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SPECIAL INTERESTS AND THE MEDIA: THEORY AND AN APPLICATION TO CLIMATE CHANGE

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ABSTRACT

I present a model in which competing special interests seek policy influence through the news media. In the model a journalist reports on expert opinion to a voter. Two competing interested parties can invest to acquire credentialed advocates to represent their positions in the press. Because advocates are easier to obtain when expert opinion is divided, the activities of special interests can reveal useful information to the voter. However, competition among special interests can also reduce the amount of information communicated to the voter, especially on issues with large economic stakes and a high likelihood of a scientific consensus. The model provides an account of persistent voter ignorance on climate change and other high-stakes scientific topics.

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1 Introduction

The First Assessment Report of the Intergovernmental Panel on Climate Change (1990) crystallized a scientific consensus that the climate is warming and that the cause is at least partly anthropogenic. The subsequent decade saw an explosion of activity by conservative think tanks and other organizations attempting to persuade the public that "the scientific evidence for global warming is highly uncertain" (McCright and Dunlap 2000). Much of this activity was directed at generating or influencing media coverage, for example by placing like-minded scientists in contact with journalists (Cushman 1998).

Climate change skeptics have indeed had a prominent voice in public discourse. National newspapers in the 2000s mentioned the top five skeptical scientists about one-fourth as often as their mainstream counterparts (Grundmann and Scott 2012). As recently as the early 2000s the majority of articles in national newspapers and segments in nightly news broadcasts about climate change were "balanced" in the sense of giving "roughly equal attention" to both sides (Boykoff and Boykoff 2004; Boykoff 2008). In 2010, only 52 percent of Americans reported that "most scientists believe that global warming is occurring" (Saad 2013).

As I argue below, it is common for special interests to attempt to influence public opinion and public policy through the strategic placement of credentialed advocates in the news media. These actions are often aimed at creating the impression of scientific controversy or ambiguity, leading the public to doubt even settled scientific conclusions. Although economists have long recognized that pressure groups try to influence public discourse,[1] prominent theories of special interests (e.g., Grossman and Helpman 1994) have focused mainly on attempts to influence who is elected or how politicians behave while in office.

In this paper I present a model in which competing special interests seek policy influence through the news media. I use the model to study when competition among special interests improves voter information, to show the effect of media institutions on the activities of special interests, and to rationalize persistent voter ignorance on topics such as climate change where experts have reached a lasting consensus.

In the model, a voter makes a policy decision. The optimal policy depends on an unknown, binary state. There is a large population of disinterested experts who each receive a binary signal about the true state. Expert opinion is either evenly divided or is unanimous and correct. There are two interested parties, each wishing the voter to believe in a particular state. Each party may, at some cost, affiliate an expert with its position. The cost is low when experts are divided and high when experts are united against the party's position, in which case the party must use resources to make a non-expert appear as an expert.

[1] Becker (1983) writes that "research findings that oppose the interests of powerful pressure groups frequently have little political impact because they are offset by the dissemination of selected information and by other appeals to public opinion and legislatures."

The voter does not directly observe expert opinion. Rather, the voter learns about expert opinion from the report of a journalist. To make her report the journalist first learns the opinion of a single, random expert. The journalist then solicits a comment from the party opposed to the random expert's signal. If this opposition party has an affiliated expert, the journalist reports both the opinion of the original, neutral expert and that of the affiliated, opposition expert. I argue that this simple model of the journalist's process captures realistic features of the news media that are important in understanding the activities of special interests.

The model shows that competition among special interests can benefit the voter. If it is easy to affiliate an expert when opinion is divided but difficult to affiliate one who will stand against a consensus position, the game admits an equilibrium in which the parties have affiliates only when experts are divided. In this case, the journalist reports both sides only when the science is indeed uncertain, and the voter always chooses the policy that is optimal given the distribution of expert opinion. This is in some sense the typical case: most often, basic findings of fact are reported in the news media without much pretense of controversy.

The model also shows that the strategic behavior of special interests can harm the voter. If a party opposed to the scientific consensus finds it attractive to affiliate an expert, then the journalist always reports both sides of the issue, and the voter learns nothing from the journalist's report. This case is most likely when the stakes are large and when the likelihood of an expert consensus is greatest.

The counterintuitive finding that a greater likelihood of expert consensus can make the journalist's report *less* informative arises from the incentives of the special interests. On an issue where expert consensus is likely, the unchallenged opinion of a random expert conveys a lot of information, as it is likely that other experts share the opinion. Therefore a greater likelihood of expert consensus raises the incentive for the parties to affiliate an expert. When this incentive is sufficiently strong, there exists no equilibrium in which the journalist's report is informative to the voter. The model's prediction that informative communication is least likely on topics with high economic stakes and high likelihood of scientific consensus provides a simple rationale for the persistence of public ignorance on policy-relevant scientific topics like climate change.

After analyzing the model's implications for the behavior of special interests I close the model by endogenizing the journalist's reporting strategy. I allow that with a small probability the journalist is an opinionated type who wishes to persuade the voter of her point of view. Unopinionated journalists are motivated to convince the voter that they are not opinionated. Balanced reporting emerges as an equilibrium reporting strategy because an uninformative report is more attractive to an unopinionated journalist than to an opinionated one. I argue that this explanation for balanced reporting is consistent with sociological accounts of the emergence and persistence of norms of objectivity in US journalism.

Lastly I explore the model's empirical implications for the case of climate change. Consistent with me-

dia reports being uninformative, I show that, in survey data, those who consume more news are not more knowledgeable about climate change, although they are more knowledgeable about bland factual matters such as the majority party in Congress. Consistent with the model's emphasis on the role of media institutions, I show that countries with a stronger professional norm of balance in the press exhibit less public agreement with the climate-change consensus. Finally, I show how the model applies to a recent controversy over the connection between vaccines and autism.

This paper makes three principal contributions. The first is an economic model of special interests' efforts to influence policy through the news. Most economic models of special interests' influence on public policy treat the expenditure of resources to influence voter beliefs and information implicitly, either as part of a reduced-form function relating expenditures to votes or influence or as a motivation for politicians to seek campaign resources from interest groups (e.g., Stigler 1971, Peltzman 1976, Becker 1983, Grossman and Helpman 1994). My paper follows Yu (2005) in modeling the effect of resources on voter beliefs, but, importantly, joins Sobbrio (2011) in explicitly modeling both the media outlet's reporting decision and the voter's Bayesian updating given media reports.[2] My model differs from past work in showing conditions under which special interests' influence activities can improve the efficiency of policymaking, and in showing why these conditions fail in prominent cases such as climate change.[3]

The second is an economic explanation of the journalistic practice of balanced reporting. In the model, an unbiased journalist facilitates obfuscation by special interests despite receiving no direct transfers from the interest group (as in Petrova 2012) and having no indirect incentives to support the group's interests (as in Germano and Meier 2013). Uninformative reporting is supported instead as an optimal strategy for a journalist wishing to avoid the appearance of favoring one side or the other.[4] This finding contributes a formal economic model to a large sociological literature on the origins of objectivity as a professional norm in journalism (Tuchman 1972, Schudson 2001). It also stands as a counterpoint to the argument in Strömberg (2004) and Dyck et al. (2013) that mass media dampen the influence of special interests.

The third is a rationale for experts' inability to communicate their consensus position to voters on policy-relevant scientific topics such as climate change. Prior research on policy expertise focuses on agency frictions that arise when policymaking is delegated to an informed actor such as a bureaucrat or committee (e.g., Gilligan and Krehbiel 1987, Callander 2008). I consider instead the frictions that prevent even disinterested

[2]Stone (2011) models interest groups' strategic choice of research and lobbying activity, though in a model without a media actor.

[3]The finding that competition among special interests can be socially productive relates broadly to theories of advocacy and expertise (e.g., Dewatripont and Tirole 1999, Krishna and Morgan 2001) and to the literature on the effect of political competition on voter information (e.g., Heidhues and Lagerlöf 2003, Murphy and Shleifer 2004, Glaeser 2005).

[4]Gentzkow and Shapiro (2006) also study the effect of reputation on the information content of media reports.

experts from disclosing their collective opinion to the public. In this sense my paper contributes to research on the communication of scientific findings to the public (Mazur 1973; Check 1987; Limoges 1993; Dearing 1995; Boykoff and Boykoff 2004), and on the role of expert communities in environmental policy (Haas 1989, 2000; Toke 1999).

The remainder of the paper is organized as follows. Section 2 motivates the model with a discussion of case evidence. Section 3 defines the model. Section 4 takes the actions of the journalist as given and characterizes the equilibrium investment behavior of the interested parties. Section 5 characterizes the equilibruim reporting strategy of the journalist in a model with reputation. Section 6 applies the model to climate change and another prominent case of public ignorance in the presence of an expert consensus. Section 7 concludes.

2 Background

2.1 How Special Interests Influence the News

It is common for special interests who wish to affect public perception of a scientific issue to recruit sympathetic experts and to make these experts accessible to the news media.

A leaked 1998 memo by a public relations representative of the American Petroleum Institute outlined a "Global Climate Science Communications Plan" that would "identify, recruit and train a team of five independent scientists to participate in media outreach," "conduct briefings by media-trained scientists for science writers in the top 20 media markets," and "distribute a steady stream of climate science information via facsimile and e-mail to science writers around the country." A proposed Global Climate Science Data Center would be used for "identifying and establishing cooperative relationships with all major scientists whose research in this field supports our position" and "responding to claims from the scientific alarmists and the media." The plan proposed a budget and concrete metrics of success including "the percent of media articles that raise questions about climate science" (Walker 1998; see also Cushman 1998).

