

# Advertising, Media Coverage, and Public Opinion about Climate Change

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Camp Resources

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# Motivation

- Climate change is one of the most consequential policy issues facing humanity
- Despite consensus among scientists, public remains skeptical
  - For past two decades, vast majority of scientists have agreed that anthropogenic climate change is both real and a serious threat
  - According to a 2013 Gallup poll, only 57% of Americans believe in anthropogenic climate change
  - Only 62% think most scientists believe in it
- Research question
  - What causes popular opinion to diverge from the scientific consensus about climate change?
- Hypothesis:
  - Advertising from firms in carbon-emitting industries shapes media coverage
  - Some media coverage diverges from scientific consensus in order to attract advertising
  - Media coverage informs public opinion

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# Overview of model

- I model advertising, media coverage, and public opinion
  - I focus on the link between advertising and media coverage
- Framework:
  - Consumers prefer newspapers that align with prior beliefs
  - Advertisers from carbon-emitting industries prefer climate-skeptical consumers
  - Newspapers choose coverage to maximize revenue
- Equilibrium:
  - Coverage is more skeptical to attract advertisers
  - Bias is greater when advertisers are more willing to pay for access to skeptics
    - E.g. advertising a new truck release in a rural area or air-conditioning during a hot summer

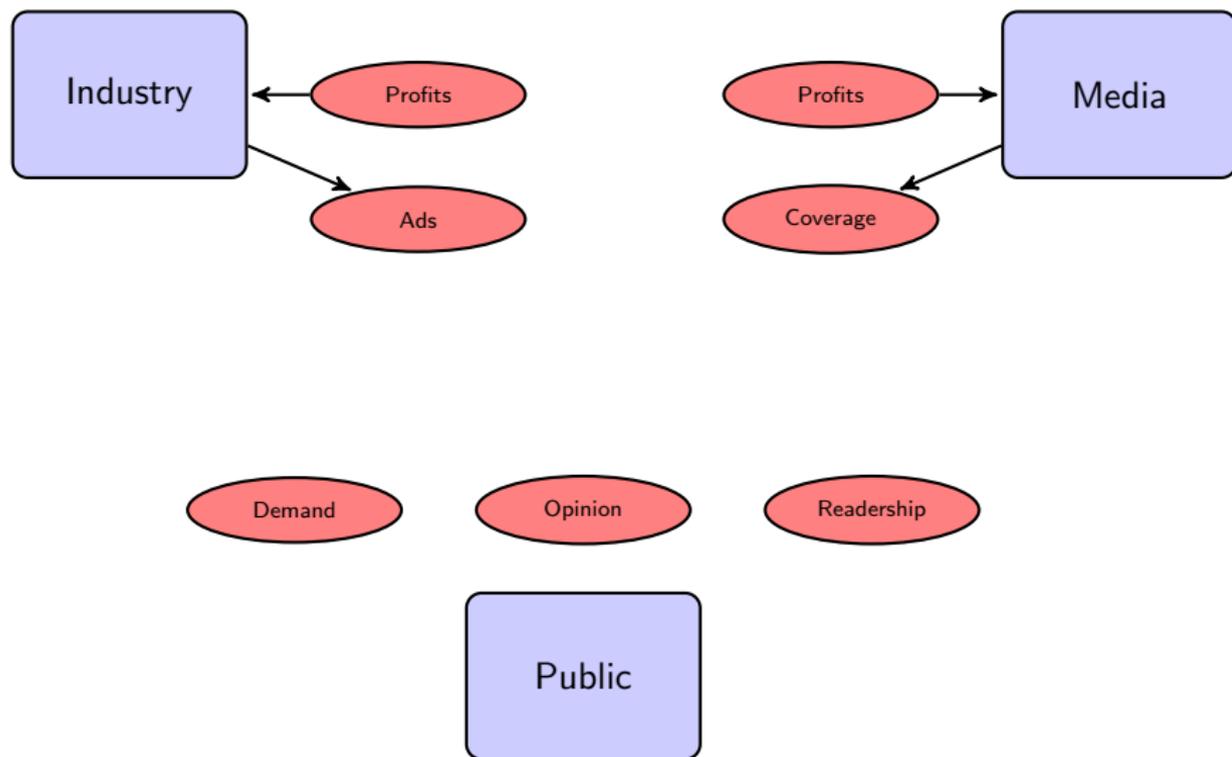
# Players

Industry

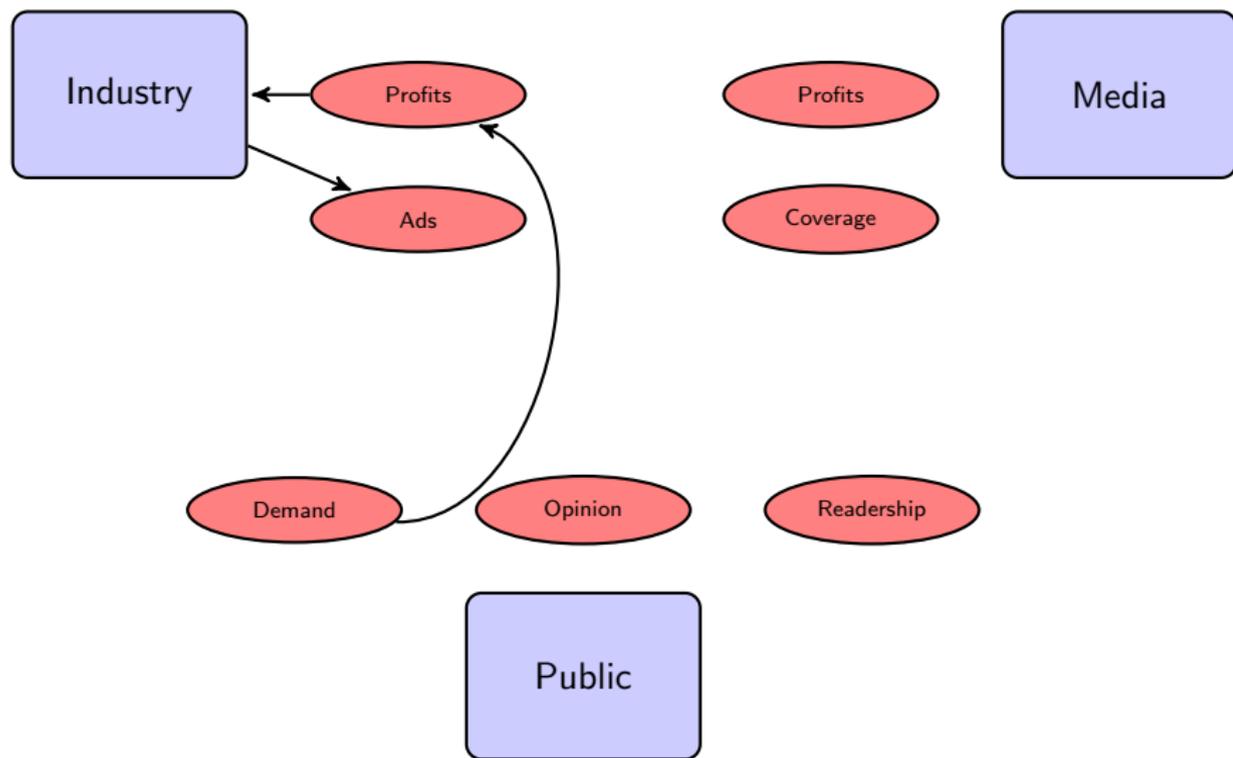
Media

Public

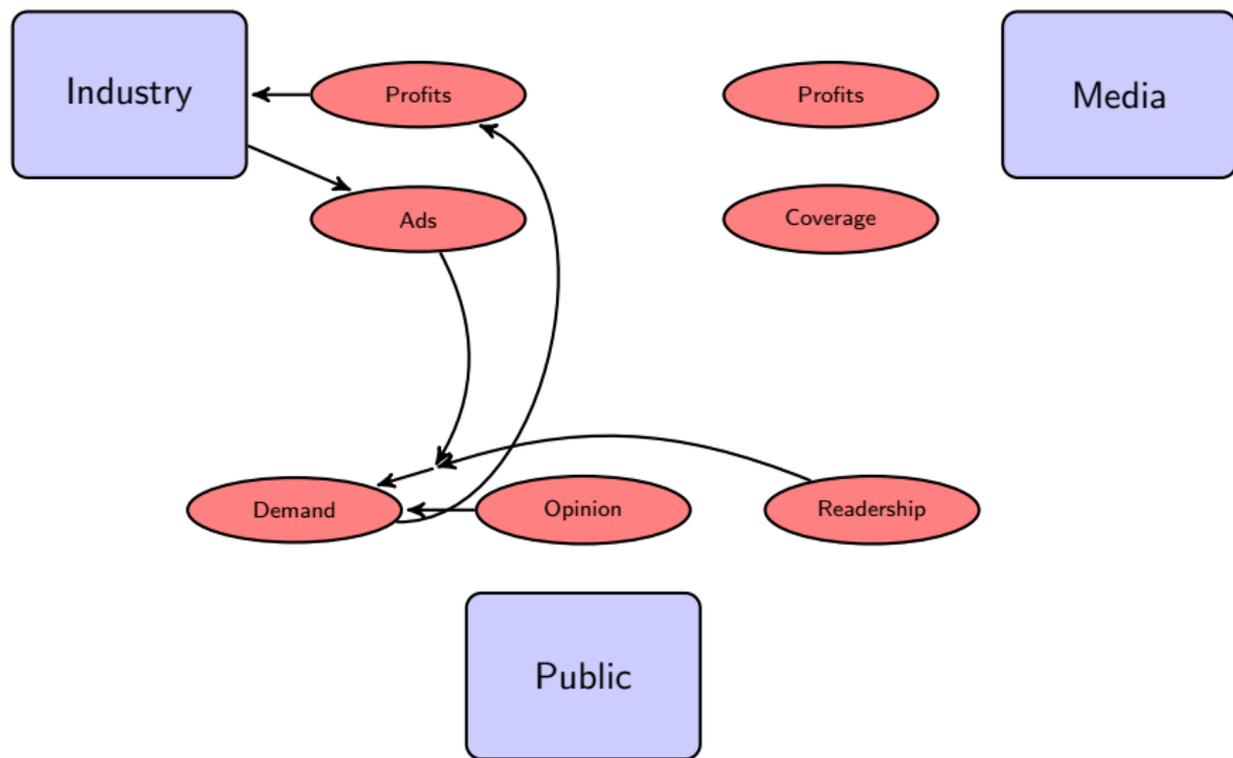
# Inputs and Outputs



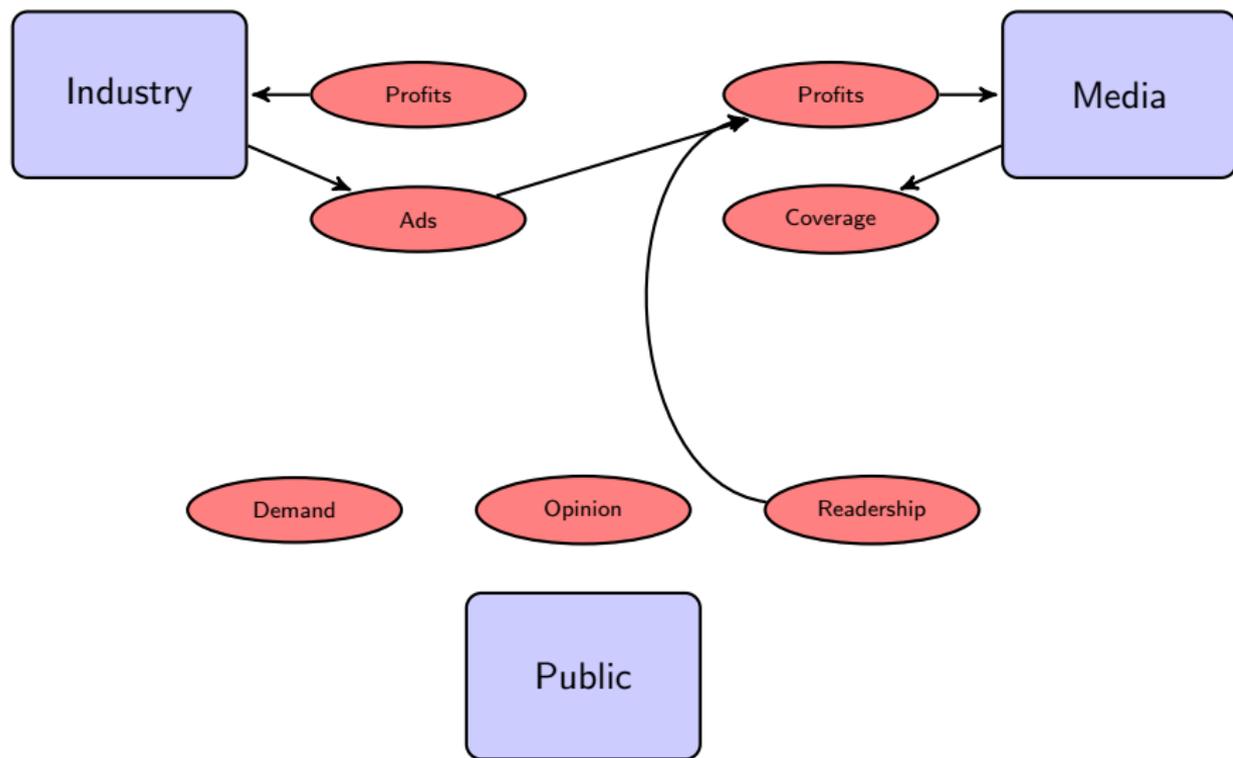
# Industry profits



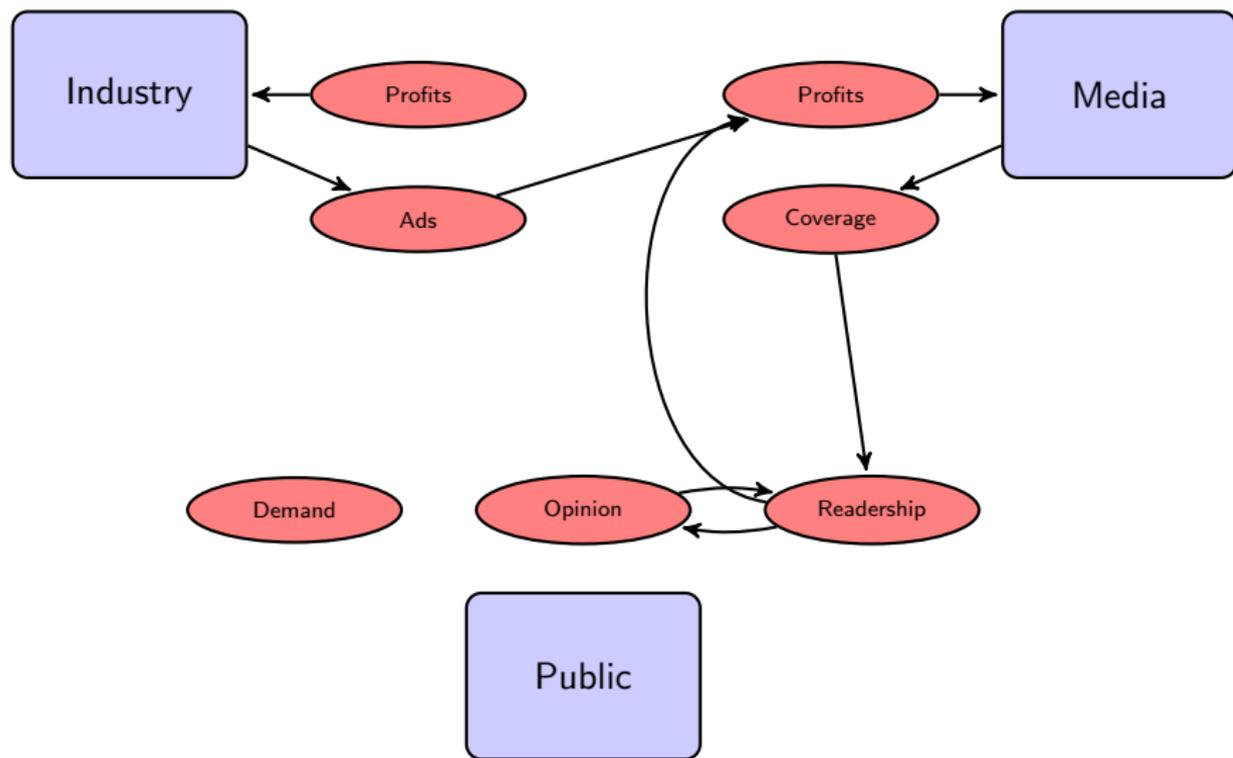
# Determinants of demand



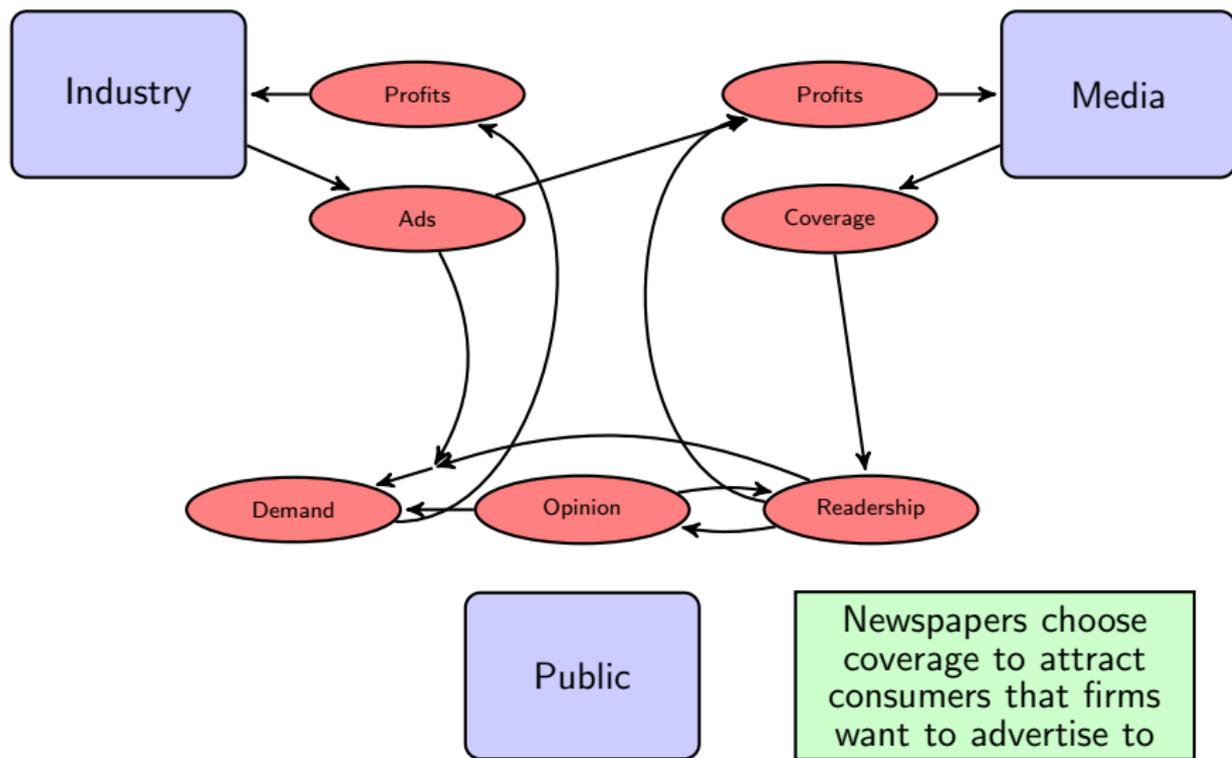
# Media profits



# Determinants of readership



# Complete set of linkages



## Data: Measuring media coverage

- I analyze every article mentioning “global warming” or “climate change” in 48 major American newspapers between 2005 and 2008
- Measure of media coverage is an index calculated using phrase frequency analysis
  - Compare newspaper text to IPCC (scientific consensus) and NIPCC (skeptical) reports
  - Identify key phrases indicative of one perspective
    - Phrases used more frequently in IPCC or NIPCC report
  - Classify newspaper text which uses scientific consensus phrases more often as “environmental”
  - Classify newspaper text which uses skeptical phrases more often as “skeptical”

