

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

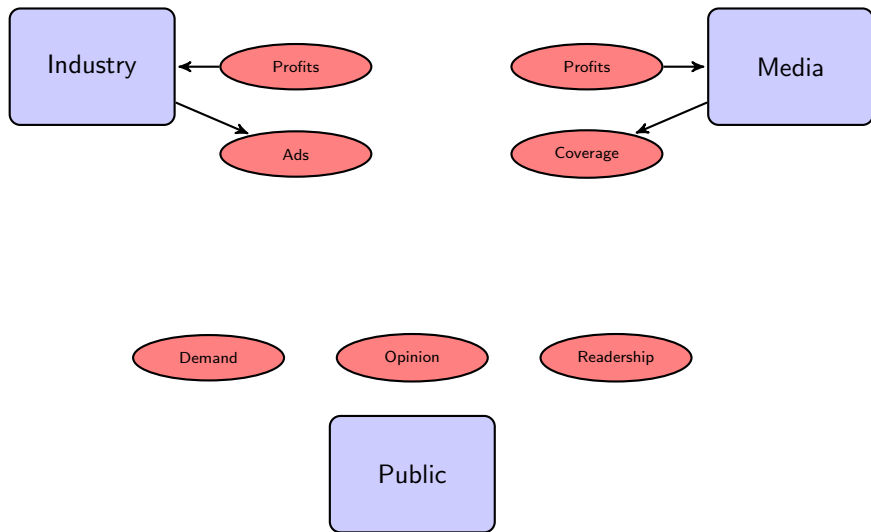
Players

Industry

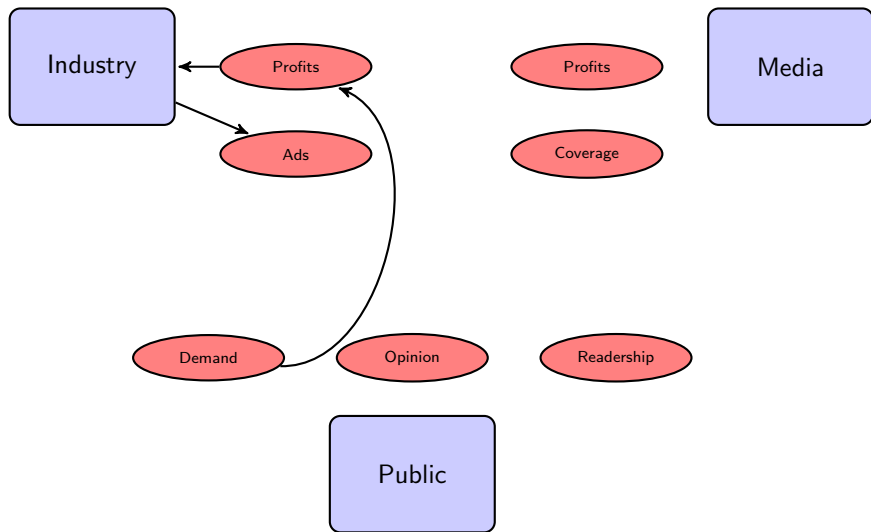
Media

Public

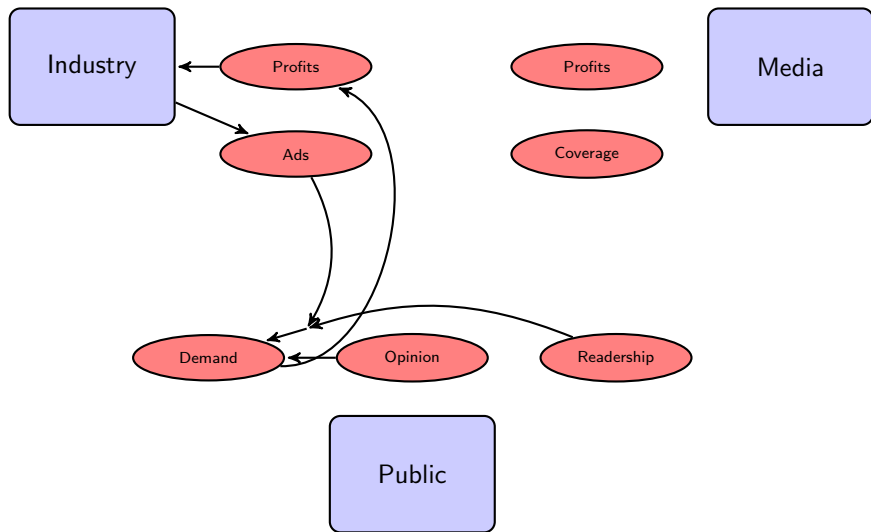
Inputs and Outputs



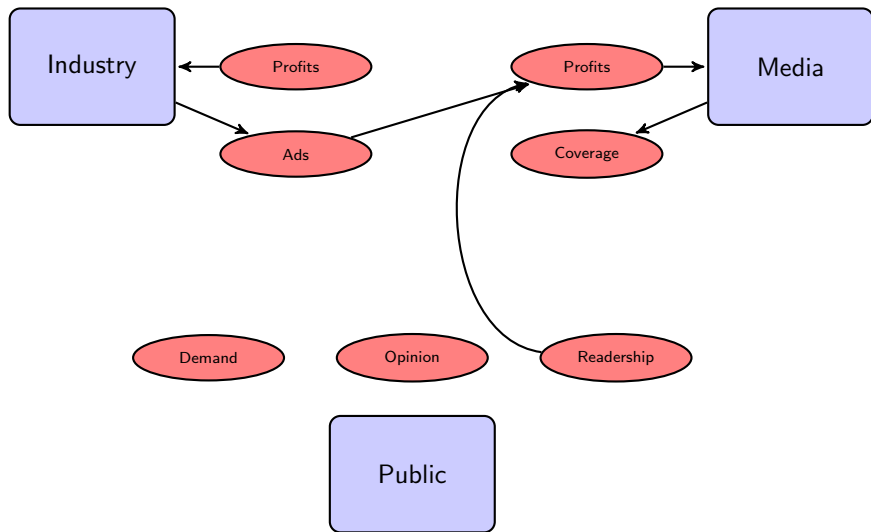
Industry profits



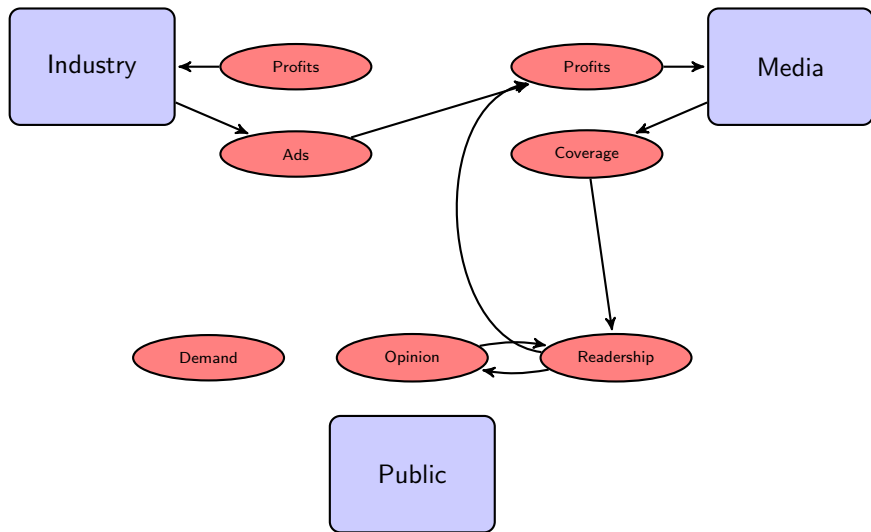