The tactics outlined in the Global Climate Science Communications Plan are used routinely by special interests who want to affect public perception of a scientific issue (Oreskes and Conway 2010). For example, in the face of rising concern in the 1980s over the health effects of secondhand smoke, the industry-funded Tobacco Institute formed the "Scientific Witness Team," a group of scientific consultants whose "businesses are to market their scientific expertise" (Drope and Chapman 2001). These consultants formed part of a larger group of affiliated experts, including 14 academics, who were expected to conduct media tours and to "appear on television and radio talk shows–often in debate formats" and to "assist the industry in responding to media reports by preparing critiques of adverse research" (Tobacco Institute 1988).

To be effective, such tactics require credentialed experts who are willing to disagree publicly with the consensus view. In the climate change case, two of the most prominent skeptics have been Frederick Seitz and S. Fred Singer. Seitz, a prominent signatory to the so-called "Leipzig Declaration," was a former president of the National Academy of Sciences and a highly respected solid-state physicist.[5] Singer, a lead co-author of the 868-page Nongovernmental International Panel on Climate Change (NIPCC) assessment report, is an atmospheric physicist who served as the first director of the US Satellite Weather Service and who has testified to a Senate panel that there is "no appreciable climate warming" (Singer 2000).[6]

Skeptical voices have received weight in US media accounts of climate change out of proportion to their importance in the scientific community.[7] From 2000 to 2010, Singer and Seitz alone were cited in the top 10 US newspapers 31 percent as often as the most-cited scientific advocate for anthropogenic climate change (Grundmann and Scott 2012). As recently as 2009-10, 34 percent of climate-change articles in the *New York Times* or *Wall Street Journal* included a skeptical voice on climate change (Painter and Ashe 2012).

Skeptics are often cited in opposition to a new study or finding. For example, Singer was cited by the *Los Angeles Times* in response to news that 1997 was the warmest year of the 20th century (Gerstenzang 1998), by the *New York Times* in response to a new geological study that attributes global warming to human activity (Revkin 2000), and by the *Philadelphia Inquirer* in 2006 in response to evidence that recent climatic changes are very unusual in long-term perspective (Toner 2006). These citations create an impression of scientific controversy. For example, the *Los Angeles Times* article is titled "1997 Ranks as warmest year of the century. New figures raise concerns about risks of global heating. Some remain skeptical of phenomenon." Quantitative content studies by Boykoff and Boykoff (2004) and Boykoff (2007) find that such "balanced" treatment was the norm in the US press until the mid-2000s.

It is also common for skeptics to prompt news coverage on their own initiative through an event or report. The *Charleston Gazette* reported in 2007 on a local speech by Singer in an article titled "Climate change skeptic tells West Virginia not to worry" (Ward 2007). London's *Daily Telegraph* published an article in 2008 about the re-release of a petition originally circulated by Seitz (Tibbetts 2008).[8]

[5]The "Leipzig Declaration" stated that "there does not exist today a general scientific consensus about the importance of greenhouse warming from rising levels of carbon dioxide" (Science and Environmental Policy Project 1995). A later petition with similar themes circulated with a cover letter by Seitz and an article typeset in the style of the *Proceedings of the National Academy of Sciences*. This prompted a letter from the then-president of the National Academy of Sciences dissociating the academy from the article and petition (National Academy of Sciences Council 1998).

[6]The NIPCC report states that "natural causes are very likely to be the dominant cause" of any climate change (Idso and Singer, 2009).

[7]Nearly all active climate researchers accept the prevailing view that the climate is warming and the cause is likely at least partly anthropogenic (Oreskes 2004; Doran and Zimmerman 2009; Anderegg et al. 2010).

[8]It is surprisingly easy for private organizations to prompt media coverage through public relations activity (Cameron et al. 1997). For example, nearly 20 percent of articles in the UK quality press are verifiably derived mainly or wholly from public relations material such as press releases, with the majority of these coming from private entities (Lewis et al. 2008).

Skeptics also appear as part of point-by-point debates, more often in broadcast than in print media.[9] In November 2009, BBC Two televised a debate between prominent skeptic S. Fred Singer and (now Sir) Robert Watson, the chief scientific advisor at the UK's Department for Environment, Food and Rural Affairs (BBC 2009). Both men have impressive records of scientific achievement and public service. Both speak calmly and sensibly. Both look distinguished, with grey beards and an academic air. From the content of the debate, it is unclear how a lay viewer could tell that Watson speaks for the scientific consensus and Singer for a vocal minority.[10] Such ambiguity is common in televised debates on the subject.[11]

Climate-change skeptics might carry little weight in public discourse if they were seen as working on behalf of special interests. Indeed, some public commentators have tried to publicize the case that climate-change skeptics have ulterior motives and cannot be trusted (e.g., Begley 2007, Oreskes and Conway 2010). But accusations of bias run both ways. Skeptics contend that government-funded organizations like the IPCC have an interest in increasing the state's role in economic activity.[12]

[9] From 2007-2008, guests on major cable news networks consisted of 81 doubters and 111 believers in climate change. Although the majority of doubters were hosted on Fox News, even MSNBC (widely seen as left-leaning) aired the views of 3 skeptics as against 11 clear believers (Feldman et al. 2012).

[10] Arguably, Singer gets the better of the encounter, scoring a point on the subject of the interdecadal variability in global temperatures predicted by climate change models:

> The models actually don't do that unless you train them to do this. These variations that my colleague here described were put in after the fact to explain why there was, for example, a cooling between 1940 and 1975...when people worried about the coming Ice Age. I was not among those.

At this point, the moderator turns the topic of the debate over to the ClimateGate scandal, in which leaked e-mails from scientists at the University of East Anglia led some to accuse the scientists of deliberately withholding data from the public.

[11] In October 1997, CNN aired a Crossfire episode featuring Carol Browner, the Administrator of the US Environmental Protection Agency (Press and Sununu 1997). John Sununu, the show's co-host and a former Governor of New Hampshire, criticized Browner's stance in favor of then-President Clinton's proposed emissions policy:

> BROWNER: Why would you reject 2500 scientists who have no interest in the outcome of this, who say we are in fact, putting too much pollution in the air. That pollution will warm the earth's climate. It has begun to happen and we will feel consequences—irreversible consequences—if we fail to act. How can you walk away from 2500 renowned scientists?
>
> SUNUNU: Because there are 2500 on the other side.

Sununu was no stranger to this debate. As Chief of Staff under President George H. W. Bush, Sununu adopted a skeptical stance on policy remedies to climate change. In a *New York Times* opinion article called "Sununu vs. Scientists," Leslie Gelb criticized Sununu for ignoring the scientific consensus (Gelb 1991). In a Letter to the Editor, MIT Professor of Meteorology Richard S. Lindzen (1991) excoriated Gelb, noting that Sununu had a doctorate from MIT and saying "I can think of no previous White House chief of staff as capable of deeply understanding scientific issues." Lindzen went on to question the strength of the scientific consensus as portrayed by Gelb, and to call out a scientific inaccuracy in Gelb's article.

[12] The NIPCC states that "Because we do not work for any governments, we are not biased toward the assumption that greater government activity is necessary" (NIPCC 2011). In a 1996 Op-ed in the *Wall Street Journal*, Seitz accused the IPCC of releasing a report that had been substantially altered after its content was approved by a panel of scientific contributors (Seitz 1996). In 2003, Singer wrote a letter to the editor of the journal *Science* accusing its editor of using "his Editorials inappropriately to advocate politically derived goals" (Singer 2003).

2.2 Norms of Balanced Reporting

Skeptics receive significant coverage in the media in part because of a strong journalisic norm of objectivity. Although objectivity is somewhat amorphous, in practice it often means giving "airtime" to both sides of an issue (Tuchman 1972). The Code of Ethics of the Radio Television Digital News Association (RTDNA) calls upon journalists to "present a diversity of expressions, opinions, and ideas in context" (RTDNA 2013). The 2005 BBC Editorial Guidelines called for a "commitment to impartiality," meaning that they "strive to reflect a wide range of opinion and explore a range and conflict of views" (Thompson 2005). Asked what objectivity means, a sample of US journalists rated "express[ing] fairly the position of each side" ahead of "not allow[ing] the journalist's own political beliefs to affect the presentation of the subject" (Donsbach and Klett 1993). Balance often goes surprisingly far: it was not until 1979 that the *New York Times* stopped routinely quoting Tobacco Industry representatives to provide the "other side" of the smoking-cancer link (Hoyt 2008).

Balanced reporting protects a journalist from accusations of one-sidedness. Journalists often report claims they cannot verify directly. Quoting someone critical (or likely to be critical) of a given claim provides a routine way to avoid appearing to endorse the original claim (Tuchman 1972).[13] This is important because evidence of one-sided reporting, especially when it seems to favor an interest of the news organization, is extremely damaging reputationally. For example, the *New York Times* lost face over its reporting on the presence of weapons of mass destruction in Iraq when subsequent events revealed that quoted sources exaggerated the case for the presence of such weapons (Okrent 2004; The *Times* and Iraq 2004). This instance was especially costly because of the appearance that the *Times* had tilted its reporting in order to retain access to administration sources (Foer 2004).

