, illustrating the necessity of a careful identification strategy to identify causal effects.

Table 4. *Summary Statistics.*

	Observations	Mean/%	SD
Vehicles			
Efficiency (MPG)	128,158	26.51	7.31
Car	128,158	53.9%	
Trips			
Use HH's most efficient vehicle	422,910	42.3%	
People on trip	528,486	1.50	0.90
Individuals			
Age	186,198	47.84	21.84
Female	186,198	52.7%	
Bachelor's degree or higher	186,198	34.3%	
Number of driving trips (day of survey)	186,198	2.84	2.72
Households			
Fuel use (gallons, day of survey)	90,467	1.95	3.03
Exp. env. art. received (week before survey)	90,467	0.16	0.32
Exp. scept. art. received (week before survey)	90,467	0.08	0.20
Income above $80,000	90,467	30.9%	
Urban area w/pop $>$ 1 million	90,467	37.3%	
Average temperature (°F, day of survey)	90,467	61.6	17.4
Precipitation (in, day of survey)	90,467	0.08	0.31
Air quality index (day of survey)	90,467	56.00	31.58
Gasoline price ($, day of survey)	90,467	2.88	0.94
Newspapers			
Share HHs subscribed in zip codes with subscriptions	25,753	0.15	0.18
Zip codes served	516	50.11	134.41
Circulation	516	47,823	72,450

Notes: Inclusion in these summary statistics is conditional on not having missing values for any of these variables, and thus being included in most of the regressions.

3.3. *Weather and Air Quality*

In order to control for factors that might influence both coverage and public opinion about environmental issues, I include weather data from the National Oceanic and Atmospheric Administration and air quality data from the Environmental Protection Agency (Environmental Protection Agency, 2023; National Oceanic and Atmospheric Administration, 2023). The weather data are matched to a zip code by identifying the monitoring station closest to the zip code's centroid and consist of maximum and minimum daily temperatures as well as total precipitation. Air quality data are matched by core-based statistical area, and consist of the maximum of air quality index scores for ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide and particulate matter.[14] This is a standard measure of air quality, which assigns a score based on the largest threat to air quality measured at a particular monitoring station.

Table 4 shows the summary statistics for each of the variables discussed in this section along with some of the demographic variables from the NHTS that are used as control variables in the empirical analysis.

[14] There are two standard particulate matter scores. One (PM 10) measures the concentration of suspended particulate matter with diameter between 2.5 and 10 μm. The other (PM 2.5) measures the concentration of suspended particulate matter less than 2.5 μm in diameter.

4. Empirical Strategy

The main empirical specification is given by

$$\text{Action}_{i,z,t} = \beta_0 + \beta_1 \sum_{j=1}^{6} \text{Coverage}_{z,t-j} + \beta_2 X_i + \beta_3 Y_{z,t} + \mu_d + \phi_z + \psi_m + \epsilon_{i,z,t}, \quad (1)$$

where $\text{Action}_{i,z,t}$ is a travel action taken by individual i in zip code z on day t and $\text{Coverage}_{z,t-j}$ is the coverage of climate change delivered to zip code z on the day j days prior to day t (so $\sum_{j=1}^{6} \text{Coverage}_{z,t-j}$ is the total coverage in the week leading up to day t); X_i is a vector of individual controls, including age, sex, income and education and $Y_{z,t}$ is a vector of controls for zip code, including temperature, precipitation, air quality and gas prices; μ_d, ϕ_z and ψ_m are day-of-week, zip code and month-level fixed effects, respectively.

This specification evaluates whether the probability that an action is taken is a function of the coverage that an individual is likely to have read during the past week. Since each household only appears in the sample for one day, it is not possible to create individual- or household-level panel data. The data can be thought of as zip-code-level panel data, with households being representative of the zip code on the day they appear in the data set.[15]

Coverage is matched to households at the zip code level, so inclusion of zip code fixed effects means that β_1 is an estimate of short-term effects—it takes a positive value if a given action is more likely to be taken, relative to the sample average in that zip code, immediately after newspaper coverage in that zip code contains more environmental articles about climate change than the sample average.

More importantly, the zip code fixed effects account for heterogeneity across zip codes that could bias the results through selection or differential responses to coverage. It is well documented that consumers tend to read newspapers that conform to their prior beliefs (Gentzkow and Shapiro, 2010). Consumers who are more concerned about the environment may prefer newspapers that cover climate change more frequently and from a more environmental perspective. It has also been shown that consumers with 'greener' ideologies are more likely to make environmentally friendly travel decisions (Kahn, 2007). Furthermore, newspaper readership may be correlated with demographic characteristics or political ideology—factors that could also affect travel decisions. If individuals who are more likely to read environmental coverage are also more likely to take more environmentally friendly actions, then an estimate without zip code fixed effects would be biased in the direction of showing that environmental coverage causes environmental behaviour.

Alternatively, if households in zip codes that receive less environmental coverage react more to the coverage that they do receive, an estimate of the effect of coverage without zip code fixed effects would be biased away from showing that environmental coverage causes environmental behaviour.

Although the direction of the bias is uncertain, a simple regression of behaviour on coverage could yield biased estimates. Previous work studying the effect of coverage on voting decisions has used natural (DellaVigna and Kaplan, 2007) or field (Gerber *et al.*, 2009) experiments to overcome these biases. I address it by exploiting the panel nature of the data set. Coverage is matched to survey respondents at the zip code level, which means that each household is assigned coverage as if they were a representative household from their zip code. Therefore, zip-

[15] The zip code by day panel is quite sparse. In a table shown in the Online Appendix I check that inclusion in the sample is not correlated with the dependent variable.

code fixed effects ensure that β_1 is not biased by endogeneity in newspaper consumption choice or heterogeneity across households in response to coverage, so it can reasonably be interpreted as the effect of coverage on behaviour.

The zip code fixed effects also address a potential concern involving reverse causality. Newspapers may choose their coverage strategically to attract readers (Gentzkow and Shapiro, 2010), so if the potential audience of a given newspaper is particularly environmentalist and interested in reading about climate change, that newspaper may provide more of this coverage to attract more readers. However, since I match newspapers to readers using a single cross section of zip-code-level circulation, the zip code fixed effects ensure that long-term matching between newspapers and readers does not affect the results. In order for this relationship to drive the results, newspapers would need to be able to detect and react to local week-to-week shocks to public opinion. This requires an implausible level of responsiveness on the part of newspapers.

I also control for air quality, precipitation and temperature. These factors may, not only affect coverage of climate change in a way that varies both geographically and over time—for instance, unusual weather may generate discussion of its relationship to climate change—but might also influence travel decisions directly. Unpleasantly, hot weather may cause people to drive instead of walking or biking and icy weather or poor air quality may induce people to stay home. In addition to temperature, precipitation and air quality on the travel day, I control for weather during the week prior to the travel day and deviations from historical mean temperatures, variables that might affect perceptions of and coverage of weather and thus climate change.

