Competitive Capture of Public Opinion*

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Abstract

Two opposed interested parties (IPs) compete to influence citizens with heterogeneous priors which receive news items produced by a variety of sources. The IPs fight to capture the coverage conveyed in these items. We characterize the equilibrium level of capture of item as well as the equilibrium level of information transmission. Capture increases the prevalence of the ex ante most informative messages and can explain the empirical distribution of slant at the news-item level. Opposite capturing efforts do not cancel each other and instead undermine social learning as rational citizens discount informative messages. Citizen skepticism makes efforts to capture the news strategic substitutes. Because of strategic substitution, competition for influence is compatible with horizontal differentiation between successful media. In equilibrium, rational citizens choose to consume messages from aligned sources despite knowledge of the bias in a manner consistent with recent empirical evidence.

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1 Introduction

Since public opinion over issues shapes policy, interested parties (henceforth IPs) care about beliefs in the population.[1] To shift public opinion, IPs try to secure favorable coverage in the news that reach citizens through various sources of information. Traditional media are often subject to influence which affects its coverage, and IPs exert this pressure in ways which range from leveraging economic relationships such as advertising to outright ownership.[2] However, these efforts are not limited to traditional media. For example, Oreskes and Conway (2010) describe how scientists deeply connected to conservative funding sources have inserted themselves in the scientific debate to cast doubt on the consensus over issues ranging from the harmful effects of smoking to global warming.[3] Increasingly, IPs are also reaching the public with concerted campaigns through social media.[4]

These examples suggest that IPs channel their influence through information sources with various degrees of credibility and which reach different segments of the public. Moreover, for many policy domains – ranging from climate policies to reproductive rights – groups are organized on opposite sides of an issue and are therefore competing over public opinion. Crucially, while IPs care about the beliefs and attitudes of the public, they cannot directly manipulate them. They instead try to shape public opinion indirectly by molding news coverage.[5] Therefore, a proper analysis of these influence activities must take into account how citizens update their views –the object of IP interest– when they suspect the news coverage to be tainted by manipulation.

These strategic interactions at multiple levels pose several questions. What is the effect of capture on the distribution of bias in published news? How does the "court of

[1]We adopt the term interested parties following tradition that dates back at least to Milgrom and Roberts (1986). In the lobbying literature the usual term is Special Interest Groups, but these have the connotation of being external to the institution. Since a possible interpretation of our model is than an Interested Party could be an ideologically biased owner or subset of journalists, we adopt the more general term.

[2]Researchers have identified many instances of IPs influencing coverage. For example, Beattie, Durante, Knight, and Sen (2021) describe the effect of advertisement links, Durante, Fabiani, Laeven, and Peydro (2021) the effect of financial links, and Durante, Pinotti, and Tesei (2019) and Martin and McCrain (2019) the effect of ownership.

[3]See also the analysis of climate change coverage in Shapiro (2016).

[4]See Conley, Mina, Stefanov, and Vladimirov (2016) and Allcott and Gentzkow (2017) for examples of how social media is being actively exploited to spread ideas by international and domestic interest groups.

[5]In contrast, the canonical political lobbying literature has focused on quid-pro-quo exchanges in which government, in exchange for Special Interest Group funds, delivers policy: the object that the lobby directly cares about. See, among others, Grossman and Helpman (2001).

public opinion" react to possible capture? Does competition between IPs foster balance in new coverage or otherwise alleviate the deleterious effects of news capture? How do competing IPs strategically target news items in equilibrium?

To make headway on these questions, we propose a model with two IPs, left and right, multiple information sources and citizens with heterogeneous priors over a binary state of the world. IPs care about the posterior beliefs of the public and are diametrically opposed: each IP wants citizens to update towards a different state of the world. IPs can simultaneously and covertly spend resources to capture how a news item (an article, an entry in a social media feed, a talk show program, etc) covers an issue. In the absence of capture, what we call *honest coverage*, the news item conveys the outcome of a Blackwell experiment: its coverage is an informative signal of the state of the world. However, if the news-item coverage is captured, the successful IP determines the message published. Citizens observe one published item and rationally update their beliefs without knowing if the coverage was captured, and if so by whom.

Several noteworthy features of this model are motivated by the questions we pose. As we are interested in *disinformation*, captured coverage is unconstrained by the true state of the world. We aim to characterize the effects of capture on the distribution of published news within and across sources. To do so, we work with a continuous message space which allows for a rich gradation in the information conveyed in the coverage, and better matches the emerging empirical literature on the distribution of slant at the news item level. Furthermore, we consider citizens with heterogeneous priors to capture the multiplicity of views present in the public opinion that IPs try to manipulate. Finally, we depart from commitment to an editorial line. In other words, there is no commitment to either the resources covertly spent in capture or the communication strategy of IPs.

We characterize the equilibrium strategies of IPs as well as the equilibrium information transmission and obtain several important insights about competitive information manipulation. First, when an IP successfully captures an item, it plays a mixed strategy whose support ranges from the relatively favorable to the extremely favorable messages. The equilibrium distribution of coverage is therefore a mixture between the honest distribution and the mixed strategies that the IPs play. Capture shifts weight towards the tails of the message distribution: extreme messages (those with high or low likelihood ratios), which would be very informative in the absence of capture, become more frequent. For example, a media source whose items in equilibrium tend to be captured by, say, the right IP, displays a distribution of observed coverage which, while frequently right-wing to various degrees, still spans the ideological range.

This equilibrium distribution of messages aligns with the findings of a recent literature which characterizes the distribution of bias at the item level.[6] Despite varied methodologies and data sources, there is an emerging agreement over several features of this distribution. First, variation of slant within sources is much larger than across sources. It is therefore important to go beyond channel or newspaper-level assessments of bias. Second, a surprisingly large share of news items published display little bias and are centrist in tone independently of the source publishing them. Third, the frequency with which sources publish items with slant opposite to their average slant is non-negligible. The model accommodates these features as the result of the tug of war between IPs and the underlying craft of honest journalists.

Second, rational citizens display selective skepticism towards extreme messages. In equilibrium, the best IPs can do is to mix over a set of favorable messages to equalize the effective likelihood ratio citizens use to update: a combination of how informative (extreme) this message would be if it was honest, and the frequency with which the IP sends that message. In turn, this equalization leads citizens to censor the informativeness they assign to each message in the support of an IP's strategy. Therefore, citizens treat each suspicious coverage with more skepticism the more informative the message is at face value. This means that the equilibrium distribution of messages, which appears to be more informative, does not imply that citizens' posteriors move far from their priors.[7] It follows that capture is extremely deleterious to social learning: the messages that would lead to faster updating about the state of the world, are the ones that are being jammed and therefore rationally discounted by the public. Competing IPs do not cancel each other: they instead degrade the overall informativeness of the environment.

Third, a natural question that arises if capture is endogenous is why do we observe large, successful and systematically biased information sources. One would naturally expect that competition between opposite IPs would balance sources, particularly those who reach a large share of the public. The model provides an answer that is inherent

[6] We discuss Budak, Goel, and Rao (2016), Kim, Lelkes, and McCrain (2022) and Braghieri, Eichmeyer, Levy, Mobius, Steinhardt, and Zhong (2024) at length in Section 3.