Objectivity was crystallized as the centerpiece of Anglo-American journalistic ethics in the 1920s, at the end of a long transition from explicit partisanship to political independence (Schudson 1978, 2001). Schudson (2001) argues that the objectivity norm arose in part in response to the rise of the public relations industry and other organized efforts to influence media coverage. With substantial resources devoted to manipulating the press, journalists felt it especially important to "assert their collective integrity" and to show that they did not pander to one or another side of an issue (Schudson 2001).

[13] Tuchman's (1972) seminal sociological account of objectivity in the newsroom offers the following abstract example. "A [Democratic] US senator may claim that America lags behind the Soviet Union in the development of a specific type of missile. A reporter certainly cannot check that claim in time to meet his deadline, and it is possible he could never locate adequate information with which to assess the extent to which the claim is a 'fact'...He can, however, write that the [Republican] secretary of defense stated [the charge is 'false']...Presenting both truth-claim 'A' attributed to the senator and truth-claim 'B' attributed to the secretary of defense, the newsman may then claim he is 'objective' because he has presented 'both sides of the story' without favoring either man or political party."

Many analysts have argued that traditional norms of objectivity are inappropriate for scientific journalism, where there should be no presumption that issues have two legitimate sides (Check 1987). Russell (2010) contends that "it can be confusing–or even misleading–for the public if each side is given equal weight just to make a story appear 'balanced.'" Partly due to criticism of the BBC's coverage of climate change and other scientific topics (Jones 2011), the BBC's 2010 Editorial Guidelines clarified that "minority views should not necessarily be given equal weight to the prevailing consensus" (Lyons 2010).

3 Model

I model an environment in which a pair of interested parties wish to affect a voter's policy choice by influencing the voter's belief about a binary state of the world. There is a population of informed, disinterested experts and a journalist who reports on expert opinion to the voter. The journalist may be aligned with one of the parties or may be neutral.

The game proceeds as follows. Nature determines the policy-relevant state, the opinions of the experts, and the journalist's type. The interested parties observe the distribution of expert opinion and choose whether to invest in acquiring an affiliated expert. The journalist learns the opinion of a random expert and may seek a rejoinder from an affiliated expert. The journalist then makes a report to the voter. The voter chooses a policy, payoffs are realized, and the game ends.

Formally the state of the world is $\omega \in \{0,1\}$ with $\Pr(\omega = 1) = \frac{1}{2}$. A journalist sends a message m to a voter who does not know ω and who chooses a policy $a \in [0,1]$ after observing m. After making her policy choice the voter learns the true state and suffers a loss given by

$$L(a,\omega) = (a-\omega)^2 \tag{1}$$

Each of two interested parties, denoted 0 and 1, then receives a payoff that depends on the voter's policy choice. Party j has ideal policy $a = j$ and obtains a bounty equal to $aj + (1-a)(1-j)$.

There is a unit mass of experts. Each expert forms a binary opinion. With probability $(2\gamma - 1)$ all experts form opinion ω. With probability $2(1-\gamma)$ experts are evenly divided, with half forming opinion ω and half forming opinion $1-\omega$. The unconditional probability that a randomly chosen expert has a correct opinion is $\gamma \in \left(\frac{1}{2}, 1\right)$. Let $\sigma \in \left\{0, \frac{1}{2}, 1\right\}$ denote the realized share of experts with opinion 1.

After observing the distribution σ of expert opinion, each party decides whether to invest in obtaining an affiliated expert. If $\sigma = \frac{1}{2}$, then it costs either party $\underline{c}/2 > 0$ to obtain an affiliated expert. If $\sigma \in \{0,1\}$, then party $j = \sigma$ can obtain an affiliated expert at no cost, and party $j = 1-\sigma$ can obtain an affiliated expert

only by paying cost $\overline{c} > \underline{c}$ to groom a non-expert to appear like an expert.

The journalist solicits the opinion s of a randomly chosen expert. The journalist then chooses whether to report $m = s$ or to contact the opposition party $1 - s$ for a rejoinder. In the latter case, if the party has no affiliated expert, the rejoinder is "no comment" and the journalist reports $m = s$. If instead the party has an affiliated expert, the affiliated expert gives her opinion and the journalist reports the unordered set $m = \{s, 1-s\}$, which I abbreviate as $m = \frac{1}{2}$.

With probability $\lambda < 1$ the journalist is an opinionated type concerned about persuading the voter. This type's payoff is equally likely to be a or $1 - a$. With probability $1 - \lambda$, the journalist is an unopinionated type concerned about her reputation for honesty. This type's payoff is a strictly decreasing function of $\hat{\lambda}(m)$, where $\hat{\lambda}(m)$ is the posterior probability that the voter assigns to the event that the journalist is opinionated, conditional on observing message m. I will think of λ as small.

After the voter observes the message m, the voter updates her beliefs about the journalist's type and the journalist realizes her reputational payoff. The voter then chooses a policy a and party j obtains profits equal to its bounty net of any costs paid to affiliate an expert. Finally, the voter obtains a payoff as a function of the state ω and her action a.

I will use Perfect Bayesian Equilibrium as a solution concept. An equilibrium is a set of voter beliefs, voter actions, and party actions such that (i) voter beliefs given message m are consistent with Bayes' Rule for any message m observed with positive probability on the equilibrium path, (ii) the voter chooses her action to minimize her expected loss for any m given her beliefs, (iii) each type of journalist maximizes its expected payoff given the observed s and the equilibrium strategies of the voter and interested parties, and (iv) each party maximizes its expected profits given the observed σ and the equilibrium strategies of the voter and journalists.

I will sometimes restrict attention to symmetric equilibria. A symmetric equilibrium is one in which the action of party j depends only on the share of experts $\sigma j + (1-\sigma)(1-j)$ whose opinions align with the party's position and not on the party's identity.

Because of the quadratic form of the voter's loss function, the voter's optimal action $a(m)$ given message m is given by $a(m) = \mathrm{E}(\omega|m)$ for any m with positive probability on the equilibrium path. For m with zero probability, any $a(m) \in [0,1]$ is optimal. I will treat $a(m)$ as a description of both the voter's beliefs and her actions.

I will treat the expected loss $\mathrm{E}(L(a,\omega))$ as a measure of the informativeness of an equilibrium. A voter who knows only her prior has $\mathrm{E}(L(a,\omega)) = \frac{1}{4}$. A voter who learns the true state has $\mathrm{E}(L(a,\omega)) = 0$. A voter who learns the distribution σ of expert opinion has $\mathrm{E}(L(a,\omega)) = \frac{1}{2}(1-\gamma) \in \left(0, \frac{1}{4}\right)$.

Discussion

Before characterizing the model's equilibria I pause to consider the interpretation of the important assumptions and parameters.

Begin with the origins of expert opinion. We may think of experts as forming an opinion after observing some data. When the data are unambiguous, experts are unanimous. When the data are ambiguous, experts are divided, either because they observe private data or because they interpret public data differently. We can interpret the parameter γ as measuring the amenability of the topic to empirical science. On topics where data are likely to be decisive (e.g., whether the earth is warming), γ is high; on topics where data are unlikely to resolve differences in opinion (e.g., the optimal rate of capital taxation), γ is low.

Given their opinions, experts are assumed to report truthfully. If experts are unanimous, this means that an interested party opposed to the expert consensus must invest resources to groom a non-expert to appear like an expert by, for example, creating an institute headed by the non-expert, funding the non-expert's participation in scientific conferences, etc. We can interpret the cost $\overline{c}$ of grooming a non-expert as a measure of the voter's sophistication. The more sophisticated is the voter, the greater are the resources required to make a non-expert appear credible.

It is easy to recast the model as one in which experts will report any opinion for a fee. Suppose, for example, that expert affiliates are hired in a competitive market and that an expert who affiliates with an interested party pays a professional cost in terms of lost reputation or prestige. Suppose further that this cost is increasing in the fraction of other experts who disagree with the party's position. In competitive equilibrium, an affiliate's wages will compensate her for this professional cost, leading to an investment cost structure identical to the one I assume above.

Parties make their investment decisions after observing the distribution σ of expert opinion. This is a reasonable assumption in light of the narrative evidence in the cases I discuss above. Tobacco industry representatives, for example, conducted extensive reviews of scientists' research prior to choosing potential affiliates (Michaels 2008, p. 80). The assumption that parties observe σ, together with the assumption that $\overline{c} > \underline{c}$, means that the incentive for a party to invest is greater when experts are divided than when experts are unanimous.

We may think of the costs $\overline{c}$ and $\underline{c}$ as inversely related to the importance of the issue to the parties. Formally, a model in which the parties' gross payoffs are scaled by a constant $v > 0$ is equivalent to the model above with costs $\overline{c}/v$ and $\underline{c}/v$. Higher costs can therefore be thought of as implying lower economic stakes, all else equal.

The model embeds reputational considerations for the journalist by supposing that with some small probability λ the journalist is an opinionated type who would like to persuade the voter of one position or another. The "standard" unopinionated type is motivated to convince the voter that she is not interested in the voter's policy choice. This approach is motivated by the sociological literature on objectivity in journalism that I summarize above. Although I model a static game, the journalist's concern for reputation can be rationalized by imagining a future round of play in which the journalist charges a price proportional to the expected informativeness of her report, and the report of an unopinionated journalist is more informative than that of an opinionated journalist.