# Phrases which indicate a perspective

## Examples of phrases used more often in IPCC reports

greenhouse gas

sustainable development

extreme event

dioxide emission

very likely

small island

mitigation policy

renewable energy

## Examples of phrases used more often in NIPCC reports

dioxide concentration

ice age

medieval warm

sea ice

polar bear

millennial scale

solar variability

tree ring

- Advertising spending is total advertising spending by firms in carbon-emitting industries in newspaper  $n$  in month  $t$ 
  - Automobile, gasoline, heating, power
- Public opinion taken from Transatlantic Trends Survey
  - Annual survey asking about concern over global warming
  - Data at state-year level

# Empirical strategy

Taking linear approximations of equilibrium conditions from model gives two estimating equations:

$$x_{nt} = \beta_0 + \beta_1 A_{nt} + \beta_2 S_{nt} + \delta_n + \phi_t + \epsilon_{nt}$$

$$A_{nt} = \gamma_0 + \gamma_1 x_{nt} + \gamma_2 S_{nt} + \gamma_3 a_{nt} + \delta_n + \phi_t + \eta_{nt}$$

- $x_{nt}$  is index of media coverage in newspaper  $n$  in month  $t$
- $A_{nt}$  is advertising from carbon-emitting industries
- $S_{nt}$  is public opinion about climate change
- $a_{nt}$  is how much extra advertisers will pay to advertise to a skeptical consumer.
- $\delta_n$  and  $\phi_t$  are newspaper and time fixed effects

# Simultaneity Issues

- Advertising is endogenous in a model of coverage
- Coverage depends on advertising
  - Newspapers choose coverage to attract advertising
  - Provide skeptical coverage to attract skeptics and advertising directed at skeptics
  - Coverage is more skeptical when advertisers are willing to pay more for skeptical consumers
- Advertising depends on coverage
  - Advertisers seek out skeptical coverage
  - Skeptical coverage attracts skeptical consumers willing to buy their products
  - Willing to pay more when coverage is more skeptical
- I disentangle these influences using instrumental variables

- I use two instruments for newspaper advertising
  - Advertising in neighboring newspapers
    - Amount of advertising in month  $t$  from carbon-emitting industries in the 3 newspapers geographically closest to newspaper  $n$
  - Price of television advertising in the same market
    - Average price that retailers pay to advertise in the same market that the newspaper serves

# First stage: Neighboring advertising

- Amounts of advertising from carbon-emitting industries in neighboring newspaper markets are correlated
  - Markets for advertised products are larger than a single newspaper market
    - E.g. trucks in rural areas, air-conditioning in hot areas
  - An exogenous increase in advertising that affects one newspaper market apparent in neighboring newspaper markets as well
    - E.g. A new truck release is advertised heavily in midwest; air-conditioning is advertised heavily during a hot summer in the south

## Exclusion restriction: Neighboring advertising

- Advertising in neighboring newspapers a function of readership of neighboring newspapers and market for advertised products
- Error term in equation for newspaper coverage consists of shocks to coverage that are independent of
  - National trends in coverage
  - Time-invariant differences among newspapers
  - Regional trends in public opinion and coverage
- A shock to the error term in one market does not occur in neighboring markets
  - E.g. a one time story or editorial ran by one newspaper
  - Does not affect readership of neighboring newspapers
  - Does not affect advertising in neighboring newspapers

## First stage: Price of television advertising

- Supply of television advertising is inelastic; increase in price signals an increase in demand
- If a shock to television advertising demand includes carbon-emitting industries, it will apply to newspapers as well
  - E.g. A local shock to disposable income; a large sale by an auto manufacturer
- If a shock to television advertising demand does not include carbon-emitting industries, it can raise price of television advertising and cause firms to substitute to newspapers
  - E.g. Holiday sales for retailers
- Television advertising prices are correlated with demand for advertising in newspapers