[7] This aligns with the empirical literature. For example, Angelucci and Prat (2024) find that most viewers are able to identify fake political news. Martin and Yurukoglu (2017) find that cable news have progressively polarized in terms of coverage but that ideological polarization in the population is proportionally much smaller, which is in line with existing research in political science (Ansolabehere, Rodden, and Snyder, 2006).

in strategic competition for information: under natural conditions, capturing efforts by the two IPs are strategic substitutes at each information source. This follows from *sophisticated skepticism* endogenously generated by capture: when the left is expected to capture an item with high probability, citizens become more skeptical when they observe messages favorable to the left. This limits the leftward shift of citizens' beliefs and therefore reduces the marginal benefit of capture perceived by the right. To be precise, the higher is the effort citizens expect from the left, the lower is the return to effort for the right. This observation explains why in equilibrium one can have biased, successful, sources despite the fact that there is competition: high capture effort by one IP can coexist with low capture effort by the other even if the field was even ex ante.

We then explore which source attributes make them more attractive as targets of capture. We distinguish between horizontal (those that make a source more attractive to one IP and less attractive to the other) and vertical attributes (those that are attractive to both IPs). For example, a larger audience is a vertical attribute, but the ideological leaning of the audience is, for general IP preferences, horizontal. One may intuitively expect that a source which commands a larger audience will lead to more capture effort by both IPs. But strategic substitution implies that this is not necessarily the case: as one IP increases effort due to the source becoming more attractive, the opponent may give up. In the case of horizontal attributes, however, the result is unambiguous: one IP will increase capture and the other will decrease it leading to increased polarization in the media landscape.

Finally, we allow citizens to endogenously choose the news item which is most useful to them in expectation. We show that this leads to sorting: under general conditions, citizens that have leftist priors will sort into sources most likely captured by the left, and the same is true at the other end of the distribution of priors. This aligns with a well-known empirical pattern.[8] The mechanism is novel and intuitive: citizens' informational needs are uneven across the message distribution. In particular, a citizen with priors that favor the right-wing state has little value for messages that move her rightwards. Instead, she would change her choices if she received a *credible* left-wing message. The problem is that such messages are tainted when published by a source expected to be captured by the left. Hence the citizen *rationally chooses* to consume right-wing media: in these outlets, the left-favoring messages she values are credible. We discuss how the model explains recent experimental evidence on demand

[8] Gentzkow and Shapiro (2010) seminal contribution shows robust alignment between a media outlet's slant and viewership.

for biased news.[9]

We probe the robustness of these insights in several directions. First, we show that the presence of behavioral *naive* citizens, whose vulnerability to manipulation is very high, does not result in IPs disregarding the share of public opinion which is sophisticated. Second, we allow citizens to consume more than one news item and show that the equilibrium structure in our base game remains an equilibrium in this multi-homing game. Third, we extend the game beyond the binary state space to allow for a finite state space. Under natural conditions we can construct communication equilibria with the same properties as in the binary state space. Fourth, we show that citizen sorting into aligned media also obtains if instead citizens share a common prior but are heterogeneous in preferences. Finally, we allow for multiple IPs exerting pressure in an uncoordinated manner.

We contribute to the theoretical literature on the political economy of media capture. This literature has advanced dramatically in recent decades.[10] Models of government capture of media focus on the case with a single IP. Besley and Prat (2006) relies on a disclosure game where printed news are never lies. In Gehlbach and Sonin (2014) commitment to an editorial line means media filter information, but do not distort it.[11] Similarly, Petrova (2008) focuses on capture by a single party –the rich– and assumes exogenous costs of lying by the media. Corneo (2006) and Shapiro (2016), in contrast, offer models with multiple IPs potentially capturing a single media outlet. Prat (2018) considers multiple media platforms and characterizes robust upper bounds on the ability of an IP to influence beliefs. These existing models consider viewers with homogeneous priors and limit the message space to a binary signal. We advance on the literature by considering IPs with opposing interests, which influence multiple information sources that reach citizens with heterogeneous priors.[12] In addition, we put no restrictions on the message space and assume no commitment to a publishing rule. These features allow us to have predictions on both the shape of the distribution of slant in published news which we show aligns with the empirical literature; and the resulting compression of citizens' beliefs.

[9]In particular, we discuss Chopra, Haaland, and Roth (2024) and Brookman and Kalla (forthcoming).

[10]For a theoretical survey see Prat (2015)

[11] Gitmez and Molavi (2022) also follows this modeling tradition and considers heterogeneous receivers but a single sender.

[12]To our knowledge, Petrova (2012) is the only previously existing model with multiple IPs and media outlets. However, it is not a model with information transmission.

The theoretical literature on media economics has also been preoccupied with horizontal differentiation in slant across outlets. Arguments have been offered for supply and demand drivers of such polarization.[13] We contribute to this literature by noting that influence efforts by IPs are strategic substitutes, which exacerbates horizontal differentiation. Leveraging this finding we show that competition between IPs does not necessarily lead to balancing slant in the most attractive media sources. Relatedly, we obtain sorting of consumers into aligned media in a distortion model with continuous message space and no commitment.[14]

The literature on strategic communication has shown that competition between senders with opposed interests may allow receivers to obtain more information.[15] In our model, sender's identity is unknown to receivers and information is not verifiable, driving our result that IP competition actually reduces, not increases, citizens' information. We also contribute to the literature where the sender may have uncertain motives. Sobel (1985) shows how a biased sender can maintain a reputation for honesty.[16] In contrast, IPs in our model do not have an incentive to build a reputation for honesty. Morgan and Stoken (2003) and Li and Madarasz (2008) show that information transmission may be reduced if the sender discloses his preferences. In our model, however, knowing the captured status of the news would lead to (weakly) more informative media. Thus, in our setup concealment of motives reduces information transmission but incentivizes capture. Wolinsky (2003) and Dziuda (2011) study models with partial verifiability: the sender may be biased in favor or against a given issue, but can only conceal evidence, not fabricate it. We replicate some of their equilibrium features despite the fact that in our model IPs are free to fabricate the news, which again we consider to capture better the *post truth* media environment.

Finally, Glazer, Herrera, and Perry (2020) considers a biased sender that can costlessly misrepresent a fake review as honest, while Chen (2011) studies a Crawford-Sobel's constant-bias leading example where the sender may be honest and the receiver

[13] For a theoretical survey see Gentzkow, Shapiro, and Stone (2015) and Perego and Yuksel (2022) for a recent contribution showing how media's incentives to differentiate may lead to a worse-informed public.

[14] We relate our mechanism to the classical contributions of Suen (2004) and Gentzkow and Shapiro (2006) in Section 6.

[15] See, e.g., Dewatripont and Tirole (1999) for the case in which senders message is verifiable, Battaglini (2002) for the case that is cheap talk, and Gentzkow and Kamenica (2017) for the case in which senders can commit to a disclosure rule.

[16] See also Shin (1993) and Morris (2001).

may be naive.[17] The communication equilibria in these papers share features with our findings in Section 3. Notably, Glazer, Herrera, and Perry (2020) also show that communication strategies are independent of receiver priors.[18] However, we have competing senders and our main focus is on endogenizing the levels of capture and on citizen sorting, both of which are exogenously set in those papers.