4 Equilibrium Behavior of Special Interests

I begin by taking the journalist's reporting strategy as given in order to focus on the incentives of the interested parties. Formally, one may think of this section as assuming that $\lambda = 0$, in which case voter beliefs $\hat{\lambda}(m) = 0$ for all m are trivially consistent with Bayes' Rule and with any reporting strategy of the journalist.

Suppose first that the journalist chooses not to contact the opposition party, which I will refer to as the case of *unbalanced reporting*. Then the interested parties do not invest and $m = s$, i.e. the journalist's report is the opinion of a randomly chosen expert. By Bayes' Rule, $a(1) = \gamma = 1 - a(0)$ and $\mathrm{E}(L(a,\omega)) = \gamma(1-\gamma)$.

Suppose next that the journalist chooses to contact the opposition party, which I will refer to as the case of *balanced reporting*. Then the interested parties may invest. If $\sigma = 0$, then party 1 is willing to invest if $a\left(\frac{1}{2}\right) - a(0) \geq \overline{c}$. If $\sigma = \frac{1}{2}$, then party 1 is willing to invest if $a\left(\frac{1}{2}\right) - a(0) \geq \underline{c}$. Party 0's incentives are analogous.

It is instructive to characterize the set of symmetric equilibria in pure strategies. If the parties invest if and only if $\sigma = \frac{1}{2}$, then $m = \sigma$, $a(m) = m$, and $\mathrm{E}(L(a,\omega)) = \frac{1}{2}(1-\gamma)$. Such a *separating* equilibrium exists if and only if $\overline{c} \geq \frac{1}{2} \geq \underline{c}$. No equilibrium can be more informative than a separating equilibrium, because a separating equilibrium reveals σ to the voter. In particular, a separating equilibrium is more informative than equilibrium under unbalanced reporting.

If the parties do not invest at all, then $a(1) = \gamma = 1 - a(0)$ and $\mathrm{E}(L(a,\omega)) = \gamma(1-\gamma)$. In order for the parties to be willing not to invest, it must be that $\underline{c} \geq \gamma - \min\left\{a\left(\frac{1}{2}\right), 1 - a\left(\frac{1}{2}\right)\right\}$. Such a *no-investment* equilibrium exists if and only if $\underline{c} \geq \gamma - \frac{1}{2}$. A no-investment equilibrium is less informative than a separating equilibrium and is payoff-equivalent to equilibrium under unbalanced reporting.

If the parties invest regardless of σ, then $m = \frac{1}{2}$ with probability 1, $a\left(\frac{1}{2}\right) = \frac{1}{2}$, and $\mathrm{E}(L(a,\omega)) = \frac{1}{4}$. In

order for the interested parties to be willing to invest, it must be that $\min\left\{a(1)-\frac{1}{2},\frac{1}{2}-a(0)\right\}\geq\overline{c}$. Such a *full-investment* equilibrium exists if and only if $\overline{c}\leq\frac{1}{2}$. A full-investment equilibrium is uninformative and is therefore worse for the voter than equilibrium under unbalanced reporting.

One of these three types of equilibria always exists, and these three are exhaustive of the possible types of symmetric equilibria in pure strategies.[14] To summarize:

Proposition 1. *An equilibrium with balanced reporting exists. Under balanced reporting there exists a separating equilibrium if and only if $\overline{c}\geq\frac{1}{2}\geq\underline{c}$, a no-investment equilibrium if and only if $\underline{c}\geq\gamma-\frac{1}{2}$, and a full-investment equilibrium if and only if $\overline{c}\leq\frac{1}{2}$.*

Observe that among symmetric equilibria in pure strategies, informative balanced reporting is possible only when $\overline{c}\geq\frac{1}{2}$ or $\underline{c}\geq\gamma-\frac{1}{2}$.

These comparative statics survive when considering the set of all equilibria:

Proposition 2. *Under balanced reporting there exists an informative equilibrium if and only if $\overline{c}\geq\frac{1}{2}$ or $\underline{c}\geq\gamma-\frac{1}{2}$.*

The "if" direction is implied by proposition 1. To prove the "only if" direction, observe first that optimization by the parties implies that any party j is at least as likely to invest if $\sigma=\frac{1}{2}$ as it is if $\sigma=1-j$. Together with Bayes' Rule, this optimization condition implies that if message $m=1$ is on the equilibrium path, then $a(1)\geq\gamma$, and symmetrically for message $m=0$.

Now pick $\overline{c}<\frac{1}{2}$ and $\underline{c}<\gamma-\frac{1}{2}$ and consider that in an informative equilibrium at least one of $m=1$ or $m=0$ must occur on the equilibrium path. If only one of these messages occurs, say $m=1$, then party 1 must invest with certainty, so by Bayes' Rule $a\left(\frac{1}{2}\right)\leq\frac{1}{2}$. Because $a(1)-a\left(\frac{1}{2}\right)\geq\gamma-\frac{1}{2}>\underline{c}$, party 0 invests with certainty when $\sigma=\frac{1}{2}$. But then $a(1)=1$, so that party 0 invests with certainty when $\sigma=1$, implying the contradiction that $m=1$ is not observed. If both $m=1$ and $m=0$ occur on the equilibrium path, then either $a\left(\frac{1}{2}\right)\leq\frac{1}{2}$ or $a\left(\frac{1}{2}\right)\geq\frac{1}{2}$; say it is the former. Then party 0 will invest with certainty when $\sigma=\frac{1}{2}$; following the logic above this implies that the party will also invest with certainty when $\sigma=1$ and hence that $m=1$ is not observed in equilibrium.

Discussion

Figure 1 shows the informativeness of the most informative symmetric equilibrium as a function of parameter values. The figure illustrates the key lessons of propositions 1 and 2.

[14] The assumption that $\overline{c}>\underline{c}$ rules out the possibility of an equilibrium in which parties invest when $\sigma\in\{0,1\}$ but not when $\sigma=\frac{1}{2}$.

As panel A of figure 1 illustrates, the strategic behavior of special interests can be socially productive. When $\overline{c}$ is high and $\underline{c}$ is low, there is an equilibrium in which the voter learns σ with certainty. Although the model does not explicitly account for the cost of the journalist's time, it is noteworthy that learning σ requires only two phone calls: one to learn the opinion of a random expert, the other to learn whether the opposing party has an expert of its own. By exploiting the parties' incentives this equilibrium achieves significant efficiencies relative to, say, a survey of experts.

In practice, such a case is most likely to arise when (i) the stakes are low or moderate and (ii) there is a strong professional structure among experts that makes it difficult to "forge" an expert, or to convince one to change her opinion. This is in some sense the typical case: most basic findings of fact (e.g., a comet has struck the sun) are reported uncontroversially in the press. Though just about any fact has its doubters, in most cases skeptics are limited in both credibility and resources.

Importantly, though, as panel B of figure 1 illustrates, the strategic behavior of special interests can also be counterproductive. When $\overline{c} < \frac{1}{2}$ and $\underline{c} < \gamma - \frac{1}{2}$, the parties invest regardless of σ, so any equilibrium with balanced reporting is uninformative. The condition that $\overline{c} < \frac{1}{2}$ is intuitive: informative communication is more likely to break down when stakes are high, the voter is unsophisticated, and experts are easily forged or captured.

More surprising is the condition that $\underline{c} < \gamma - \frac{1}{2}$, which means that a higher γ can make equilibrium less informative despite making experts more informed. The reason for this effect, illustrated in the proof of proposition 2, is that when γ is large, an uncontested report of $m = 0$ or $m = 1$ is highly informative to the voter, creating a strong incentive for the parties to invest, and leading to a collapse of informative communication.

The finding that communication is least informative when $\overline{c} < \frac{1}{2}$ and $\underline{c} < \gamma - \frac{1}{2}$ provides a lens through which to understand the poor performance of the news media in informing voters on climate change. The large economic stakes attached to environmental policy lead to low $\overline{c}$ and $\underline{c}$. The fact that data are likely to be dispositive on at least some key elements of climate science (e.g., whether the earth has gotten warmer in recent decades) means that uncontested news reports of scientific conclusions contain a lot of information. Together, these features combine to produce a "noisy" media environment, with credentialed skeptics undermining the perception of a scientific consensus.

5 Equilibrium Behavior of Journalists

Next I consider the case in which $\lambda > 0$. I will define unbalanced and balanced reporting with respect to the behavior of the unopinionated journalist.

An equilibrium with unbalanced reporting exists. If no type of journalist calls the opposition and no party invests, then no player has an incentive to deviate: neither investment by the parties nor a change in reporting strategy would affect the message delivered to the voter. In such an equilibrium $a(1) = \gamma = 1 - a(0)$ and $\mathrm{E}(L(a,\omega)) = \gamma(1-\gamma)$. For sufficiently small λ, this is the only type of equilibrium with unbalanced reporting, because for sufficiently small λ no party will have an incentive to invest in equilibrium.

An equilibrium with balanced reporting also exists. Consider the incentive of the journalist to call the opposition. If no party invests, this incentive is satisfied trivially as the journalist's reporting strategy does not affect the message m. If both parties invest with positive probability, then $a(1) > a\left(\frac{1}{2}\right) > a(0)$, so the opinionated journalist will call the opposition if and only if she disagrees with the signal s. It follows that message $m = \frac{1}{2}$ is evidence that the journalist is unopinionated, i.e. that $\hat{\lambda}\left(\frac{1}{2}\right) < \lambda < \hat{\lambda}(0), \hat{\lambda}(1)$, and hence that the unopinionated journalist wishes to call the opposition.[15]

It remains to show that balanced reporting is consistent with equilibrium investment behavior by the parties. I provide conditions for symmetric equilibria that mirror those in the prior subsection, accounting now for the fact that the opinionated journalist calls the opposition only when she disagrees with the signal s.