Finally, I also include monthly fixed effects to control for seasonality, day-of-week fixed effects to control for differences between weekdays and weekends, and individual- and household-level demographic variables. Since the effect of demographics, weather and air quality on travel decisions is likely to be non-linear, I control for them non-parametrically by including fixed effects, each representing binned groups.

Estimates of (1) evaluate the short-term effect of coverage, and thus take longer-term decisions such as where to live and what vehicles to own, as given. These longer-term decisions, which may also be a function of media consumption, provide the context in which households make the day-to-day travel decisions that I study.

5. Results

In this section, I present empirical results demonstrating that newspaper coverage has an effect on driving behaviour. I begin with vehicle choice in households with multiple vehicles. This choice is made every time a trip is taken, so there are many more observations than individual- or household-level variables. It is also an example of a behaviour where good substitutes—using a different household vehicle—are likely to be available. These factors make this a particularly good place to search for an effect of coverage on behaviour. I first estimate (1) using the decision to use the household's most fuel-efficient vehicle as the dependent variable and find that environmental coverage of climate change does indeed have an effect on driving behaviour. I then perform a series of robustness checks and look for heterogeneity by both demographics and media coverage. Lastly, I present some evidence that it is newspaper coverage itself affecting behaviour and not simply news events.

Next, I consider the extensive margin of driving—how often people drive and how much fuel they use. These are behaviours that have greater social cost, but may not have good substitutes.

Table 5. *Effect of Coverage on the Decision to Use the Most Fuel-Efficient Vehicle.*

	(1)	(2)	(3)	(4)	(5)
Circulation-weighted env. articles (past week)	0.006	0.006	0.013***	0.012**	
	(0.004)	(0.004)	(0.005)	(0.005)	
Circulation-weighted env. phrases (past week)					0.004**
					(0.002)
Month fixed effects	No	Yes	Yes	Yes	Yes
Zip code fixed effects	No	No	Yes	Yes	Yes
Demographic controls	No	No	No	Yes	Yes
Weather controls	No	No	No	Yes	Yes
Air quality	No	No	No	Yes	Yes
Gas price	No	No	No	Yes	Yes
Day-of-week fixed effects	No	No	No	Yes	Yes
Observations	582,345	582,345	582,275	422,639	422,639
Mean of dep. variable	0.424	0.424	0.424	0.423	0.423

Notes: SEs clustered by county by month are reported in parentheses. *** $p < .01$, ** $p < .05$. In each column, the dependent variable is a binary variable that takes a value of 1 if a member of a household with multiple vehicles takes a trip in the household's most efficient vehicle and 0 if a trip is taken in another vehicle. Demographic controls include age, education, income and sex. Weather controls include temperature and precipitation on the day of travel and the previous week and deviations from historical mean temperatures. Weather, air quality and demographic controls consist of fixed effects representing bins of data.

I find that coverage only has a significant effect on behaviour when there is likely to be good substitutes available—carpooling or driving less when the weather is nice.

Finally, I further demonstrate the mechanics of the relationship between coverage and behaviour by discussing how likely it is that the results are explained by respondent dishonesty, showing that the tone of coverage of climate change matters, and testing how long the effect of coverage lasts.

5.1. *Vehicle Choice*

Many households own multiple vehicles, presenting them with frequent choices about which one to drive for a particular journey. In addition to environmental concerns about emissions, this decision is a function of many other factors, such as comfort, safety, appearance, available seating and carrying capacity. In Table 5, I test whether households make a different choice shortly after they are likely to have read environmental coverage of climate change.

Each trip is matched to a household vehicle, which has known fuel efficiency based on vehicle make, model, year and body type.[16] The dependent variable in Table 5 is a binary variable that takes a value of 1 if a trip is taken in a household's most fuel-efficient vehicle and 0 if a trip was taken in another vehicle. Trips taken by other modes of travel, such as walking, public transportation or taxi are excluded, as are trips taken by households who own only one vehicle. Overall, the results show that a given trip is more likely to occur in a household's most fuel-efficient vehicle during the week after a newspaper that includes more environmental articles about climate change is delivered to their zip code.

Column (4) of Table 5 presents the most demanding specification. This specification includes both month and zip code fixed effects, ensuring that seasonal trends and selection bias do not drive the results.[17] It also includes demographic controls for age, sex, education and household

[16] The fuel efficiency measure is based on EPA classification using a 55/45 city/highway split.

[17] Since each household appears in the data once, the zip-code-level fixed effects are the most demanding possible in this dimension.

income of the driver as well as local gas price. Other control variables include weather and air quality, factors that might affect both travel decisions and coverage of climate change. The weather and air quality controls include fixed effects for bins of temperature, precipitation and air quality for the day of travel, the previous week and deviations from the historical mean. Finally, it includes day-of-week fixed effects, since travel patterns are very different on weekdays than on weekends.[18] The relevant coefficient is 0.012, implying that, for every environmental article (~ 3 SDs) received by a household that owns multiple vehicles, 1.2% more driving trips are taken using the household's most efficient vehicle during the next week. For context, in a regression with continuous weather measures as independent variables, the magnitude of the effect of an environmental article is equivalent to the effect of a 17 °F increase in temperature or a 1.8 mm decrease in precipitation.

DellaVigna and Gentzkow (2010) proposed a measure of persuasion rate given by $f = [(v_t - v_c)/(e_t - e_c)][1/(1 - v_c)]$, where v_t and v_c are the outcomes for the treated and control groups and e_t and e_c are exposures to the treatment. If the treatment is receiving one environmental article then the first term in this expression is given by the estimate of β_1 in (1). The second term normalises by the persuadable population (e.g., if 90% of people already do a particular activity then only 10% are available to be persuaded). Of trips taken by households in zip codes that had received no environmental coverage in the past week, 42% were taken in the household's most efficient vehicle, so households are persuaded to use their most fuel-efficient vehicle by an environmental article about climate change at a rate of $f = 0.012 \times [1/(1 - 0.42)] = 2\%$. This is the proportion of the trips that would have been taken in a vehicle other than a household's most fuel-efficient vehicle absent receiving an environmental article that are taken in a household's most fuel-efficient vehicle after receiving an environmental article. For comparison, Chiang and Knight (2011) found that an unsurprising newspaper endorsement has a similar 2% persuasion rate (a surprising endorsement has a persuasion rate of 6.5%); Gerber and Green (2000) found mailing get-out-the-vote cards has a 1% persuasion rate on voting; Martin and Yurukoglu (2017) found persuasion rates of Fox News exposure on Republican voting equal to 58% in 2000, 27% in 2004 and 28% in 2008 (DellaVigna and Kaplan, 2007 found a persuasion rate of 11% in 2000); and Simonov *et al.* (2022) found that the persuasion rate of Fox News discouraging social distancing during the COVID-19 pandemic ranged between 6% and 30%.[19]