Determinants of demand



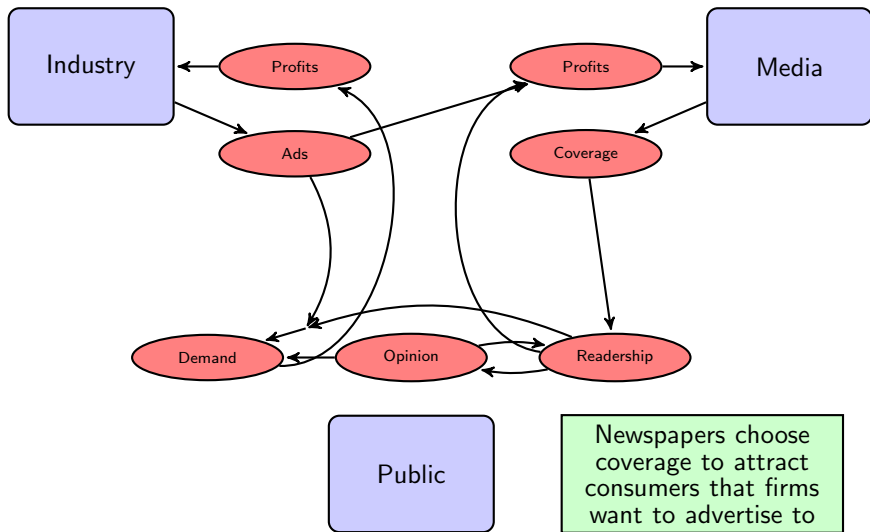
Media profits



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.
- δ_n and ϕ_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 ~ 0.4 standard deviations
- \$1 million decreases the number of articles mentioning climate change by ~ 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