In a separating equilibrium the parties invest if and only if $\sigma = \frac{1}{2}$. Then if the journalist is unopinionated $m = \sigma$, but if the journalist is opinionated message $m \in \{0,1\}$ is possible even if $\sigma = \frac{1}{2}$. By symmetry $a\left(\frac{1}{2}\right) = \frac{1}{2}$. By Bayes' Rule, $a(1) = 1 - \varepsilon(\lambda) = 1 - a(0)$ where $\varepsilon(\lambda)$ is a function, continuous and strictly increasing in λ, with $\varepsilon(0) = 0$ and $\varepsilon(\lambda) \in (0, 1-\gamma)$ for $\lambda > 0$. Such an equilibrium exists if and only if $\bar{c} \geq \left(1 - \frac{1}{2}\lambda\right)\left(\frac{1}{2} - \varepsilon(\lambda)\right) \geq \underline{c}$. The voter's expected loss is continuous and strictly increasing in λ with $\mathrm{E}(L(a,\omega)) < \frac{1}{4}$ for $\lambda = 1$ and $\lim_{\lambda \to 0} \mathrm{E}(L(a,\omega)) = \frac{1}{2}(1-\gamma)$.

In a no-investment equilibrium $a(1) = \gamma = 1 - a(0)$ and message $m = \frac{1}{2}$ is off the equilibrium path. Such an equilibrium exists if and only if $\underline{c} \geq (1-\lambda)\left(\gamma - \frac{1}{2}\right)$. The voter's expected loss is $\mathrm{E}(L(a,\omega)) = \gamma(1-\gamma)$.

In a full-investment equilibrium $a(1) = \gamma = 1 - a(0)$ and $a\left(\frac{1}{2}\right) = \frac{1}{2}$. Such an equilibrium exists if and only if $\left(1 - \frac{1}{2}\lambda\right)\left(\gamma - \frac{1}{2}\right) \geq \bar{c}$. The voter's expected loss $\mathrm{E}(L(a,\omega)) > \gamma(1-\gamma)$ is continuous and strictly

[15] A similar argument applies if only a single party j invests with positive probability. In this case party j must strictly prefer policy $a\left(\frac{1}{2}\right)$ to policy $a(1-j)$. Therefore an opinionated journalist receiving signal $s = 1 - j$ will call the opposition if and only if she agrees with party j. It follows that $\hat{\lambda}\left(\frac{1}{2}\right) < \lambda(1-j)$. Therefore the unopinionated journalist is willing to call the opposition after receiving signal $s = 1 - j$. (The incentive of the journalist is trivial if she receives signal $s = j$ as the reporting strategy does not affect the message m in this case.)

decreasing in λ with $\lim_{\lambda\to 0}\mathrm{E}(L(a,\omega)) = \frac{1}{4}$.

To complete the proof of existence I show in the appendix that an equilibrium in which the parties invest when $\sigma = \frac{1}{2}$ and mix when $\sigma \in \{0,1\}$ exists if and only if $\left(1-\frac{1}{2}\lambda\right)\left(\frac{1}{2}-\varepsilon(\lambda)\right) \geq \overline{c} \geq \left(1-\frac{1}{2}\lambda\right)\left(\gamma-\frac{1}{2}\right)$.

To summarize:

Proposition 3. *An equilibrium with balanced reporting exists. Under balanced reporting there exists a separating equilibrium if and only if* $\overline{c} \geq \left(1-\frac{1}{2}\lambda\right)\left(\frac{1}{2}-\varepsilon(\lambda)\right) \geq \underline{c}$*, a no-investment equilibrium if and only if* $\underline{c} \geq (1-\lambda)\left(\gamma-\frac{1}{2}\right)$*, and a full-investment equilibrium if and only if* $\overline{c} \leq \left(1-\frac{1}{2}\lambda\right)\left(\gamma-\frac{1}{2}\right)$.

Turning to comparative statics, note that the existence of the opinionated journalist makes even a full-investment equilibrium informative. However, the information content of the equilibrium vanishes as λ approaches zero.

Formally, say that the equilibria for some $\overline{c}$, $\underline{c}$, and γ are *robustly informative* if the voter's expected loss in the most informative equilibrium is bounded away from that of an uninformative equilibrium as λ approaches 0. The above discussion implies that the equilibria are robustly informative if $\overline{c} \geq \frac{1}{2}$ or $\underline{c} \geq \left(\gamma-\frac{1}{2}\right)$. In fact, I show in the appendix that if these conditions fail then for small λ the only equilibria have approximately full investment and are therefore almost uninformative, proving:

Proposition 4. *Under balanced reporting, equilibria are robustly informative if and only if* $\overline{c} \geq \frac{1}{2}$ *or* $\underline{c} \geq \gamma-\frac{1}{2}$.

Importantly, then, when the journalist values her reputation for objectivity, a norm of balanced reporting may emerge under which arbitrarily little information is transmitted in equilibrium.

Discussion

Propositions 3 and 4 close the model by showing that arbitrarily uninformative reports can emerge in equilibrium when journalists have a desire to appear objective. Proposition 4 constitutes a simple and internally consistent explanation for persistent voter ignorance about climate change. High stakes mean that $\overline{c}$ and $\underline{c}$ are low, and a high amenability to empirical science means that γ is high. Therefore any equilibrium in which journalists give the opposition a voice will have the skeptical position represented in the news media by apparent experts, making it difficult for a lay audience to discern the true weight of the scientific evidence.

Regardless of the stakes there is always an equilibrium with unbalanced reporting. The reason is that the parties will not invest if the journalist will not call them, and the journalist will have no incentive to call if the parties will always say "no comment." The interdependence between journalistic norms and special interest

activity resonates with Schudson's (2001) observation that the objectivity norm in US journalism emerged in the early twentieth century alongside a growing public relations industry, which raised concerns about media capture by special interests.[16] The fact that balanced reporting need not emerge as an equilibrium norm seems also consistent with the large variation in journalistic norms across developed countries (Donsbach and Klett 1993).

I model reputational concerns with a reduced-form payoff function that is declining in the voter's perception that the journalist is opinionated. It is easy to microfound this payoff function. Suppose that there are two periods. In the second period $\overline{c}$ is very high and $\underline{c}$ is very low so there exists a separating equilibrium in which the unopinionated journalist calls the opposition and the opinionated journalist does so only when she disagrees with the neutral expert. It is straightforward to verify that the voter's expected loss is increasing in the likelihood that the journalist is opinionated. If the voter pays the journalist an amount proportional to the reduction in her expected loss from obtaining the journalist's report, then in the first period an unopinionated journalist's payoff is decreasing in $\hat{\lambda}(m)$ as I assume above.[17]

Reputation is not the only reason that journalists may wish to pursue balance. Debates are entertaining and giving a voice to skeptics is a low-effort way to add texture to an article. These incentives will likely reinforce the model's conclusion that media outlet's incentives may facilitate obfuscation by special interests.

6 Applications

Figure 2 shows that after a period of growing acceptance of climate change in the 1990s, the US public's beliefs largely stopped converging towards those of experts in the 2000s. This is true despite a broad trend of growing media attention to climate change (Boykoff 2011; Grundmann and Scott 2012), and despite no overall trend in factual knowledge of science (National Science Board 2010). The public is skeptical both of the existence of climate change and of the existence of an expert consensus on the subject.[18]

These facts, especially when viewed in light of evidence from content studies, are consistent with a

[16] "[J]ournalists...sought to disaffiliate from the public relations specialists and propagandists who were suddenly all around them" (Schudson 2001).

[17] A slight complication arises if the opinionated journalist also takes account of the second period, leading her to wish to pool with the opinionated journalist in order to raise the credibility of her report in the second period. For small λ this incentive is small and is therefore dominated by the incentive to influence the voter's choice of policy.

[18] Few citizens believe there is a consensus position *against* global warming, but many believe that scientists remain divided on the topic. In a 2004 poll, for example, 52 percent of those expressing an opinion said that "scientists are divided on the existence of global warming and its impact" and 45 percent said that "there is a consensus among the great majority of scientists that global warming exists and could do significant damage." Only the small remaining share of respondents said that "there is a consensus...that global warming does not exist and therefore poses no significant threat" (Nisbet and Myers 2007).

model in which media reports do not inform news consumers of expert consensus. As a more direct test of this hypothesis, in table 1 I show the cross-sectional relationship between news consumption and climate change beliefs. Strikingly, those who read a newspaper daily are only slightly (and statistically insignificantly) more likely to report that there is "solid evidence that the earth has been getting warmer." I show in the online appendix that this is true for Republicans, Democrats, and Independents, indicating that it does not represent a partisan bias in the processing of information.

The weak relationship between news consumption and climate change beliefs stands in stark contrast to the relationship between news consumption and general factual knowledge. The table shows that those who read a daily newspaper are 18 percentage points more likely to know the majority party in the US House of Representatives, 17 percentage points more likely to know the name of the US Secretary of State, and 15 percentage points more likely to know the name of the British Prime Minister. The average of these three knowledge gaps is highly statistically significantly different from the corresponding gap in climate change beliefs.