The measure of coverage shown in columns (1)–(4) is the circulation-weighted number of articles that use more indicative environmental phrases than indicative sceptical phrases. It does not fully take into account the intensity of the environmental coverage—a long article using several environmental phrases is not differentiated from a short article that uses a single environmental phrase and no sceptical phrases. Column (5) of Table 5 shows the marginal effect of one additional environmental phrase delivered to a household. The independent variable is now the circulation-weighted number of phrases—the expected number of environmental phrases within articles mentioning 'climate change' that a household received during the week before their assigned travel day. An additional environmental phrase has an effect in the same direction as an additional environmental article. The magnitude of the coefficient suggests that an additional environmental phrase (~ 1.2 SDs) delivered to a household increases the probability of an individual choosing to drive their household's most fuel-efficient car by 0.4%. This is approximately the same effect as one-third of an environmental article.

[18] See the Online Appendix for a more detailed explanation of each of the control variables.

[19] The Chiang and Knight (2011) and Gerber and Green (2000) persuasion rates are taken from calculations in DellaVigna and Gentzkow (2010) and the other persuasion rates are taken from the cited papers.

Table 6. *Mean Share of Trips in the Most Fuel-Efficient Vehicle.*

	(1) Zip codes with below average overall env. coverage	(2) Zip codes with above average overall env. coverage	(2) − (1) Difference
Share of trips in most fuel-efficient vehicle	0.425	0.422	−0.003*
	(0.001)	(0.002)	
Share of trips in most fuel-eff. vehicle if coverage above zip code average	0.437	0.424	−0.013***
	(0.003)	(0.002)	

Notes: SD reported in parentheses. *** $p < .01$, * $p < .1$. The sample is restricted to observations with complete data for the control variables in column (4) of Table 5.

It is important to note that the coefficients in columns (3) and (4) of Table 5 are significantly larger than the coefficients in columns (1) and (2), which do not include zip code fixed effects. Controlling for systematic differences across zip codes increases the size of the effect. This reinforces the need for the inclusion of zip code fixed effects and also uncovers the direction of the bias caused by zip code heterogeneity. The fact that the effect is larger when including zip code fixed effects indicates that the dominant bias is not caused by more environmental households choosing more environmental behaviours and demanding and receiving more environmental coverage. Instead, it indicates that households in zip codes that receive less environmental coverage respond more to the coverage they do receive.

Table 6 corroborates this story by presenting conditional means of the share of trips taken in a household's most fuel-efficient vehicle. The first row demonstrates that households in zip codes with high environmental coverage are actually slightly less likely to use their most fuel-efficient vehicle. The second row demonstrates that households in low environmental coverage zip codes are significantly more likely than those in high environmental coverage zip codes to use their most fuel-efficient vehicle if they have received more environmental coverage than they normally do. One possible explanation for this is that those in zip codes with more environmental households already have their environmental preferences reflected in the vehicles they own (as shown in Figures 4 and 5) and thus are less sensitive to short-term changes in newspaper coverage. The zip code fixed effects control for time-invariant geographical differences, which may be reflected more in vehicle purchase choices rather than propensity to choose one household vehicle over another. This is consistent with a table shown in the Online Appendix that replicates Table 5 using the fuel efficiency of the vehicle used on the trip. It shows a large positive correlation between fuel efficiency and environmental coverage that is greatly attenuated when zip code fixed effects are added to control for geographical differences in vehicle ownership.

5.1.1. *Robustness checks*

Table 7 includes alternative measures for both vehicle choice and coverage to test whether the results in Table 5 are sensitive to the choices made in constructing these variables.

Column (1) includes the difference between the fuel efficiency of a household's most fuel-efficient vehicle and the average fuel efficiency of all of their vehicles. The coefficient on this term is negative, showing that if a household's most fuel-efficient vehicle is more of an outlier, they are less likely to use it.[20] The interaction between this variable and coverage is positive, suggesting

[20] This specification includes fixed effects for the number of household vehicles to avoid the mechanical result that, if vehicles are randomly chosen, the spread in fuel efficiency among a household's vehicles would increase and the probability of choosing a particular vehicle would decrease as the number of vehicles increases.

Table 7. *Effect of Coverage on Vehicle Choice—Alternative Specifications.*

Dep. variable:	(1) Use most eff. vehicle	(2) Eff. rank	(3) Use least eff. vehicle	(4) Use most eff. vehicle	(5) Use most eff. vehicle	(6) Use most eff. vehicle	(7) Use most eff. vehicle
Circ.-weighted env. art. (past week)	0.004	0.011**	−0.006	0.012**	0.012**	0.011**	0.010
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
Efficiency diff.	−0.0053***						
	(0.0003)						
Efficiency diff. × weighted env. art.	0.0017***						
	(0.0007)						
Time FEs	Month	Month	Month	Month	Month	Week	State × week
Cov. measure	Baseline	Baseline	Baseline	Scept. = env.	2014 IPCC	Baseline	Baseline
Zip code FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demog./Weather/AQ	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gas price	Yes	Yes	Yes	Yes	Yes	Yes	No
Day-of-week FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	422,639	422,639	422,639	422,639	422,639	422,639	422,638
Mean of dep. var.	0.423	0.522	0.383	0.423	0.423	0.423	0.423

Notes: SEs clustered by county by month are reported in parentheses. *** $p < .01$, ** $p < .05$. In columns (1) and (4)–(7), the dependent variable is a binary variable that takes a value of 1 if a trip is taken in the household's most efficient vehicle. In column (2), it is a continuous version of this variable. In column (3) it is a binary variable that takes a value of 1 if a trip is taken in the household's least efficient vehicle. Efficiency difference is the difference in miles per gallon between a household's most efficient vehicle and the average of all of their vehicles. Alternative measure 1 of environmental articles restricts the number of sceptical phrases to be equal to the number of environmental phrases. Alternative measure 2 only includes phrases that are also significant when comparing the 2014 IPCC report with the NIPCC report. Demographic controls include age, education, income and sex, as well as number of household vehicles in column (1). Weather controls include temperature and precipitation on the day of travel and the previous week and deviations from historical mean temperatures. Gas price is omitted in column (7) because state-by-week fixed effects absorb all variation. Weather, air quality (AQ) and demographic controls consist of fixed effects representing bins of data.

that if they have an outlier vehicle they are more easily nudged into using it by coverage, perhaps because the environmental benefits of switching vehicles are larger or more salient.