The rest of the paper is organized as follows. Section 2 sets out the model. Section 3 describes the optimal lying strategy of IPs and its effects on message distribution and information transmission. Section 4 studies incentives to capture news items and shows that capturing efforts are strategic substitutes. Section 5 offers comparative statics on capture and shows that the model supports horizontal differentiation and Section 6 explores the implications of audience sorting across news sources. In Section 7 we analyze several extensions to our basic model. We then offer some conclusions.

2 Model

We propose the following model in which endogenously manipulated information reaches the public. There are news sources (sources henceforth) generating news items which are informative of an underlying binary state of the world. There are two Interested Parties (IP henceforth) with opposed preferences over citizens' beliefs on the state. For example, the underlying state of the world may be the gravity of the climate crisis and the news items may cover recent weather events and be produced by a host of TV channels and newspapers. Carbon-dependent energy companies want to downplay the evidence linking current weather events with global warming, while climate activists want to highlight it. These IPs can covertly devote resources to capture the news items in order to ensure favorable slant. Citizens consume a news item and discount it according to the anticipated level of capture.

State space and Prior Beliefs: There is an unknown state $\theta \in \Theta = \{-1, 1\}$. A mass M of citizens have heterogeneous prior beliefs $p = \Pr[\theta = 1]$ over the state, with a fraction $F_p(p)$ of citizens with priors not exceeding p.

Interested Parties and Sources: There are two strategic IPs, R and L. R wants to induce in citizens the highest posterior belief over θ while L wants to induce the lowest. If μ is the posterior belief of a citizen, then the IPs utility functions are $v_R(\mu)$ and $v_L(\mu)$. They are differentiable in $[0, 1]$ with v_R strictly increasing and v_L strictly

[17]See also Kartik, Ottaviani, and Squintani (2007)

[18]For persuasion with heterogeneous priors, see den Steen (2004), Che and Kartik (2009), and Alonso and Câmara (2016).

decreasing with $|v_i'|$, $i \in \{L, R\}$, bounded away from zero. Thus, if $\mu(m;p)$ is the posterior belief of a citizen with prior p after observing message m, then the indirect utility over messages of $i \in \{R, L\}$, facing a public characterized by $F_p(p)$, is

$$V_i(m) \equiv M \int_0^1 v_i\left(\mu(m;p)\right) dF_p(p).$$

There are $n \geq 1$ sources. Each produces one news item comprised of a message, or coverage, m. In a slight abuse of notation we denote by $j \in \{1, ...n\}$ both the source and the item produced.[19] When item j is not captured, we say that the message/coverage is *honest:* the item conveys an informative signal $m^j \in \mathscr{M} \subset \mathbb{R}$, which is generated according to the density $\Pr\left[m^j = m|\theta\right] = q_\theta^j(m)$, $\theta \in \{-1, 1\}$, with m^j conditionally independent across items. Thus, the posterior belief of a $p-$citizen after observing message $m^j = m$ if item j is known to be honest is

$$\mu_H^j(m;p) = \Pr\left[\theta = 1|m^j = m, H, p\right] = \frac{q_1^j(m)p}{q_1^j(m)p + q_{-1}^j(m)(1-p)}. \tag{1}$$

Without loss of generality in this binary-state case, we order messages according to the likelihood ratio $\lambda_H^j(m) = \frac{q_1^j(m)}{q_{-1}^j(m)}$ (so that $\lambda_H^j(m)$ is increasing).[20] Following this convention, we say that a message is higher (lower) when citizens update more towards state $\theta = 1$ (-1) when the item is known to be honest. $F_{H,\theta}^j(\lambda) \equiv \Pr[\lambda_H^j(m) \leq \lambda|\theta]$ denotes the state-dependent distribution of honest coverage expected from item j in the absence of capture, and $F_H^j(\lambda;p) = F_{H,1}^j(\lambda)p + F_{H,-1}^j(\lambda)(1-p)$. [21]

Competitive Capture of News Items: For each item j, IPs simultaneously and covertly decide how much effort to expend in capturing it. We denote the efforts expended by R and L by $r_j \in [0, \overline{x}_R^j] \equiv X_R^j$ and $l_j \in [0, \overline{x}_L^j] \equiv X_L^j$. These efforts determine three possible states of capture, $S^j \in \{R, L, H\}$, where H indicates the news item remains honest while, abusing notation, R (L) indicates it has been captured by $R(L)$. Capture is probabilistic conditional on efforts exerted with $\pi_i^j(r_j, l_j) \equiv \Pr\left[S^j = i\right]$ and $\pi_H^j(r_j, l_j) = 1 - \pi_R^j(r_j, l_j) - \pi_L^j(r_j, l_j) \equiv \Pr\left[S^j = H\right]$. We assume that $\pi_R^j(r_j, l_j)$

[19] In this set up with one message per source this is inconsequential and it significantly saves on notation. In Section 7 we show that the insights of the main body of the paper are robust to allowing citizens to observe more than one message (from the same source or different sources).

[20] Our assumption that $\mathscr{M} \subset \mathbb{R}$ is made for convenience as we could have a general message space and operate with the likelihood ratio of each message under honest coverage, a positive real number.

[21] We will also denote by $\overline{F}_H^j(\lambda;p) = 1 - F_H^j(\lambda;p)$ the complementary cdf.

$(\pi_L^j(r_j, l_j))$ is continuous, non-decreasing in $r_j(l_j)$, and non-increasing in $l_j(r_j)$.

Effort is costly: if $r = (r_j)_{j=1}^n$ and $l = (l_j)_{j=1}^n$ are the effort profiles across items, R's and L's total cost of capture are $C_R(r) = \sum_{j=1}^n C_{Rj}(r_j)$ and $C_L(l) = \sum_{j=1}^n C_{Lj}(l_j)$ respectively, with C_{Rj} and C_{Lj} non-decreasing and strictly convex.[22] There is no presumption that $\frac{\partial C_R(r)}{\partial r_j} = \frac{\partial C_R(r)}{\partial r_k}$ when $r_j = r_k$ or that $\frac{\partial C_R(r)}{\partial r_j} = \frac{\partial C_L(l)}{\partial l_j}$ when $r_j = l_j$. In other words, items in some sources may be easier to capture by one IP rather than the other and items in some sources may be easier to capture overall.

If item j is captured by either IP, then the successful IP can have the source send as coverage *any* message $m \in \mathscr{M}$.[23] We assume $\mathscr{M}$ is independent of the state of capture and the state of the world so there is no restriction on the message a captured item can convey. We allow IPs to follow mixed strategies in deciding which messages to send. As each citizen will consume only one news item, the correlation of these strategies across items in the case of an IP's successful capture of multiple items is irrelevant in equilibrium. Thus, we take these strategies as independent of the state of capture of other sources and write $\tau_i = (\tau_i^j(m))_{j=1}^n$, where $\tau_i^j(m) \equiv \Pr[m^j = m \,|S^j = i]$ denotes the reporting strategy of $i \in \{R, L\}$ when capturing item j.[24]

Viewership in News Sources: We assume that the audience of each news source –i.e., the citizens exposed to that source– is exogenous and possibly heterogeneous in size and priors.[25] That is, the item conveyed by source j, reaches a mass M^j of citizens whose priors are distributed according to $F_p^j(p)$, and every citizen consumes one item.