Figure 3 shows that the US is special: among OECD countries, the US public is the most skeptical about anthropogenic climate change. The model provides a perspective on this fact. In the model, journalism norms are subject to multiple equilibria: both unbalanced and balanced reporting are possible outcomes. In fact, as table 2 shows, journalism norms vary substantially across countries. US journalists are nearly twice as likely as their German counterparts to say that objectivity means "express[ing] fairly the position of each side in a political dispute."[19] Correspondingly, the German press gives far less attention than the US to skeptical researchers when reporting on climate change, and the German public is far more accepting of anthropogenic climate change than is the American public.

Figure 4 reinforces the comparisons in table 2 in a larger sample of countries. Across the eleven countries for which data are available, countries in which journalists state that they "always make clear which side in a dispute has the better position" show substantially more acceptance of anthropogenic climate change.

An important limitation of the evidence on climate change is that citizens' stated beliefs are unincentivized and may reflect attitudes about public policy rather than true beliefs about scientific fact (Prior 2007; Bullock et al. 2013). In health domains, however, citizens make consequential personal decisions based in part on their perceptions of scientific fact. Such domains are therefore useful in corroborating the relationship between media coverage and public opinion found in the case of climate change.

The debate over the connection between autism and measles, mumps, and rubella (MMR) vaccination

[19] Among German journalists, the most common answer is that objectivity means "go[ing] beyond the statements of the contending sides to the hard facts of a political dispute."

in children affords a useful case study. In 1998 UK-based physician Andrew Wakefield and collaborators published a study in *Lancet* about bowel disorders and developmental disorders in children. In a press conference held to announce the findings Wakefield said that a possible causal connection between MMR vaccine and autism meant that he could "not support the continued use" of MMR (Mnookin 2012). Subsequent authoritative reviews of the medical evidence find no support for a connection between MMR and autism (Institute of Medicine of the National Academies 2004; Demicheli et al. 2012), and Wakefield's study was eventually retracted (Dyer 2010).

There is an organized and energetic opposition to the scientific consensus on the MMR-autism link (Mnookin 2012). There are financial stakes. Wakefield's initial interest in the effects of the measles vaccine may have grown out of an attempt to sue vaccine manufacturers (Deer 2011). In the US, thousands of families have filed for compensation for harm done by the MMR vaccine (Sugarman 2007). However, in many cases the motivation for pursuing the case against vaccination seems to stem more from personal conviction than from financial self-interest (Mnookin 2012). This conviction has proved a powerful driver of public activism. Following an ethics ruling against Wakefield by the UK's General Medical Council (GMC), activist groups rallied behind Wakefield (Cox 2010; Dominus 2011), with one organization calling the events surrounding the GMC ruling a "vaccine-industry funded media circus" (Williams 2011).

The media have devoted significant attention to non-consensus views on the MMR-autism link. This is true especially in the UK, where nearly one-third of articles on the subject from 1998 to 2006 presented arguments both in favor of and against an MMR-autism link (Clarke 2008; see also Boyce 2006). The hypothesis of an MMR-autism link gained significant traction over this period, with 53 percent of British adults reporting that there is "equal evidence on both sides of the [MMR-autism] debate" (Lewis and Speers 2003). More importantly, childhood MMR coverage has fallen significantly since 1998 (Burgess et al. 2006). As figure 5 illustrates, this decline in coverage is not observed for other vaccines in the UK that were not the target of Wakefield's criticism. Even with high population rates of vaccination, childhood vaccination decisions have consequences: in 2012, measles cases in England and Wales reached their highest levels in decades (BBC 2013).

7 Conclusions

I model special interests' efforts to influence voter opinion through the news media. I find that special interests' activities can benefit the voter by revealing private information about the distribution of expert opinion, or harm the voter by obfuscating an expert consensus. The latter case arises when the economic

stakes are large and the likelihood of an expert consensus is high. I show that obfuscation by special interests can be supported even by unbiased media with no material stake in the issue in question. The model explains persistent voter ignorance on climate change and other scientific topics in which expert consensus is not communicated to the public, and makes sense of prominent features of the cross-section of public opinion.

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Table 1: Belief and knowledge of newspaper readers

	Reads daily	Does not read daily	Difference	*N*
Solid evidence of global warming	0.7124	0.6819	0.0305	1500
	(0.0161)	(0.0175)	(0.0238)	
Factual knowledge				
US House majority	0.6118	0.4332	0.1786	3609
	(0.0105)	(0.0131)	(0.0167)	
US Secretary of State	0.5003	0.3343	0.1660	3609
	(0.0107)	(0.0124)	(0.0164)	
British Prime Minister	0.3450	0.1972	0.1479	3609
	(0.0102)	(0.0105)	(0.0146)	
Share of factual questions correct	*0.4857*	*0.3216*	*0.1641*	*3609*
	(0.0079)	*(0.0090)*	*(0.0120)*	
p-value of test that climate change difference is equal to factual question share difference			0.0000	

Note: Data are from the Pew Research Center for the People and the Press (2013). Data for the "solid evidence of global warming" row are taken from the June News Interest/Believability Survey (June 2006). The exact question is "From what you've read and heard, is there solid evidence that the average temperature on earth has been getting warmer over the past few decades, or not?" Data for the "factual knowledge" rows are taken from the Biennial Media Consumption Survey (April 2008). Exact questions are "Do you happen to know which political party has a majority in the US House of Representatives? (i) Yes, Democrat (ii) Yes, Republican (iii) No/Can't say/Don't know/Other incorrect," "Can you tell me the name of the current US Secretary of State? (i) Yes, Condoleezza Rice/Condi/Rice (ii) Yes, any other person (iii) No/Can't say/Don't know/Other incorrect," and "Who is the current prime minister of Great Britain? Is it (i) Gordon Brown (ii) Rupert Murdoch (iii) Robert Gates (iv) John Howard?" The "share of factual questions correct" row is the average across the three factual knowledge questions. The last row reports the *p*-value of the test that the climate change difference is equal to the difference in the share of factual questions correct. All calculations use recommended sample weights. Standard errors are reported in parentheses.

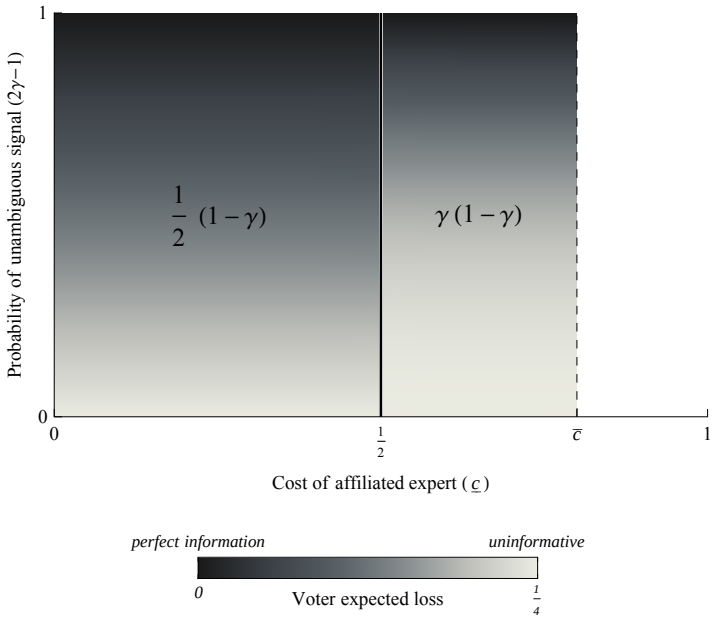
Table 2: Cross-country comparisons of journalism norms, media coverage, and beliefs in climate change

Share of...	Time period	Germany	Italy	United Kingdom	United States
...*journalists* who think objective reporting expresses fairly the position of each side	1990-1992	0.21	0.28	0.31	0.40
...*newspaper articles* mentioning skeptical scientists	2000-2010	0.02	—	0.17	0.24
...*adults* who believe that rising temperatures have a human cause	2010	0.60	0.57	0.38	0.36

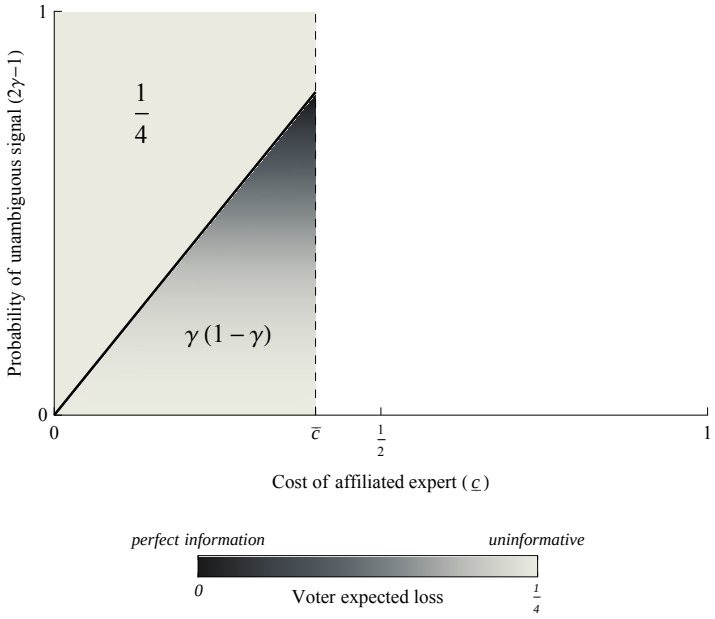
Note: Share who think objective reporting expresses fairly the position of each side is from Donsbach and Klett's (1993) survey of journalists. It is the share who answered (ii) to the following question: "Please look at the five statements about good news reporting. Which comes closest to your understanding of the term 'objectivity'? Good news reporting (i) does not allow the journalist's own political beliefs to affect the presentation of the subject, (ii) expresses fairly the position of each side in a political dispute, (iii) requires an equally thorough questioning of each side in a political dispute, (iv) goes beyond the statements of the contending sides to the hard facts of a political dispute, (v) makes clear which side in a political dispute has the better position." Share of newspaper articles mentioning skeptical scientists is from Grundmann and Scott (2012). It is the count of articles mentioning scientific researchers who are skeptical of climate change, as a fraction of articles of both advocates and skeptics, in the top 10 newspapers in each country by climate change coverage. Share of adults who believe that rising temperatures have a human cause are from a 2010 Gallup survey (Ray and Pugliese 2011) that asked: "Temperature rise is a part of global warming or climate change. Do you think rising temperatures are (i) a result of human activities, (ii) a result of natural causes, (iii) both [if volunteered], (iv) don't know/refused (v) not aware of global warming." The number reported is the share who answered (i), excluding those who answered (v).