Columns (2) and (3) use alternative measures for vehicle choice. Column (2) turns the binary variable into a continuous variable that ranges from 0 to 1. For example, if a household has three vehicles, a trip in the most fuel-efficient vehicle would take a value of 1, a trip in the second most fuel-efficient vehicle would take a value of $\frac{1}{2}$ and a trip in the least efficient vehicle would take a value of 0. The results in this column are very similar to the equivalent column in Table 5. Column (3) tests whether a household is less likely to use its least fuel-efficient vehicle after receiving environmental coverage. The coefficient is negative, which is consistent with environmental coverage inducing environmental behaviour, but it is insignificant and has a magnitude one-half of the most efficient vehicle specification.

Columns (4) and (5) use alternative measures of coverage. In the baseline measure of coverage there are many more sceptical phrases than environmental phrases, which may be a function of the sceptical texts being shorter and thus more prone to outliers. To test whether this affects results, column (4) restricts the sceptical phrases to the most significant forty-six phrases to match the number of environmental phrases. Column (5) addresses the concern that the 2007 IPCC report was published two years before the other base texts by only including phrases that are used significantly more or less in the 2014 IPCC report relative to the NIPCC report in addition to passing the tests used in the baseline measure of coverage. Both of these specifications yield almost identical results to the baseline measure, suggesting that the results are not highly sensitive to the construction of the measure of coverage.

Lastly, columns (6) and (7) replace the month fixed effects in the main specification with week and state-by-week fixed effects, respectively. Although these specifications cost a significant number of degrees of freedom and thus the coefficients are not quite as significant, the coefficients are very similar in magnitude.

5.1.2. *Heterogeneity*

Table 8 shows heterogeneity in the results in Table 5. The relationship between coverage and driving behaviour appears to be stronger among younger, richer and more highly educated respondents, but there is no discernible difference between males and females. Younger, richer and more educated people are generally most concerned about climate change and thus may be more easily nudged into feeling guilty about causing a negative externality. Furthermore, if their peer group is demographically similar and also more concerned about the environment, they may perceive greater social pressure around environmental behaviour after consuming environmental news.

While the NHTS survey does not contain information about political affiliation, this can be approximated by using county-level results from the 2008 presidential election. The coefficient is slightly larger in counties that voted for the Republican John McCain than in counties that voted for the Democrat Barack Obama. While this result may seem initially surprising, it is consistent with the result in Table 6 that respondents are more likely to use their most fuel-efficient vehicle after receiving environmental coverage if they ordinarily receive less environmental coverage. Those in Republican counties ordinarily receive less environmental coverage and may respond more to the coverage they do receive.

Table 9 shows how vehicle choice is affected by environmental coverage from different newspapers. Columns (1) and (2) split the sample into newspapers with more or fewer than 100,000 subscribers. The effect on behaviour appears to be stronger for smaller newspapers, which tend to have fewer articles so subscribers may be more likely to read a given article. Columns (3) and (4) split the sample into zip codes that received more or fewer environmental articles than the zip code average 2–4 weeks prior to the travel day. This tests whether there are increasing or decreasing returns to the scale of environmental coverage. There is no discernible difference between these two groups, so there is no evidence for either increasing or decreasing returns.

5.1.3. *News events versus newspaper coverage*

One possible mechanism for the main result is that driving behaviour responds to local news events that involve climate change, such as a speech by a local politician. Households may learn about these events from a newspaper, from other media sources or by word of mouth. The newspaper coverage variable could serve as a proxy for all of these. While this mechanism is not identical to the entire relationship being a result of households responding directly to newspaper coverage, it does reflect the same underlying phenomenon.

To the extent that it is possible, it is worth testing whether the newspaper coverage variable is simply serving as a measure of local news events. The specification with state-by-week fixed effects in Table 7 goes some of the way toward doing this by ruling out the possibility that the relationship is driven purely by state-level shocks, but does not rule out more local shocks. Furthermore, because households in zip codes with more newspaper subscriptions may be more likely to consume other news media as well, it does not rule out newspaper coverage serving as a proxy for all media coverage. Column (5) of Table 9 addresses this possibility. The variable representing the environmental coverage that a zip code receives is divided into ‘unique’ articles that appear when no other newspaper serving the zip code has printed an environmental article in

Table 8. *Effect of Coverage on the Decision to Use the Most Fuel-Efficient Vehicle—Driver Heterogeneity.*

Sample:	(1) Age > 45	(2) Age ≤ 45	(3) HH Inc. ≥ $80K	(4) HH Inc. < $80K	(5) Educ. ≥ BA/BS	(6) Educ. < BA/BS	(7) Female	(8) Male	(9) Dem. counties	(10) Rep. counties
Circulation-weighted env. articles (past week)	0.007 (0.007)	0.029*** (0.011)	0.018** (0.008)	0.002 (0.008)	0.023*** (0.008)	0.001 (0.010)	0.013 (0.010)	0.014 (0.009)	0.010 (0.006)	0.019* (0.011)
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip code fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weather controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Air quality	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gas price	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day-of-week fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	281,390	141,177	187,246	263,976	194,656	218,598	202,890	219,641	242,512	179,871
Mean of dep. variable	0.429	0.443	0.396	0.437	0.430	0.418	0.475	0.375	0.426	0.419

Notes: SEs clustered by county by month are reported in parentheses. *** $p < .01$, ** $p < .05$, * $p < .1$. In each column, the dependent variable is a binary variable that takes a value of 1 if a member of a household with multiple vehicles takes a trip in the household's most efficient vehicle and 0 if a trip is taken in another vehicle. Demographic controls include age, education, income and sex. Weather controls include temperature and precipitation on the day of travel and the previous week and deviations from historical mean temperatures. Weather, air quality and demographic controls consist of fixed effects representing bins of data.