Timing: Simultaneously, R and L covertly decide on $r_j, j = 1, ..., n$ and $l_j, j = 1, ..., n$. Then, nature selects $S^j \in \{R, L, H\}$ according to $\pi_i^j(r_j, l_j)$, but neither (r_j, l_j) nor S^j are observed by citizens. For an item j such that $S^j = R$ $(S^j = L)$, R (L) decides which message to send. Citizens then observe the message published and update their beliefs. After this, payoffs are realized.

[22]Please Section 13 in the Online Appendix where we show that all results extend to non-separable cost functions at the cost of significant additional notation.

[23]For simplicity, we assume that the choice of message by a successful IP is independent of $j's$ honest realized signal. As we show in the online Appendix, conditioning on the realized signal does not change the equilibrium distribution of citizens' posterior beliefs, nor the equilibrium capture efforts, but increases the notational burden.

[24]The single homing assumption is widespread in the literature on media bias. See, for example Gentzkow and Shapiro (2006), Chan and Suen (2008) and Duggan and Martinelli (2011). In Section 7 we allow citizens to consume multiple items so that IPs may want to correlate their coverage across the captured items. We show that there is always an equilibrium in which IPs' coverage is independent across them.

[25]In Section 6, we endow citizens with a decision problem that microfounds their demand for information and we endogenize the choice of which item to consume.

We look for a Perfect Bayesian Equilibrium of this capture and communication game (which we denote simply as "equilibrium"). In particular, if R selects $r = (r_j)_{j=1}^n$ and reporting strategy $\tau_R = (\tau_R^j(m))_{j=1}^n$, L selects $l = (l_j)_{j=1}^n$ and reporting strategy $\tau_L = (\tau_L^j(m))_{j=1}^n$,[26] and every citizen has an assessment of IP's strategies $(\tilde{r}, \tilde{l}, \tilde{\tau}_R, \tilde{\tau}_L)$, then every PBE $(r^*, l^*, \tau_R^*, \tau_L^*; \tilde{r}^*, \tilde{l}^*, \tilde{\tau}_R^*, \tilde{\tau}_L^*)$ requires that citizens' assessments are correct –i.e., $\tilde{r}^* = r^*$, $\tilde{l}^* = l^*$,$\tilde{\tau}_R^* = \tau_R^*$, $\tilde{\tau}_L^* = \tau_L^*$– while each IP's strategy is optimal given the other IP's strategy and citizens' posterior beliefs, which are derived from Bayes' rule whenever possible.

This model displays a few noteworthy features. First, it focuses on the competition between IPs and the inference problem it induces on rational consumers of information. To simplify the analysis and highlight new insights, we model sources as passive subjects of pressure from IPs.[27] Second, we allow for multiple dimensions of heterogeneity across sources. Specifically, sources can differ (a) in the informativeness of the item when they remain honest $F_{H,\theta}^j(\lambda)$; (b) in the mass M^j or ideological leanings of the audience they reach $F_p^j(p)$; or (c) in how costly they are to capture by each IP. This flexibility allows us to present general results that are compatible with traditional media, social media, and other sources of information. For example, r and l can be readily interpreted as the effort expended in bot campaigns in a social media platform. Regarding traditional media, the model can accommodate the fact that sources are often systematically slanted. Fox News can be conceptualized as having lower cost of capture by R. The cost function can thus model the ideological leaning of the source's ownership, and r would then encapsulate the attention cost that the ownership expends to make sure that each item produced aligns with their ideology.[28] The shape of the cost function is known to citizens, who take it into account when updating their beliefs. These citizens are asking themselves: "is FOX's coverage of this issue what the journalists consider to be fair and balanced or has it (again) been compromised by the ownership?"

Third, messages m have an *accepted meaning* in our model, following the termi-

[26] To simplify notation, we omit the reporting strategy's dependence on the selected profile of capture efforts. In any equilibrium, any reporting strategy will depend only on citizens assessments, rather than the actual level of capture.

[27] To the extent that sources are media conglomerates, this sidesteps the media owner trade-off between audience and bias which is already well-understood in the literature.

[28] Even a cursory examination of this particular source demonstrates that several important instances of FOX coverage are not ideologically aligned. See for instance "Fox News' Cavuto: Bombsell Smith filing shows Trump 'resorted to crimes' to stay in office" [MSN.com, October 3, 2024] or "Trump campaign attacks Fox News polling expert who called Arizona for Biden" [accessed in reuters.com, November 5, 2020]. More on this in Section 3.

nology of Sobel (2020).[29] In particular, everyone agrees how message m is to be interpreted –that is, how priors are to be updated– if the item is known to be honest. This meaning is $\lambda_H(m)$. The shadow of capture, however, drives a wedge between m's accepted meaning and m's interpretation *in equilibrium*, which we denote by $\lambda^*(m)$. This allows us to separately keep track of published messages –i.e. equilibrium m– and the effect of such messages –i.e., equilibrium audience posteriors. This is important because, empirically, slant is reflected in m, not necessarily on citizens' posteriors.

Fourth, in interpreting the model it is important to keep in mind that an IP's strategic choice of m may take two forms. It can bias the coverage of a given issue to suit its interests by omitting or adding details or manipulating the emphasis or emotional content. Alternatively, it can change which issues it chooses to cover, focusing on themes that are favorable to its interests. Both forms of bias have been empirically documented.[30] What is important is that in either strategy IPs are departing from the m that would have been conveyed by the honest journalist, which is to be interpreted as a composite of which issue to cover and how to cover it.

Finally, we impose no restrictions on the message space of captured items. More specifically, messages are not certifiable and there is no ex ante commitment to any communication strategy. In this sense we have a genuine model of disinformation in which capturing IPs can have sources manufacture fake news at will, completely untethered to the true state of the world.

3 Communication Equilibria

We start our analysis by characterizing communication equilibria for a given item conditional on efforts l and r. We drop for now the subscript j and set $M^j = 1$.

3.1 Optimal Lying, Optimal Skepticism

Consider a citizen who observes message m. If coverage was known to be honest, the likelihood ratio $\lambda_H(m) = q_1(m)/q_{-1}(m)$ would represent the informational content of message m and would suffice to compute the posterior of a citizen with any prior p according to (1). Coverage, however, is only honest with probability $\pi_H(r, l)$. Consequently, m cannot be taken at face value and citizens must modify the way they up-

[29] Sobel (2020) defines lies as statements whose accepted meaning is different from what the sender knows. IPs do lie along the equilibrium path in our model.

[30] See Durante, Fabiani, Laeven, and Peydro (2021) for a recent example of the former and Brookman and Kalla (forthcoming) for a recent example of the latter.

date in equilibrium.

Let $\tau_R^*(m)$ and $\tau_L^*(m)$ be R and L's equilibrium (mixed) strategies, and let $\mu^*(m;p)$ be the posterior belief of a citizen with prior p after observing m consistent with strategies $\tau_R^*(m)$ and $\tau_L^*(m)$. Then, the selected message by $i \in \{L, R\}$ maximizes $V_i(m) = \int v_i(\mu^*(m;p))dF_p(p)$.

The following proposition shows that equilibrium behavior takes a simple form: mixing by R (L) equalizes the *equilibrium informational content* of messages above (below) a well-defined threshold.