Figure 1: Voter's expected loss in equilibrium

Panel A: High cost of investment when experts are unanimous ($\overline{c} > \frac{1}{2}$)

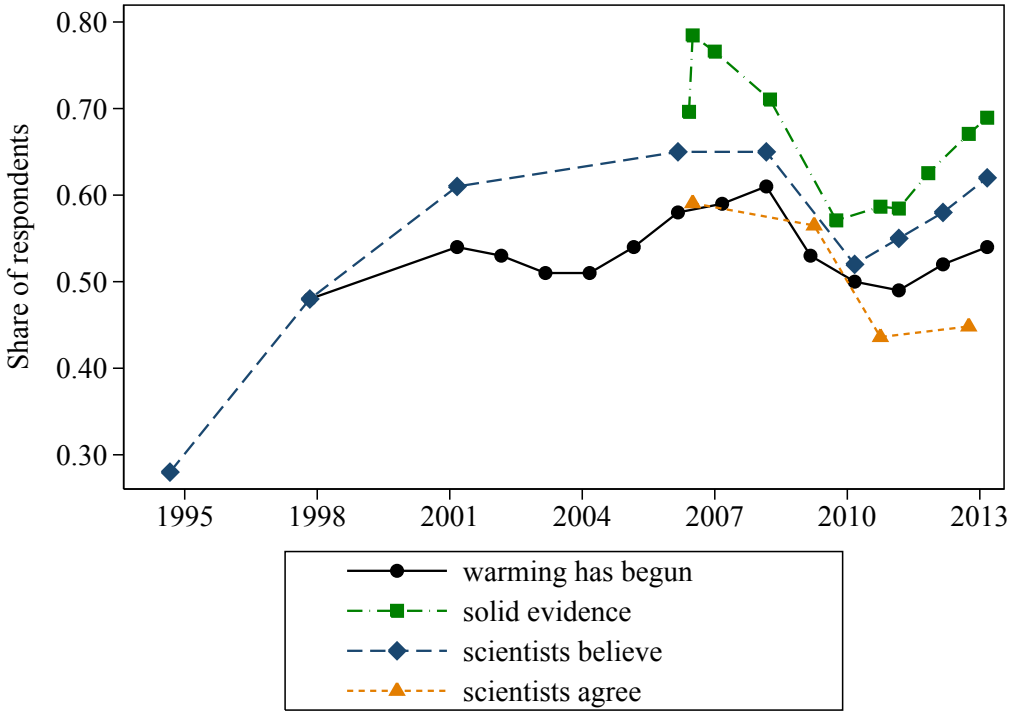


Panel B: Low cost of investment when experts are unanimous ($\overline{c} < \frac{1}{2}$)



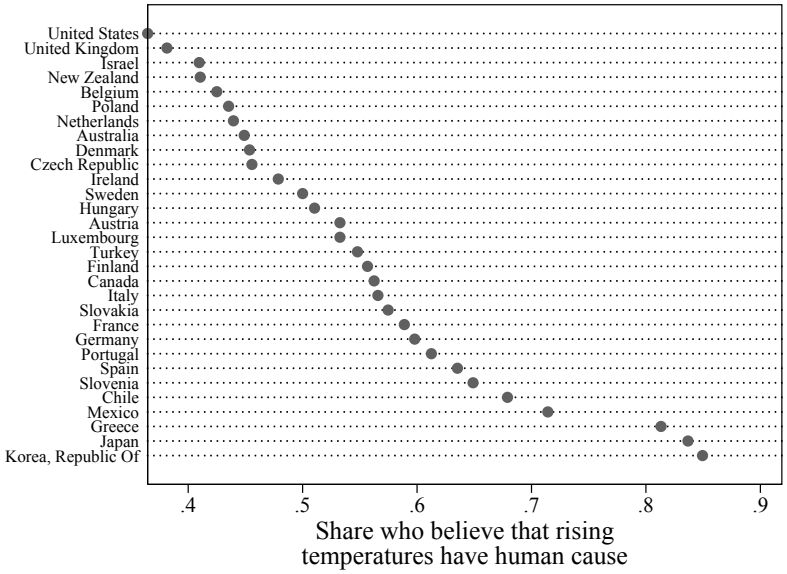
Note: Plot shows the voter's *ex ante* expected loss $\mathrm{E}(L(a,\omega))$ as a function of γ and $\underline{c}$. Panel A is drawn for the case of $\overline{c} = 0.8$. Panel B is drawn for the case of $\overline{c} = 0.4$.

Figure 2: Trends in public beliefs about climate change



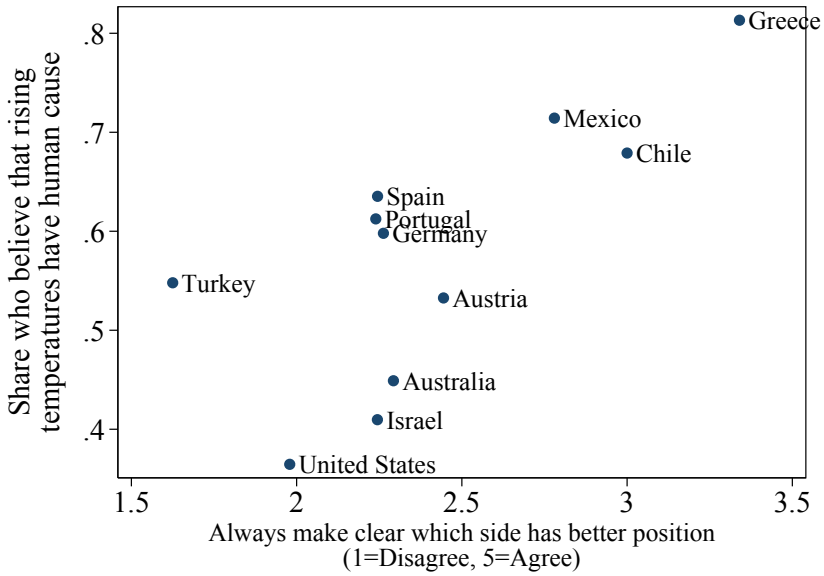
Notes: Series "warming has begun" is from Saad (2013). It is the share of respondents replying "they have already begun to happen" in response to the question "Which of the following statements reflects your view of when the effects of global warming will begin to happen? (i) they have already begun to happen (ii) they will start happening within a few years, (iii) they will start happening within your lifetime, (iv) they will not happen within your lifetime, but they will affect future generations, or (v) they will never happen." Series "solid evidence" is from the Pew Research Center for the People and the Press (2013). Studies used are the June News Interest/Believability Survey (June 2006), the July Religion and Public Life Survey (July 2006), the January News Interest Index Survey (January 2007), the April Political Survey (April 2008), the October Political Survey (October 2009, October 2010, and October 2012), the March Political Typology Survey (March 2011), the November Religion and Politics Survey (November 2011), and the March Political Survey (March 2013). The series shows the share of respondents replying "yes" to the question "From what you've read and heard, is there solid evidence that the average temperature on earth has been getting warmer over the past few decades, or not?" Series "scientists believe" is from Nisbet and Myers (2007) and Saad (2013). The series shows the share of respondents replying "most scientists believe that global warming is occurring" in response to the question "On the environmental issue known as global warming, just your impression, which one of the following statements do you think is most accurate: (i) most scientists believe that global warming is occurring, (ii) most scientists believe that global warming is not occurring, or (iii) most scientists are unsure about whether global warming is occurring or not?" Series "scientists agree" is from the Pew Research Center for the People and the Press (2013). Studies used are the Religion and Public Life Survey (July 2006), the April General Public Science Survey (April 2009), and the October Political Survey (October 2010 and October 2012). The series shows the share of respondents replying "yes" to the question "From what you've heard or read, is there general agreement among scientists that the earth is getting warmer because of human activity, or not?"