Table 9. *Effect of Coverage on the Decision to Use the Most Efficient Vehicle—Coverage Heterogeneity.*

Sample:	(1) Circ. > 100,000	(2) Circ. < 100,000	(3) Env. recently	(4) Not env. recently	(5) Zip codes w/ > 1 paper
Circulation-weighted env. art. (past week)	0.006	0.029**	0.012	0.014*	
	(0.006)	(0.012)	(0.009)	(0.008)	
Circ.-weighted env. art. unique in zip code (past week)					0.017*
					(0.009)
Circ.-weighted env. art. not unique in zip code (past week)					0.013
					(0.010)
Month FEs	Yes	Yes	Yes	Yes	Yes
Zip code FEs	Yes	Yes	Yes	Yes	Yes
Demographic controls	Yes	Yes	Yes	Yes	Yes
Weather controls	Yes	Yes	Yes	Yes	Yes
Air quality	Yes	Yes	Yes	Yes	Yes
Gas price	Yes	Yes	Yes	Yes	Yes
Day-of-week FEs	Yes	Yes	Yes	Yes	Yes
Observations	342,648	262,536	196,021	226,596	221,168
Mean of dep. variable	0.423	0.421	0.423	0.424	0.421

Notes: SEs clustered by county by month are reported in parentheses. ** $p < .05$, * $p < .1$. In each column, the dependent variable is a binary variable that takes a value of 1 if a member of a household with multiple vehicles takes a trip in the household's most efficient vehicle. Columns (1) and (2) split the newspaper sample by circulation. Columns (3) and (4) split the sample by zip codes that have receive more or less environmental coverage than their zip code average 2–4 weeks before the travel day. Demographic controls include age, education, income and sex. Weather controls include temperature and precipitation on the day of travel and the previous week and deviations from historical mean temperatures. Weather, air quality and demographic controls consist of fixed effects representing bins of data. Column (5) only includes zip codes that receive multiple newspapers in the sample. Unique in zip code refers to environmental articles that appear in a newspaper when no other newspapers in the zip code have provided environmental coverage in the past week.

the past week and 'not unique' articles that appear within a week of another newspaper serving the zip code printing an environmental article. If newspaper coverage only affects behaviour when it proxies for a major local story that appears in many media outlets, unique environmental articles should have a smaller effect on behaviour. However, the results show that the effects of the unique and not unique environmental coverage are similar. Although some of the effect of newspaper coverage may be due to underlying news events, the fact that coverage appearing in only one newspaper serving a zip code affects behaviour indicates that newspaper coverage itself can affect behaviour as well.

5.2. *Extensive Margin of Travel*

5.2.1. *Number of trips*

The previous section analysed choice among household vehicles, which can be framed as the intensive margin of emissions for a given trip. In this section, I analyse the extensive margin—whether environmental coverage can affect the propensity to take a trip at all. If an individual becomes more worried about the social cost of driving, they may choose not to take a given trip, particularly if the trip provides little additional utility. Table 10 shows the results of this analysis.

In column (1) of the top panel of Table 10 the dependent variable is the number of trips taken by personal vehicle.[21] The coefficient is insignificant, so there is no evidence that in the aggregate individuals choose to avoid driving trips altogether after reading environmental coverage.

[21] The unit of analysis in Table 10 is the individual, instead of the trip as in Table 5.

Table 10. *Effect of Coverage on Driving Patterns.*

Dep. variable:	(1) No. of driving trips	(2) No. of driving trips	(3) No. of trips to work	(4) No. of other trips
Sample:	Full sample	Urban, nice weather	Urban, nice weather	Urban, nice weather
Circ-weighted env. art. (past week)	−0.023	−0.262***	−0.013	−0.249**
	(0.023)	(0.099)	(0.046)	(0.102)
Month FEs	Yes	Yes	Yes	Yes
Zip code FEs	Yes	Yes	Yes	Yes
Demog./Weather/AQ	Yes	Yes	Yes	Yes
Gas price	Yes	Yes	Yes	Yes
Day-of-week FEs	Yes	Yes	Yes	Yes
Observations	185,126	12,663	12,663	12,663
Mean of dep. variable	2.84	2.75	0.617	2.14
	(1)	(2)	(3)	(4)
Dep. variable:	People in vehicle	People in vehicle	≥ 3 in vehicle	≥ 3 in vehicle
Sample:	Full sample	Work, rush hour	Full sample	Work, rush hour
Circ-weighted env. art. (past week)	0.010*	0.015**	0.004**	0.007***
	(0.005)	(0.007)	(0.002)	(0.002)
Month FEs	Yes	Yes	Yes	Yes
Zip code FEs	Yes	Yes	Yes	Yes
Demog./Weather/AQ	Yes	Yes	Yes	Yes
Gas price	Yes	Yes	Yes	Yes
Day-of-week FEs	Yes	Yes	Yes	Yes
Observations	527,908	66,137	527,908	66,137
Mean of dep. variable	1.50	1.10	0.107	0.017

Notes: SEs clustered by county by month are reported in parentheses. *** $p < .01$, ** $p < .05$, * $p < .1$. In the top panel, the dependent variable is the number of driving trips by an individual. Columns (3) and (4) count trips that do or do not start or end at work. Columns (2)–(4) restrict the sample to cities with population > 1 million on days when the temperature is between 55 °F and 85 °F and there is no precipitation. In the bottom panel, the dependent variable is the number of people on a trip or a binary variable indicating three or more people. Columns (2) and (4) restrict the sample to trips to or from work between 6 a.m. and 10 a.m. or 4 p.m. and 8 p.m. Demographic controls include age, education, income and sex. Weather controls include temperature and precipitation on the day of travel and the previous week and deviations from historical mean temperatures. Weather, air quality and demographic controls consist of fixed effects representing bins of data.

In many cases, there are no adequate substitutes for driving. For example, if a household is located in a rural or suburban area, many of the potential destinations for day-to-day travel may be inaccessible without driving. Furthermore, options such as walking or public transit may be unappealing even in urban areas if the weather is unpleasant. In column (2) of the top panel of Table 10, I focus on households that have more ready substitutes for driving—those who live in urban areas on days when the temperature is between 55 °F and 85 °F (13 °C and 29 °C) and there is no precipitation. The results show that individuals in these households do indeed drive less when treated with environmental coverage. For every environmental article an individual has received in the past week (∼ 3 SDs), they reduce the number of driving trips per day by approximately 0.25 (∼ 0.1 SDs). Columns (3) and (4) show that the necessity of trips is a further factor in being willing to substitute away from them. Individuals are less willing to forgo or find alternatives for driving to or from work than they are for other trips that may be less necessary. This result is also consistent with it being easier to nudge individuals toward more environmentally friendly behaviour if that change is easier.