Proposition 1. *Fix efforts r and l, with $\pi_H(r,l) > 0$. There are unique $\overline{\lambda}$, $\underline{\lambda}$, $\overline{m}^*$, and $\underline{m}^*$, with $\overline{\lambda} = \lambda_H(\overline{m}^*)$ and $\underline{\lambda} = \lambda_H(\underline{m}^*)$, so that in every communication equilibrium, we have*

1. *$m \in supp(\tau_R^*)$ iff $\lambda_H(m) \geq \overline{\lambda}$; $m \in supp(\tau_L^*)$ iff $\lambda_H(m) \leq \underline{\lambda}$.*

2. *The equilibrium likelihood ratio of message m, $\lambda^*(m) \equiv \frac{\Pr[m|\theta=1]}{\Pr[m|\theta=-1]}$, satisfies*

$$\lambda^*(m) = \begin{cases} \underline{\lambda} & \text{if } m \leq \underline{m}^* \\ \lambda_H(m) & \text{if } \underline{m}^* < m < \overline{m}^*. \\ \overline{\lambda} & \text{if } m \geq \overline{m}^* \end{cases} \tag{2}$$

3. *The maximum and minimum equilibrium likelihood ratios $\overline{\lambda} = \max_{m \in \mathscr{M}} \lambda^*(m)$ and $\underline{\lambda} = \min_{m \in \mathscr{M}} \lambda^*(m)$ satisfy*

$$\int_{\overline{\lambda}}^{\infty} \left(\lambda - \overline{\lambda}\right) dF_{H,-1}(\lambda) = \frac{\pi_R(r,l)}{\pi_H(r,l)} \left(\overline{\lambda} - 1\right), \tag{3}$$

$$\int_0^{\underline{\lambda}} \left(\underline{\lambda} - \lambda\right) dF_{H,-1}(\lambda) = \frac{\pi_L(r,l)}{\pi_H(r,l)} \left(1 - \underline{\lambda}\right). \tag{4}$$

Part 1 of the proposition states that R randomizes over messages with $\lambda_H(m)$ above a threshold likelihood $\overline{\lambda}$. These are messages that would be very convincing that $\theta = 1$ if coverage was known to be honest. Part 2 describes how citizens update. For all messages sent with positive probability by R, instead of updating according to $\lambda_H(m)$, citizens just use $\overline{\lambda}$. This has two implications. First, since $\overline{\lambda} \leq \lambda_H(m)$ for $m \in supp(\tau_R^*)$, the informational content of these messages is downgraded: because the item is possibly captured by R, citizens are skeptical of messages that are favorable to

$\theta = 1$. Second, all such messages are treated identically since $\lambda^*(m) = \overline{\lambda}$, a constant. This means that the more favorable to $\theta = 1$ messages are –the higher $\lambda_H(m)$– the stronger the downgrade that skeptical citizens apply. Of course, the same is true at the other end of the distribution.[31]

The effect of potential capture is therefore to make citizens skeptical of messages that would otherwise be very informative. Moderate messages $m \in (\underline{m}^*, \overline{m}^*)$ are instead regarded as honest and taken at face value. The proposition thus implies that $\mu^*(m; p)$ is a two-sided censored distribution of posterior beliefs for every $p-$citizen.

Part 3 of Proposition 1 characterizes the unique $\overline{\lambda}$ and $\underline{\lambda}$ induced by profile (r, l). Recall that citizens are using a constant $\lambda^*(m) = \overline{\lambda}$ for every message sent by R. The equilibrium likelihood ratio for a message $m \in supp(\tau_R^*)$ is

$$\lambda^*(m) = \frac{\pi_H(r,l)q_1(m) + \pi_R(r,l)\tau_R^*(m)}{\pi_H(r,l)q_{-1}(m) + \pi_R(r,l)\tau_R^*(m)}, \tag{5}$$

and this expression is decreasing in $\tau_R^*(m)$: the more often a message m is expected to be sent by R, the less informational content citizens assign to that message. Equalizing $\lambda^*(m)$ across the various $m \in supp(\tau_R^*)$ thus implies spreading $\tau_R^*(m)$ across messages in a very specific way. This feature, together with the fact that R must allocate one unit of lying (that is, $\int_{\overline{m}^*}^{\infty} \tau_R^*(m)dm = 1$) uniquely determines $\overline{\lambda}$.

Published Messages under Potential Capture We can now relate the extent of capture to the expected distribution of news coverage published by a source. In particular, this distribution follows a mixture between the honest distribution and the mixed strategies that the two IP play. It thus spans the same support as the honest distribution but puts more weight on its tails, so is more polarized than what an incorruptible journalist would publish. In Figure 1 we illustrate two examples. In panel A, we depict the distribution of slant in a source where $r^* > l^*$, namely a source where R is exerting more effort than L. We illustrate the opposite case in panel B and we also vary the total amount of capturing effort to be smaller. For comparability, we keep the honest distribution of coverage constant across panels. In both cases mass moves from the center to the tails and disproportionately migrates to the tail that favors the IP that is exerting higher effort.

These equilibrium features are very much aligned with the recent empirical litera-

[31] To be precise, L randomizes over a set of messages favorable to state $\theta = -1$ and citizens, skeptical of such messages, treat them all as $\underline{\lambda} \geq \lambda_H(m)$. Again, they downgrade the informational content of messages below $\underline{\lambda}$ and do so more the more such messages are favorable to $\theta = -1$.

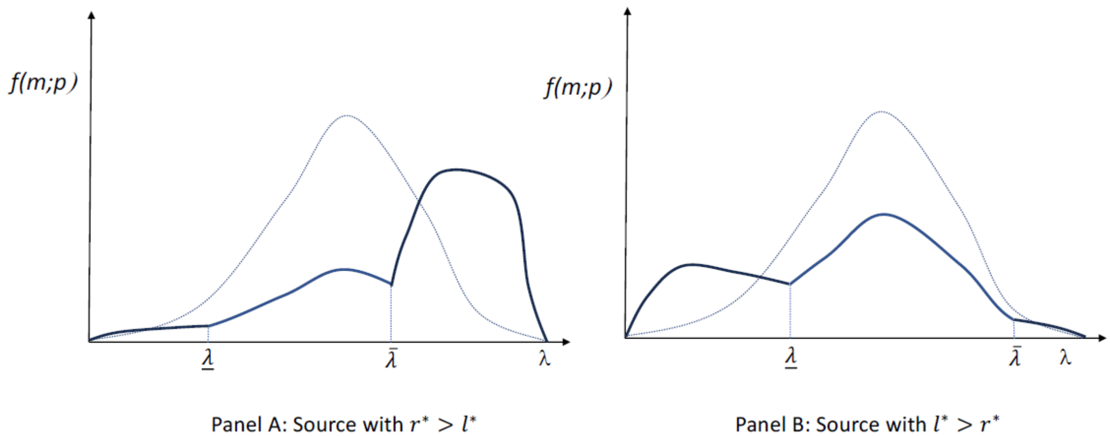

Figure 1: Published Coverage

ture that characterizes the distribution of slant at the news item level. Budak, Goel, and Rao (2016) look at a large corpus of articles in major news outlets in the USA.[32] They find that article measures of slant display enormous variation within outlet and, indeed, great overlap with articles published by outlets considered to be opposite in the ideological spectrum. For example, in the New York Times only about 20% of articles are slanted left, while 10% of articles are slanted right. By comparison, while about 25% of articles at Fox News are slanted right, 14% are slanted left, with the neutral slant again taking an overwhelming share of political reporting. Kim, Lelkes, and McCrain (2022) study bias in cable news and find large week-by-week variation in bias, not only within outlet, but within program. While on average the Hannity Show is significantly to the right of Anderson Cooper's, there is a large amount of overlap.[33] Braghieri, Eichmeyer, Levy, Mobius, Steinhardt, and Zhong (2024) examine online news at the url level.[34] They estimate that only about 35% of the article-level variation is explained by differences across outlets, leaving the bulk of the variation to be across items within outlet. Moreover, their article-level slant measure shows that a large mass of published news is actually centrist in tone.