Figure 3: Climate change beliefs across countries



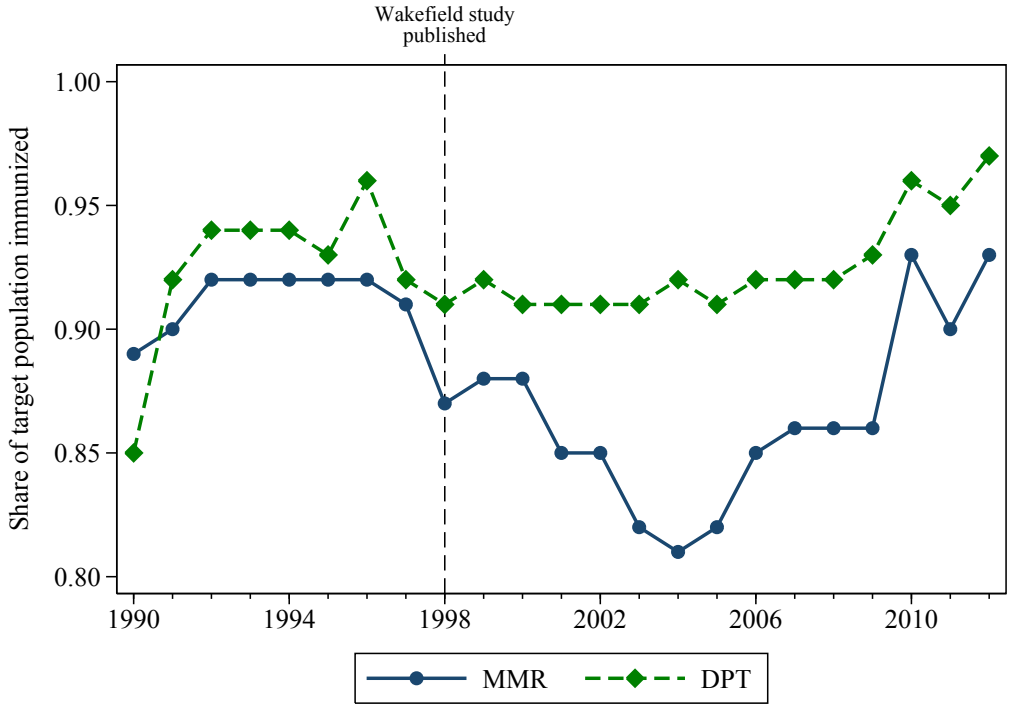
Note: Data are from a 2010 Gallup survey (Ray and Pugliese 2011) that asked: "Temperature rise is a part of global warming or climate change. Do you think rising temperatures are (i) a result of human activities, (ii) a result of natural causes, (iii) both [if volunteered], (iv) don't know/refused (v) not aware of global warming." The plot shows the share who answered (i), excluding those who answered (v). Sample is restricted to OECD countries.

Figure 4: Journalism norms and climate change beliefs across countries



Note: Data for the y-axis are from a 2010 Gallup survey (Ray and Pugliese 2011) that asked: "Temperature rise is a part of global warming or climate change. Do you think rising temperatures are (i) a result of human activities, (ii) a result of natural causes, (iii) both [if volunteered], (iv) don't know/refused (v) not aware of global warming." The y-axis is the share who answered (i), excluding those who answered (v). Data for the x-axis are from the 2007-2009 Worlds of Journalism Study survey of journalists, and are the average rating on a 1 (strongly disagree) to 5 (strongly agree) scale of the statement "I always make clear which side in a dispute has the better position." Sample is restricted to OECD countries.

Figure 5: Vaccine coverage in the UK following Wakefield's announcement



Note: Data are from the World Health Organization Immunization Surveillance database (World Health Organization 2010). The "MMR" series shows the share of the target population immunized with a measles-containing vaccine as of the given year. The "DPT" series shows the share of the target population immunized with the third dose of the diptheria toxoid, tetanus toxoid, and pertussis vaccine as of the given year. The target population is defined as those who, in the given year, reach the age by which they are recommended to be immunized.

Proofs

Proof of Proposition 3

I complete the proof of existence by showing that an equilibrium in which the parties invest when $\sigma = \frac{1}{2}$ and mix when $\sigma \in \{0,1\}$ exists if and only if $\left(1-\frac{1}{2}\lambda\right)\left(\frac{1}{2}-\varepsilon(\lambda)\right) \geq \overline{c} \geq \left(1-\frac{1}{2}\lambda\right)\left(\gamma-\frac{1}{2}\right)$.

Let ρ be the probability that party j invests when $\sigma = 1-j$. Then by Bayes' Rule there exists continuous function $f()$ such that $a(1) = f(\lambda,\rho) = 1-a(0)$. It is straightforward to show that $f(\lambda,0) = 1-\varepsilon(\lambda)$, $f(\lambda,1) = \gamma$, and that $f(\lambda,\rho)$ is strictly decreasing in ρ.

Indifference by the parties when $\sigma \in \{0,1\}$ requires that $\left(1-\frac{1}{2}\lambda\right)\left(f(\lambda,\rho)-\frac{1}{2}\right) = \overline{c}$. There exists a unique ρ that solves this equation if and only if $\left(1-\frac{1}{2}\lambda\right)\left(\frac{1}{2}-\varepsilon(\lambda)\right) \geq \overline{c} \geq \left(1-\frac{1}{2}\lambda\right)\left(\gamma-\frac{1}{2}\right)$. Indifference when $\sigma \in \{0,1\}$ implies that the parties are willing to invest when $\sigma = \frac{1}{2}$ because $\underline{c} < \overline{c}$.

Proof of Proposition 4

Proposition 3 establishes that if $\overline{c} \geq \frac{1}{2}$ or $\underline{c} \geq \gamma - \frac{1}{2}$ the equilibria are robustly informative. Here I show that if $\overline{c} < \frac{1}{2}$ and $\underline{c} < \gamma - \frac{1}{2}$ then the equilibria are not robustly informative. I do this by establishing that for λ sufficiently small the only equilibrium is symmetric, with investment with certainty when $\sigma = \frac{1}{2}$ and investment with positive probability when $\sigma \in \{0,1\}$.

Pick $\overline{c} < \frac{1}{2}$ and $\underline{c} < \gamma - \frac{1}{2}$. Define λ' and λ'' so that $\underline{c} = \left(1-\lambda'\right)\left(\gamma-\frac{1}{2}\right)$ and $\overline{c} = \left(1-\frac{\lambda''}{2}\right)\left(\frac{1}{2}-\varepsilon(\lambda'')\right)$. If no such λ'' exists, then define $\lambda'' = 1$. Choose $\lambda < \min\{\lambda', \lambda''\}$.

In any equilibrium with balanced reporting, both parties invest. Consider party 0. Because the party is weakly more likely to invest when $\sigma = \frac{1}{2}$ than when $\sigma = 1$, Bayes' Rule implies that $a(1) \geq \gamma$. If party 0 does not invest at all then Bayes' Rule implies that $a\left(\frac{1}{2}\right) \leq \frac{1}{2}$. Because $\underline{c} < (1-\lambda)\left(\gamma-\frac{1}{2}\right) \leq (1-\lambda)\left(a(1)-a\left(\frac{1}{2}\right)\right)$, it follows that party 0 invests with positive probability when $\sigma = \frac{1}{2}$ regardless of the behavior of the opinionated journalist. The same argument applies to party 1.

There can be no equilibrium in which both parties mix when $\sigma = \frac{1}{2}$. In such an equilibrium $\left(1-\frac{1}{2}\lambda\right)\left(a\left(\frac{1}{2}\right)-a(0)\right) = \underline{c} = \left(1-\frac{1}{2}\lambda\right)\left(a(1)-a\left(\frac{1}{2}\right)\right)$, but because $a(1) \geq \gamma$ and $a(0) \leq 1-\gamma$ and $\underline{c} \leq (1-\lambda)\left(\gamma-\frac{1}{2}\right) < \left(1-\frac{1}{2}\lambda\right)\left(\gamma-\frac{1}{2}\right)$ there exists no $a\left(\frac{1}{2}\right)$ that supports this condition for both parties. A similar argument shows that there can be no equilibrium in which one party invests with certainty when $\sigma = \frac{1}{2}$ and the other party mixes when $\sigma = \frac{1}{2}$.

Therefore in any equilibrium with balanced reporting both parties invest with certainty when $\sigma = \frac{1}{2}$. Letting $\rho(0)$ and $\rho(1)$ be the investment probabilities of the two parties when $\sigma = 1$ and $\sigma = 0$, respectively, it is possible to show that $a(1) = f(\lambda,\rho(0))$ and $a(0) = 1-f(\lambda,\rho(1))$ where $f()$ is defined in the proof of proposition 3. Conditions on $f()$ and $\overline{c}$ then imply that $\rho(0),\rho(1) > 0$. Together with the observation that $a\left(\frac{1}{2}\right) \lesseqgtr \frac{1}{2} \iff \rho(0) \lesseqgtr \rho(1)$ these conditions also imply that $\rho(0) = \rho(1)$.

If $\overline{c} < \left(\gamma-\frac{1}{2}\right)$ then for λ sufficiently small the unique equilibrium has $\rho(0) = \rho(1) = 1$. Otherwise for λ sufficiently small the unique equilibrium has $\rho(0) = \rho(1) = \rho^* \in (0,1)$. Because $\lim_{\lambda\to 0} f(\lambda,\rho') = 1$ for all ρ', $\lim_{\lambda\to 0}\rho^* = 1$. In either case, the limit of the voter's expected loss as $\lambda \to 0$ is $\frac{1}{4}$.