The bottom panel of Table 10 shows the effect of coverage on carpooling, another decision that might reduce the number of vehicles on the road, but one that may involve a better substitute, as passengers still ride in a personal vehicle to their destination. I use two measures: the number

Table 11. *Effect of Coverage on Household Fuel Use.*

Unit of analysis: Sample:	(1) Individual Full sample	(2) Individual Nice weather, urban	(3) Household Full sample	(4) Household Nice weather, urban
Circ.-weighted env. art. (past week)	0.011 (0.021)	−0.145** (0.073)	0.023 (0.045)	−0.340*** (0.116)
Month fixed effects	Yes	Yes	Yes	Yes
Zip code fixed effects	Yes	Yes	Yes	Yes
Demographic controls	Yes	Yes	Yes	Yes
Weather controls	Yes	Yes	Yes	Yes
Air quality	Yes	Yes	Yes	Yes
Gas price	Yes	Yes	Yes	Yes
Day-of-week fixed effects	Yes	Yes	Yes	Yes
Observations	185,126	12,663	87,919	5,846
Mean of dep. variable	0.98	0.96	1.95	1.59

Notes: SEs clustered by county by month are reported in parentheses. *** $p < .01$, ** $p < .05$. In columns (1) and (2) the dependent variable is the amount of fuel used during trips where an individual is driving, calculated based on reported trips and the fuel efficiency of the vehicles used. In columns (3) and (4), the dependent variable is the amount of fuel used when a member of the household is driving. Nice weather is defined as temperatures between 55 °F and 85 °F and no precipitation. Urban refers to those living in cities with pop. > 1,000,000. Demographic controls include age, education, income and sex. Weather controls include temperature and precipitation on the day of travel and the previous week and deviations from historical mean temperatures. Weather, air quality and demographic controls consist of fixed effects representing bins of data.

of people in a vehicle for a given trip (columns (1) and (2)) and a binary variable indicating that there are more than three people in a vehicle on a given trip (columns (3) and (4)). Columns (1) and (3) show that environmental coverage causes more carpooling, while columns (2) and (4) show that this is particularly pronounced in trips to or from work during rush hour.

Taken together, the results in Tables 5 and 10 paint a consistent picture: an individual who is treated with more environmental coverage of climate change will substitute toward more environmentally friendly actions, but only if good substitutes are readily available. There is no evidence that individuals are willing to make more drastic changes to their daily life in the short term, such as cancelling daily activities or walking in inclement weather.

5.2.2. *Fuel usage*

The results in the previous sections show that environmental coverage of climate change causes more environmentally friendly decisions. However, these effects are concentrated in behaviours with good substitutes that tend to involve smaller changes to emissions and thus have a smaller social benefit.

An intuitive way to measure the overall effect of coverage of climate change is to determine the effect on overall fuel usage. The specifications in Table 11 do this by weighting the distance of each trip by the fuel efficiency of the vehicle driven and aggregating at the individual or household level.

The overall effect of coverage on fuel use is shown in columns (1) and (3) of Table 11, where the coefficients are insignificant. The top panel of Table 10 suggests a reason for the absence of an overall effect: individuals are not willing to substitute away from driving if it is not easy or pleasant to do so. Even if they do drive more fuel-efficient vehicles, this effect may be too small to create a detectable effect on fuel use.

Columns (2) and (4) confirm this hypothesis. There is a large negative effect of coverage in urban areas during nice weather (temperature between 55 °F and 85 °F and no precipitation)

when there are more likely to be substitutes for driving. The magnitude of this effect on this subset of households is more than a third of a gallon per household (~ 0.15 SDs).

Table 11 shows that the effect of coverage on emissions varies considerably. For some households, the effect is substantial, but it is concentrated among those for whom substituting away from driving is easy. Since this is a small subset of cases, the total effect of coverage on emissions is not distinguishable from zero. These results highlight a limit to the social benefit that news coverage about climate change provides, but also how this limit can be relaxed. There are households who could and would be nudged toward lower emissions if this substitution were easier, which illustrates the importance of availability of good substitutes for high-emission activities.

5.3. *Mechanics of the Relationship between Coverage and Behaviour*

5.3.1. *Respondent honesty*

The previous sections present evidence that individuals who have recently read environmental coverage of climate change *report* travelling in a more environmentally friendly way. It is important to consider how much credence should be given to these reports. If respondents who have recently read environmental coverage about climate change believe that they *should* drive in a more environmentally friendly way, they may more report doing so even if they do not. It is also worthwhile considering a related concern about a Hawthorne effect—that survey participants who had been treated with recent environmental coverage moderated their behaviour more than they otherwise would have because they knew they would report it.

There are reasons to believe that these types of bias are not a significant risk. First, respondents are unlikely to connect the environmental coverage they received to the survey. The NHTS is not an environmental survey and does not ask respondents about environmental or political topics. This should reduce the risk of social desirability bias as respondents are less likely to try to impress interviewers with environmental behaviour. It is also worth highlighting that driving behaviour is observable by many people aside from the interviewer. If a respondent chooses to travel in a more environmentally friendly way, this choice is visible to friends, neighbours and co-workers. This should greatly reduce the potential for a Hawthorne effect as being an NHTS participant does not significantly increase the visibility of driving behaviour.

Furthermore, some of the results are more consistent with honest responses than dishonest responses. For instance, poor weather makes it more costly for an individual to replace a driving trip with an alternative like walking, biking or public transit, but does it not make it more costly for a respondent to dishonestly claim they avoided driving. The fact that reported behaviour only responds to coverage in nice weather indicates that the reported behaviour reflects actual behaviour.

There is one feature of the NHTS survey that can be exploited as a partial test of this social desirability bias. Respondents were provided with a diary to keep track of their travel during their assigned travel day. The majority of respondents completed this diary and used it as a reference when reporting their travel to the interviewer. Others, who forgot or did not bother to complete the diary, were asked to recreate their travel from memory. The NHTS cites the travel diary as an effective way of enhancing the accuracy of responses. Furthermore, time-use or diary surveys similar to the NHTS have been shown to reduce social desirability bias (Niemi, 1993). Diary use should also reduce the potential for self-deception bias caused by respondents falsely remembering their behaviour as being more virtuous than it actually was. If receiving environmental newspaper coverage causes respondents to dishonestly or mistakenly report more

Table 12. *Effect of Coverage on Driving Behaviour—Diary Only.*

Dep. variable:	(1) Use most eff. vehicle	(2) Eff. rank	(3) No. of driving trips Urban,	(4) Three or more in vehicle	(5) HH fuel use Urban, nice
Sample:	Full sample	Full sample	nice weather	Work, rush hour	weather
Circ.-weighted env. art. (past week)	0.011*	0.010*	−0.286***	0.007**	−0.354***
	(0.006)	(0.005)	(0.110)	(0.003)	(0.135)
Month FEs	Yes	Yes	Yes	Yes	Yes
Zip code FEs	Yes	Yes	Yes	Yes	Yes
Demographic controls	Yes	Yes	Yes	Yes	Yes
Weather controls	Yes	Yes	Yes	Yes	Yes
Air quality	Yes	Yes	Yes	Yes	Yes
Gas price	Yes	Yes	Yes	Yes	Yes
Day-of-week FE	Yes	Yes	Yes	Yes	Yes
Observations	368,962	368,962	9,841	56,986	4,692
Mean of dep. variable	0.423	0.522	3.00	0.016	1.65