Despite their various methodologies, domains and time periods, there is an emerging agreement over several features of the empirical distribution of item-level slant.

[32]More precisely, Budak, Goel, and Rao (2016) use a combination of machine learning and crowdsourcing to scale up a measure of ideological content of articles published in 2013 by the top 13 US news outlets and two popular political blogs.

[33]The methodological innovation in Kim, Lelkes, and McCrain (2022) is that they use the visibility of political actors featured in each channel's program to score the ideological lean of the program.

[34]In this paper each article published online by the top 100 US outlets in 2019 is assigned a slant measure using a combination of expert rating and machine learning.

First, no matter how biased an outlet is considered to be, a surprisingly large share of items published display little bias and are centrist in tone. Second, slanted news themselves show variation, from middling slant to very strong bias (i.e. Fox News publishes items at a variety of right-wing bias intensity, from moderate to extreme). Third, the frequency with which outlets produce items with slant opposite to their average slant is non-negligible. The model accommodates these features as a result of the tug-of-war between the journalists and the competing IPs. Moreover, looking at the empirical distributions through the lens of the model suggests that even in media considered to be systematically biased, the actual probability that an item is captured is relatively low.[35]

3.2 Informativeness of Captured Coverage

The previous discussion shows that capture affects informativeness by changing the distribution of effective likelihood ratios of the messages conveyed. Using (2) in Proposition 1, the equilibrium distribution of likelihood ratios for a p-citizen is

$$F(\lambda;p)=\begin{cases}0 & \text{if } \lambda<\underline{\lambda},\\ \pi_L(r,l)+\pi_H(r,l)F_H(\lambda;p) & \text{if } \underline{\lambda}\le\lambda<\overline{\lambda},\\ 1 & \text{if } \lambda\ge\overline{\lambda}.\end{cases} \tag{6}$$

The specter of capture decreases the likelihood that a citizen revises her beliefs to entertain a very high or very low view of the world even when the item is honest: optimal lying downgrades the informational content of each message to $\lambda^*(m)\in[\underline{\lambda},\overline{\lambda}]$. As a consequence, capture reduces the Blackwell-informativeness of the source since $F(\lambda;p)$ second-order stochastically dominates $F_H(\lambda;p)$. This downgrade operates through two channels. First, it limits the informativeness of very informative messages to either $\lambda_H(\overline{m}^*)=\overline{\lambda}$ or $\lambda_H(\underline{m}^*)=\underline{\lambda}$. Second, it reduces the likelihood that a message $m\in(\underline{m}^*,\overline{m}^*)$ is observed. These two effects are depicted in Figure 2 in which we illustrate $f(\lambda;p)$ the equilibrium density of likelihood ratios that citizens use for the two cases depicted in Figure 1. Panel A shows that citizens discount right-wing news more than they discount left-wing news, mirroring the fact that items are more likely captured by R. The opposite takes place in Panel B. Note also that while messages become polarized because of IP interference, beliefs become compressed due to skepticism.

We now present comparative statics on these bounds on informativeness. We show

[35] The results in Budak, Goel, and Rao (2016) suggest that π_L in the NYT and π_R at FOX are at most 0.25.

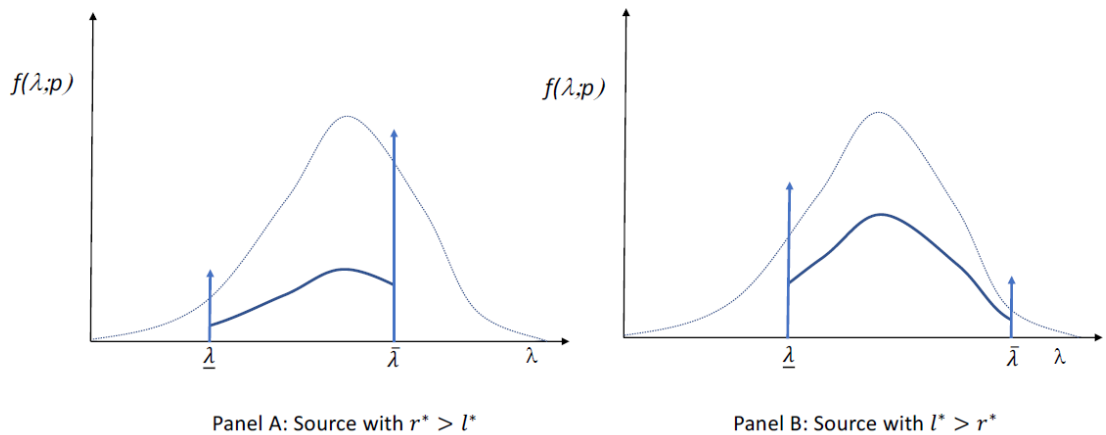

Figure 2: Informational Content of Messages

that (i) increasing effort by either IP can exacerbate citizens' skepticism over messages at *both* ends of the spectrum; (ii) citizens' priors do not affect equilibrium lies; and (iii) citizens are less skeptical when honest items are Blackwell more informative.

Lemma 1. *Let* $\overline{\lambda}$, $\overline{m}^*$, $\underline{\lambda}$ *and* $\underline{m}^*$ *be the equilibrium quantities defined in Proposition 1. Then,*

1. $\overline{\lambda}$ *and* $\overline{m}^*$ *are decreasing in* r *and, if* π_R/π_H *increases in* l*, also decreasing in* l*;* $\underline{\lambda}$ *and* $\underline{m}^*$ *are increasing in* l*, and if* π_L/π_H *increases in* r*, also increasing in* r*.*

2. $\overline{\lambda}$, $\overline{m}^*$, $\underline{\lambda}$ *and* $\underline{m}^*$ *are invariant in* F_p*.*

3. $\overline{\lambda}$ *increases and* $\underline{\lambda}$ *decreases, and the (potentially captured) item is more informative, if the honest item is Blackwell more informative.*

When an IP increases effort, citizens become more skeptical of messages favoring that IP -this is Lemma 1.1. In particular, those messages are now treated as conveying lower informativeness and the set of messages that citizens discount expands. This effect is clear as, say, increasing r by R makes it more likely that a high message is the result of capture and thus messages that favor R should be treated with more caution. We call this effect *sophisticated skepticism.* In addition, if π_L/π_H increases in r, citizens also become more skeptical about left-leaning messages. We discuss the meaning and implications of this informational externality in detail in Section 4.2.