## Exclusion restriction: Price of television advertising

- Price of television advertising is a function of viewership and the demand for advertising
- Error term in equation for newspaper coverage consists of shocks to coverage that are independent of
  - National trends in coverage
  - Time-invariant differences among newspapers
  - Regional trends in public opinion and coverage
- Newspaper coverage may affect demand for advertising in the newspaper itself, but does not affect demand for advertising on television
  - Newspapers set their advertising prices annually
  - In short run, changes in demand affect quantity, not price
  - Any shocks to demand for newspaper advertising caused by coverage will not lead to substitution to television advertising
    - Will not affect price of television advertising

## Main results: Index of coverage

	OLS	IV Neigh. ads	IV TV ad price	IV Both
Carbon emitting ads (\$ millions)	-0.144** (0.071)	-0.388*** (0.138)	-0.252* (0.152)	-0.370*** (0.136)
Paper FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
Public opinion	Yes	Yes	Yes	Yes
Neighboring coverage	Yes	Yes	Yes	Yes
Observations	2,204	2,196	2,165	2,165
# of newspapers	48	48	48	48
First-stage F-statistic		20.56	9.06	10.73
Overid Test				0.243

Standard errors clustered by newspaper in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

## Alternative measure of coverage: Number of articles

	OLS	IV Neigh. ads	IV TV ad price	IV Both
Carbon emitting ads (\$ millions)	-2.95** (1.37)	-6.90** (3.44)	-7.26** (3.71)	-6.97** (3.48)
Paper FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
Public opinion	Yes	Yes	Yes	Yes
Neighboring coverage	Yes	Yes	Yes	Yes
Observations	2,204	2,196	2,165	2,165
# of newspapers	48	48	48	48
First-stage F-statistic		20.56	9.06	10.73
Overid Test				0.579

Standard errors clustered by newspaper in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

## Main results: Summary

- Higher levels of advertising from carbon-emitting industries are correlated with more skeptical coverage
- IV results show that this relationship is causal
  - The presence of advertising from these industries causes coverage to be more skeptical than it would otherwise be
  - Also reduces amount of coverage
- \$1 million of monthly advertising (about the sample average) shifts coverage towards skepticism and away from the scientific consensus by a combined  $\sim 0.4$  standard deviations
- \$1 million decreases the number of articles mentioning climate change by  $\sim 7$  articles per newspaper per month

## Quantifying the results: Persuasion

- To evaluate effect of advertising on coverage, I look at effect of coverage on public opinion
  - Survey data from 2004 and 2008
- I use a modified first-difference specification

$$E_{i,s,t} = \alpha + \beta_1 \cdot (x_{s,t} - x_{s,t-1}) + \beta_2 E_{s,t-1} + Y_i \beta_3 + \epsilon_i$$

- $E_{i,s,t}$  is a response to an environmental policy question from respondent  $i$  in state  $s$  in year  $t$
- $E_{s,t-1}$  is the lagged average opinion of respondents in state  $s$
- $x_{nt}$  is the average index score of newspapers (weighted by circulation) in state  $s$  in each year
- $Y_i$  is a vector of demographic controls
  - Age, sex, race, education, income, census region, political orientation

## Quantifying the results: Persuasion

- This specification evaluates whether changes in coverage are correlated with changes in public opinion
  - I regress public opinion on lagged public opinion and the difference in coverage
- A positive coefficient suggests that if coverage in a market becomes more skeptical, the readership becomes more skeptical

## Results: Effect on potential readers

	(1) Environment over econ.	(2) Keep coastal drilling ban
Diff. in coverage (2004 to 2008)	0.020** (0.009)	0.065*** (0.025)
Prior beliefs	Yes	Yes
Dem. controls	Ye	Yes
Observations	9,737	5,617
R-squared	0.140	0.206

Standard errors clustered by state in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

## Results: Effect on potential readers

- When coverage becomes more environmental, readers are more likely to support
  - Protecting the environment over growing the economy
  - Maintaining bans on coastal oil drilling

# Conclusion

- Advertising affects coverage of climate change
  - Shifts coverage towards skepticism
  - Decreases quantity of coverage
  - This effect is causal
- In states where newspapers become less skeptical, population is more likely to support environmental policies
  - Suggestive evidence of persuasion
- Calculation quantifying effect of advertising in newspapers:
  - Advertising from carbon-emitting industries causes an additional  $\sim 1\%$  of the population to support economic growth over protecting the environment