Notes: SEs clustered by county by month are reported in parentheses. *** $p < .01$, ** $p < .05$, * $p < .1$. In column (1) the dependent variable is a binary variable that takes a value of 1 if a member of a household with multiple vehicles takes a trip in the household's most efficient vehicle. In column (2), the dependent variable is a continuous variable that takes a value of 1 if a member of a household with multiple vehicles takes a trip in the household's most efficient vehicle and 0 if a trip is taken in the household's least efficient vehicle. In column (3), the dependent variable is the number of trips an individual took by car and the sample is restricted to urban areas with population > 1 million on days when the temperature is between 55 °F and 85 °F and there is no precipitation. In column (4) the dependent variable is a binary variable indicating whether three or more people are on the trip and the sample is restricted to trips starting or ending at work, taking place between 6:00 a.m. and 10:00 a.m. or between 4:00 p.m. and 8:00 p.m. In column (6), the dependent variable is the amount of fuel used during trips where a member of the household is driving, and the sample restrictions are identical to column (3). Demographic controls include age, education, income and sex. Weather controls include temperature and precipitation on the day of travel and the previous week and deviations from historical mean temperatures. Weather, air quality and demographic controls consist of fixed effects representing bins of data.

environmental behaviour, then restricting the sample to a more accurate and honest subsample should attenuate the estimated coefficients even if the diary subsample is not completely accurate or honest. Table 12 shows that this is not the case. The coefficients in the diary only sample are similar to and not systematically smaller in magnitude than the coefficients for the full sample. This indicates that biased reporting of behaviour does not affect the results.

5.3.2. *Tone of coverage*

There are two possible channels that would lead to the results shown in the previous sections. One possibility is that environmental coverage of climate change simply reminds readers about climate change. Those who are concerned about climate change, but not to the extent that it is always a primary determinant of their actions, may temporarily increase the weight they attach to climate change when making day-to-day travel decisions if reminded of it by newspaper coverage. If this is the only channel through which coverage affects behaviour then the *content* of coverage of climate change should not matter. Any mention of climate change would have the same effect regardless of perspective. The effect of the environmental articles on behaviour could simply be attributed to more environmental articles representing more coverage of climate change in general.

Alternatively, it is possible that beliefs and actions are shaped by the content of the coverage and that those who receive environmental coverage of climate change take more environmentally friendly actions, not only relative to those who do not receive any coverage, but also relative to those who receive more sceptical coverage. If this is the case, the effect of environmental articles

Table 13. *Effect of Coverage on the Decision to Use the Most Fuel-Efficient Vehicle.*

	(1)	(2)	(3)	(4)	(5)
Dep. variable:	Use most eff. vehicle	Use most eff. vehicle	No. of driving trips	Three or more in vehicle	HH fuel use
Sample:	Full sample	Full sample	Urban, nice weather	Work, rush hour	Urban, nice weather
Circ.-weighted env. art. (past week)	0.012**		−0.268***	0.007***	−0.328***
	(0.005)		(0.098)	(0.002)	(0.118)
Circ.-weighted scept. art. (past week)	0.002	0.003	0.062	−0.005	−0.146
	(0.008)	(0.008)	(0.118)	(0.003)	(0.135)
Month FEs	Yes	Yes	Yes	Yes	Yes
Zip code FEs	Yes	Yes	Yes	Yes	Yes
Demog. controls	Yes	Yes	Yes	Yes	Yes
Weather controls	Yes	Yes	Yes	Yes	Yes
Air quality	Yes	Yes	Yes	Yes	Yes
Gas price	Yes	Yes	Yes	Yes	Yes
Day-of-week FEs	Yes	Yes	Yes	Yes	Yes
Observations	422,639	422,639	12,663	66,137	5,846
Mean of dep. variable	0.423	0.423	2.75	0.017	1.59

Notes: SEs clustered by county by month are reported in parentheses. *** $p < .01$, ** $p < .05$. In columns (1) and (2) the dependent variable is a binary variable that takes a value of 1 if a member of a household with multiple vehicles takes a trip in the household's most efficient vehicle. In column (3), the dependent variable is the number of trips an individual took by car and the sample is restricted to urban areas with population > 1 million on days when the temperature is between 55 °F and 85 °F and there is no precipitation. In column (4), the dependent variable is a binary variable indicating whether three or more people are on the trip and the sample is restricted to trips starting or ending at work, taking place between 6:00 a.m. and 10:00 a.m. or between 4:00 p.m. and 8:00 p.m. In column (6), the dependent variable is the amount of fuel used during trips where a member of the household is driving and the sample restrictions are identical to column (3). Demographic controls include age, education, income and sex. Weather controls include temperature and precipitation on the day of travel and the previous week and deviations from historical mean temperatures. Weather, air quality and demographic controls consist of fixed effects representing bins of data.

on behaviour would be a function of the language that designates these articles as environmental. Sceptical articles might have no effect or even a negative effect on environmental behaviour if they serve to reassure readers that environmental behaviour is not necessary.

To test these two hypotheses, I include the circulation-weighted number of sceptical articles as an independent variable and replicate the main specifications. Table 13 shows the results of these specifications, which indicate that the effect of coverage on behaviour does depend on the tone of coverage. Articles written using more sceptical phrases than environmental phrases have no effect on behaviour. This provides support for the hypothesis that individuals use the content of articles to inform their actions and that mentioning climate change, but providing a more sceptical perspective does not affect behaviour.

These findings have implications for interpreting the effect of coverage. Media may slant coverage of climate change either by reducing the amount of coverage or by shifting the tone toward scepticism. Table 13 shows that either type of slant may lead to fewer environmental driving decisions, as only the presence of environmental articles encourages these decisions.[22] If factors such as media capture or journalistic norms for balance reduce the share of articles about climate change that are environmental without increasing the number of articles, then people will choose fewer environmentally friendly behaviours.

[22] Note that if newspapers slant coverage toward scepticism solely by adding sceptical articles to the existing environmental coverage, this would not affect behaviour.

5.3.3. *Timing*

The analysis of sceptical coverage shows that discussing climate change from a sceptical perspective does not affect behaviour. This result suggests that the relationship between coverage and behaviour is not simply driven by salience, and that in order for individuals to adjust their behaviour, they must be informed about climate change from an environmental perspective.

In this section, I explore the timing of the relationship between environmental coverage and behaviour to determine how long this effect of coverage lasts. If the information provided by environmental coverage causes individuals to permanently update their beliefs about climate change, then longer lags of coverage will have a significant effect on behaviour. On the other hand, if environmental coverage simply reminds individuals of the threat posed by climate change, only recent coverage should affect behaviour. Figure 6 shows tests of these hypotheses by adding variables representing coverage in other weeks besides the week prior to the travel day.