Lemma 1.2 shows that IP strategies are invariant to audience priors given l and r. This is because, as shown in (5), equalizing the informational content only depends on properties of the honest distribution and not on the priors of the public. In short, conditional on capturing coverage, the optimal lies of an IP are independent of who is receiving the message. The ideological leaning of a source's audience, however, affects incentives to capture, as we show below.

Finally, lemma 1.3 shows that IPs can afford to send more extreme messages if the honest item is more informative.[36] This result follows readily from a higher dispersion of posterior beliefs induced by a Blackwell more-informative honest item and its effect on equilibrium conditions (3) and (4). Intuitively, when the honest item is more informative, a given amount of lying has a smaller effect on citizens' discounting. In fact, capture does not change the informativeness ranking of items: for the same levels of capture, a (potentially captured) item is more informative in equilibrium if its honest version is more informative.[37] Therefore, if each IP equalizes its effort across several items, citizens' equilibrium value of information would still be highest from the item with the most informative honest coverage.

4 Competitive Capture of News Items

Having established the effects of capture on published news, we now turn to the determinants of equilibrium capture l and r for each item. To ease notation we continue to elide the j subscript.

4.1 Equilibrium Competitive Capture

To understand IPs' capture incentives, we can express each $p-$citizen's equilibrium posterior as $\mu^*(\lambda; p) = \lambda p/(\lambda p + 1 - p)$, so that the expected value to $i \in \{R, L\}$ when citizens interpret message m as $\lambda^*(m) = \lambda$ is

$$V_i(\lambda) \equiv M \int_0^1 v_i \left(\mu^*(\lambda; p)\right) dF_p(p) = M \int_0^1 v_i \left(\frac{\lambda p}{\lambda p + 1 - p}\right) dF_p(p).$$

This expression varies with the message –through its associated λ– and it also depends on the priors of the audience –through $F_p(p)$. We can then express $i \in \{L, R\}$'s payoffs from capture profile (r, l) and citizens' assessment $(\tilde{r}, \tilde{l})$ as $W_R(r, l; \tilde{r}, \tilde{l}) - C_R(r)$ and

[36]Note that we cannot say how this will change the messages that citizens trust as we impose no structure on the message space of a Blackwell more-informative source.

[37]Note that this result is not immediate as capture jams the most informative messages, possibly negating the informational advantage of a Blackwell more informative item. However, as citizens posteriors average to the prior, equilibrium conditions (3) and (4) guarantee that the weighted mass of messages jammed by each IP balances with the source's informativeness in its tails, thus preserving informativeness rankings.

$W_L(r, l; \tilde{r}, \tilde{l}) - C_L(l)$ where

$$W_i(r, l; \tilde{r}, \tilde{l}) = \pi_L(r, l)V_i\left(\underline{\lambda}(\tilde{r}, \tilde{l})\right) + \pi_H(r, l)\mathbb{E}_H\left[V_i(\lambda); p_i\right] + \pi_R(r, l)V_i\left(\overline{\lambda}(\tilde{r}, \tilde{l})\right), \quad (7)$$

with

$$\mathbb{E}_H\left[V_R(\lambda); p_i\right] = \overline{F}_H(\overline{\lambda}; p_i)V_i(\overline{\lambda}) + \int_{\underline{\lambda}}^{\overline{\lambda}} V_i(\lambda)dF_H(\lambda; p_i) + F_H(\underline{\lambda}; p_i)V_i(\underline{\lambda}), \quad (8)$$

which is R's expected utility when, unbeknownst to citizens, the item remains honest. A similar expression would obtain for L's payoff. Our first result concerns existence and characterization of equilibria of the full game.

Proposition 2. *Suppose that $i \in \{R, L\}$ can invest in capturing an item at an increasing and convex cost C_i, with capture probabilities $\pi_k(r, l)$, $k \in \{R, L, H\}$, that are concave in r and concave in l. Define*

$$B_R(r, l; \tilde{r}, \tilde{l}) \equiv \int_{\underline{\lambda}(\tilde{r}, \tilde{l})}^{\overline{\lambda}(\tilde{r}, \tilde{l})} V_R'(\lambda)\left(\frac{\partial \pi_R(r, l)}{\partial r}F_H(\lambda; p_R) - \frac{\partial \pi_L(r, l)}{\partial r}\overline{F}_H(\lambda; p_R)\right)d\lambda, \quad (9)$$

$$B_L(r, l; \tilde{r}, \tilde{l}) \equiv \int_{\underline{\lambda}(\tilde{r}, \tilde{l})}^{\overline{\lambda}(\tilde{r}, \tilde{l})} V_L'(\lambda)\left(\frac{\partial \pi_R(r, l)}{\partial l}F_H(\lambda; p_R) - \frac{\partial \pi_L(r, l)}{\partial l}\overline{F}_H(\lambda; p_R)\right)d\lambda. \quad (10)$$

Then, there is a pure-strategy equilibrium r^* and l^* with unique $\overline{\lambda}$ and $\underline{\lambda}$ satisfying

$$B_R(r^*, l^*; r^*, l^*) = C_R'(r^*), \quad (11)$$

$$B_L(r^*, l^*; r^*, l^*) = C_L'(l^*), \quad (12)$$

$$\int_{\overline{\lambda}}^{\infty} \left(\lambda - \overline{\lambda}\right)dF_{H,-1}(\lambda) = \frac{\pi_R(r^*, l^*)}{\pi_H(r^*, l^*)}\left(\overline{\lambda} - 1\right), \quad (13)$$

$$\int_0^{\underline{\lambda}} \left(\underline{\lambda} - \lambda\right)dF_{H,-1}(\lambda) = \frac{\pi_L(r^*, l^*)}{\pi_H(r^*, l^*)}\left(1 - \underline{\lambda}\right). \quad (14)$$

Expressions (9) and (10) are simply the marginal returns to capture for L and R if citizens anticipate capture efforts $(\tilde{r}, \tilde{l})$. Equations (11) and (12) equate these returns when citizens correctly anticipate IPs efforts –so that $\tilde{r} = r^*, \tilde{l} = l^*$– to the marginal cost of capture so that neither IP has an incentive to covertly increase effort. Following Proposition 1, (13) and (14) represent the most R-favorable and L-favorable equilibrium likelihood ratios consistent with expected capture. Equations (11-14) encapsulate the main equilibrium tension in our model: (11) and (12) show that each IP's marginal benefit from capturing the item increases if citizens are more trusting –as then $\overline{\lambda}$ is higher and $\underline{\lambda}$ is lower. Unfortunately for the IPs, more intense capture lowers citizens' trust as indicated by (13) and (14). As we show next, this feedback contributes to making capturing efforts strategic substitutes.

4.2 Strategic Effects of Citizen Skepticism

In IPs' contest to control coverage, the effect of higher effort by, say, R is to increase π_R at the expense of π_L and π_H. This is beneficial to R as $\overline{\lambda}$ is a more favorable message than either $\underline{\lambda}$, which is how any message send by L is interpreted, or $\mathbb{E}_H\left[V_R(\lambda); p_R\right]$ which is R's expected utility when the item remains honest –see (8). Of course, the magnitude of the gain associated with either displacement depends on $\left(\underline{\lambda}, \overline{\lambda}\right)$, which depend on citizens' assessments of effort $(\tilde{r}, \tilde{l})$.[38] Moreover, this gain depends on the rate at which R displaces π_L and π_H which may vary with the effort exerted by L. We will eliminate this second channel on an IP's marginal returns from capture by imposing the following condition.