The upper panels of Figure 6 show the effect of the number of environmental articles on a household's use of their most fuel-efficient vehicle. When only coverage prior to the travel day is included, the coefficient for the week before the travel day is similar to the coefficient in Table 5, the coefficient for the second week before is approximately half the magnitude and the coefficients for the third and fourth weeks are close to 0. In the upper right panel, although the SEs increase, the magnitudes of the coefficients are similar or larger when coverage during the week after the travel day is introduced to the specification. The lower panels show that the effect of environmental coverage on the number of trips and household fuel use in urban areas during nice weather follows a similar pattern. The effect of coverage is attenuated in the second week before the travel day relative to the first week and disappears in the third and fourth weeks.

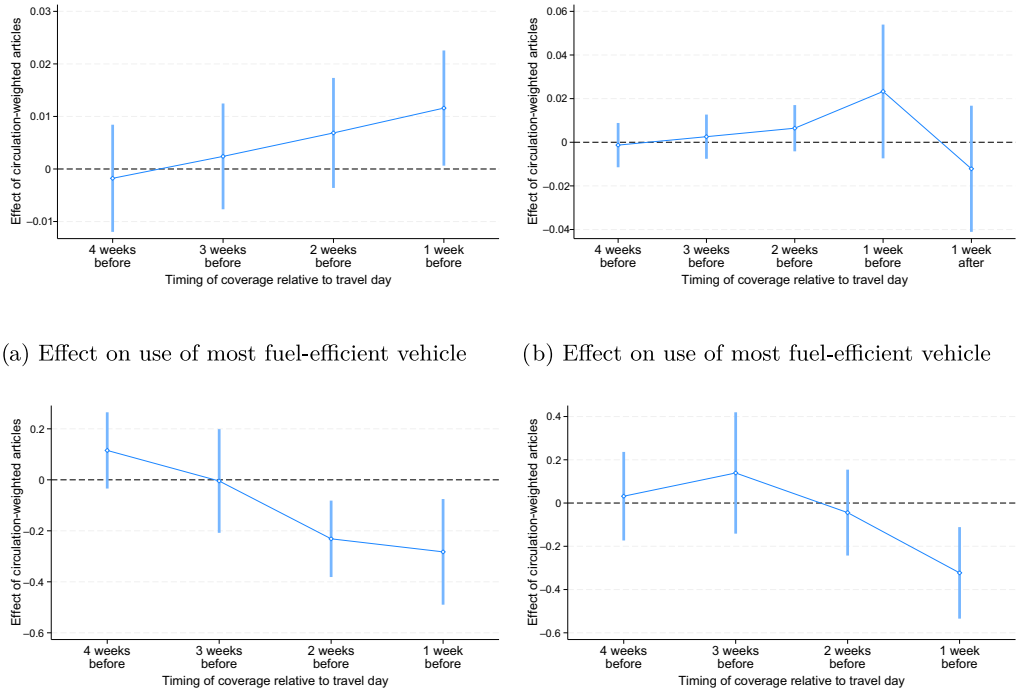
Taken together, the absence of an effect of both sceptical coverage and longer lags of environmental coverage on behaviour clarify how people respond to coverage of climate change. While coverage of climate change can encourage environmental behaviour, it only does so if the coverage has an environmental perspective on climate change and even then only for a limited time. The fact that the effect of the coverage is so short lived is a considerable step toward rejecting a learning or updating explanation for the effect of coverage on behaviour. If readers use newspaper coverage to update their prior beliefs about climate change, the effect of coverage would be fairly permanent. The short-term effect is more consistent with a salience explanation: reading an environmental article about climate change temporarily raises awareness of climate change and reminds readers of the beliefs they already hold. However, in order to raise awareness in a way that affects behaviour, coverage must use an environmental tone.

6. Conclusion

In this paper, I investigate the effects of newspaper coverage of climate change on environmental behaviour, specifically travel decisions. I argue that individuals who read particularly environmental coverage of climate change increase the weight they attach to emissions when choosing among travel options. This may lead them to choose lower-emission options, particularly when those options are readily available.

To estimate this relationship, I create a measure of the tone of newspaper coverage of climate change by comparing phrase frequency in newspaper articles with phrase frequency in texts with known environmental or sceptical perspectives.

I match this index of coverage to households sampled by the NHTS using zip-code-level circulation data. This survey contains detailed information about travel patterns and can be used



(a) Effect on use of most fuel-efficient vehicle

(b) Effect on use of most fuel-efficient vehicle

(c) Effect on number of driving trips (urban, nice weather)

(d) Effect on household fuel use (urban, nice weather)

Fig. 6. *Effect of Coverage of the Number of Environmental Articles on Driving Behaviour.*
Notes: The coefficients shown are for the circulation-weighted number of environmental articles during a given week in a regression. In panels (a) and (b) the dependent variable is a binary variable that takes a value of 1 if a trip is taken using a household's most fuel-efficient vehicle. In panels (c) and (d), the dependent variables are the number of trips an individual took by car and the amount of fuel used during trips where a member of the household is driving, when the sample is restricted to urban areas with population $>$ 1 million on days when the temperature is between 55 °F and 85 °F and there is no precipitation. In each case, the regression includes month, day-of-week and zip code fixed effects as well as controls for age, sex, education, income, temperature, precipitation, gas price and air quality. The error bars show the 95% confidence interval using SEs clustered by county by month.

to identify behaviours with environmental consequences, such as the number of trips and vehicle chosen for a given trip. The main empirical analysis evaluates these behaviours as a function of coverage in the past week and includes zip code fixed effects to ensure that the results are not driven by selection or geographical heterogeneity. I find that, when treated with environmental coverage of climate change, people are more likely to drive their household's most fuel-efficient vehicle and more likely to carpool. I also find that they take fewer driving trips, but only in urban areas when the weather is nice. All of these results are consistent with individuals being persuaded to substitute toward a more environmentally friendly action when this substitution is not too costly.

The results of the empirical analysis illustrate the potential social benefits of environmental coverage of climate change, but also identify limitations to these benefits. An environmental

article can cause a household to reduce their fuel use by as much as one-third of a gallon, but only when substitution is easy. Furthermore, unlike environmental coverage, sceptical coverage of climate change does not have an effect on behaviour.

Although the focus of this paper is not on explicitly designed information or persuasion interventions, the results do have some policy implications. They demonstrate the effects of media bias and provide additional motivation for policies that can reduce this bias, such as antitrust laws that increase competition among media outlets. Furthermore, the analysis contributes to the understanding of information mechanisms in environmental policy by demonstrating that information provision can have a role in encouraging environmental behaviour, but also that the effect is not long lasting. Finally, the analysis shows that the presence of viable substitutes for environmentally harmful behaviours is critical—information can have an effect on behaviour, but only when good alternatives are available.

Loyola Marymount University, USA

Additional Supporting Information may be found in the online version of this article:

Online Appendix
Replication Package

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