Assumption I. Capture probabilities satisfy

$$\frac{\partial^2 \pi_i}{\partial r \partial l} = 0, i \in \{L, R, H\}.$$

Assumption I simply rules out second order effects coming from the shape of the contest function as these are orthogonal to our interest in informational competition.[39]

As shown in Lemma 1, a higher anticipated l generates *sophisticated skepticism* which increases $\underline{\lambda}$. This effect increases $V_R(\underline{\lambda})$ and $\mathbb{E}_H\left[V_R(\lambda); p_R\right]$, reducing R's gain from shifting probability away from $\pi_L(r^*, l^*)$ and $\pi_H(r^*, l^*)$. Intuitively, citizens discount $L-$favorable messages if the news item is more likely to be captured by L, which moderates losses for R and hence reduces the urge to exert r.

However, a higher l also generates an *informational externality* on R's coverage, as it affects $\overline{\lambda}$ –see Lemma 1. Increasing capture by l thus also indirectly affects the benefit that R obtains from its own lies. We can formally see these two effects by

[38] In equilibrium, citizens' assessments $(\tilde{r}, \tilde{l}, \tilde{\tau}_R, \tilde{\tau}_L)$ satisfy Proposition 1 with $r = \tilde{r}$, $l = \tilde{l}$,$\tau_R^* = \tilde{\tau}_R$ and $\tau_L^* = \tilde{\tau}_L$ so that $\lambda^*(m)$ is given by (2). Therefore, citizens' assessments of effort must be correct in equilibrium.

[39] See Corchon (2007) and Acemoglu and Jensen (2013) for treatments of the complexity of comparative statics for arbitrary contest functions.

differentiating (9) and applying Assumption I,

$$\left.\frac{\partial B_R(r,l;\tilde{r},\tilde{l})}{\partial l}+\frac{\partial B_R(r,l;\tilde{r},\tilde{l})}{\partial \tilde{l}}\right|_{l=\tilde{l}} = -V_R'(\underline{\lambda})\left(\frac{\partial \pi_R(r,l)}{\partial r}F_H(\underline{\lambda};p_R)-\frac{\partial \pi_L(r,l)}{\partial r}\overline{F}_H(\underline{\lambda};p_R)\right)\frac{\partial \underline{\lambda}}{\partial \tilde{l}}$$

$$+V_R'(\overline{\lambda})\left(\frac{\partial \pi_R(r,l)}{\partial r}F_H(\overline{\lambda};p_R)-\frac{\partial \pi_L(r,l)}{\partial r}\overline{F}_H(\overline{\lambda};p_R)\right)\frac{\partial \overline{\lambda}}{\partial \tilde{l}} \tag{15}$$

The first term on the rhs of (15) is the effect of L's capture on left-favoring messages and it is *always* negative to R's incentives. The second term is the informational externality on right-favoring coverage. Our next assumption guarantees that this second term is also negative, thus making the total effect on R's marginal returns negative.

Assumption II. π_R/π_H increases in l, and π_L/π_H increases in r.

Proposition 3. *Suppose that Assumption I and II hold. Then $B^R(r,l;\tilde{r},\tilde{l})$ decreases along $l=\tilde{l}$ and $B^L(r,l;\tilde{r},\tilde{l})$ decreases along $r=\tilde{r}$.*

In other words, under mild assumptions, capturing is a game in strategic substitutes at the item level. It is important to understand Assumption II as it is central to comprehending competition to capture information. The crucial question is: as L increases effort, is it taking chances away from R, or is it silencing honest reporting? Formally, as π_L increases with l, it can increase mostly at the expense of π_H; or it can mostly reduce π_R, thus *crowding out* R. Assumption II is satisfied when crowding out does not dominate. It then follows from Lemma 1 that a higher $\tilde{l}$ decreases $\overline{\lambda}$: besides skepticism over L-favoring messages, citizens also become more skeptical of messages that favor R. This externality is intuitive: if π_R/π_H increases with $\tilde{l}$, then higher $\tilde{l}$ implies that all messages are less likely to be honest. In this case, sophisticated skepticism and the informational externality both dampen R's incentives to exert effort and r and l are unambiguous strategic substitutes.[40]

How plausible is Assumption II? The model accords with the strong intuition that, other things equal, if $\tilde{l}>\tilde{r}$ rational citizens are more skeptical regarding left-leaning messages than regarding right-leaning messages, as shown in Panel B of Figure 2. In other words, the model delivers asymmetric skepticism *in levels* without need for

[40]While Proposition 3 provides sufficient conditions for strategic substitutability, Appendix OA-11 discusses necessary and sufficient conditions for strategic substitutability with general contest and cost functions.

Assumption II. However, if Assumption II does not hold, we have that $\partial\overline{\lambda}/\partial\tilde{l} > 0$, which has an unpalatable implication: the item necessarily becomes locally *more informative* when capture increases. To see this, note that as the left increases effort, there are right-leaning messages m which voters previously considered tainted by right-wing influence, which somehow become trustworthy as a result of *more* capture. This is very unlikely since in our model of disinformation more capture necessarily increases the chances that the message contains no true information. Assumption II avoids this scenario, guaranteeing both that capture is a game in strategic substitutes –see Proposition 3– and that increasing effort by either IP unambiguously makes a news item less informative.[41]

A Linear example To see the role of *crowding out*, consider the following functional form for the contest function: $\pi_R(r,l) = \rho + r - \eta l$ and $\pi_L(r,l) = \rho + l - \eta r$ with $\rho > 0$. Parameter η is the share of an IPs effort that shifts probability away from the other IP, with $1-\eta$ the share taken away from honest reporting. For example, if $\eta = 1$ then the gains to R come entirely from changing $\underline{\lambda}$ into $\overline{\lambda}$ in citizens' interpretation of the news item. Conversely, if $\eta = 0$ the gains come from replacing the expected honest coverage with a $\overline{\lambda}$ message. As noted, the sign of $\partial\overline{\lambda}/\partial\tilde{l}$ depends on what happens to π_R/π_H as $\tilde{l}$ increases. In this linear example, this ratio increases for all r and l if and only if $\rho \geq \eta/(1+\eta)$.[42] Therefore, if crowding out η is small enough, $\frac{\partial\overline{\lambda}}{\partial\tilde{l}}$ is negative and hence $B^R(r,l;\tilde{r},\tilde{l})$ decreases along $l = \tilde{l}$. We thus have strategic substitutes if capturing effort detracts enough from honest coverage. It is important to note that the opposite is not true: if capture consists entirely of crowding out, $\eta = 1$, we do not necessarily have strategic complements. While high η ensures that the second term in (15) is positive, we still have the effect on $\underline{\lambda}$ which remains strictly negative.

5 Source Attributes and Competitive Capture

In the model, citizens can be reached through a variety of sources. In this section we provide comparative statics to explore which kinds of sources should be subject to more pressure and by which IP. This analysis in the absence of endogenous demand-side effects from citizens' sorting sheds light on information markets where audience is not responsive to variations in capture, a situation which finds some support in the

[41] See the discussion in Section 6 and Lemma 2 for a formal proof of the reduction in informativeness with capture.

[42] This follows readily from differentiating $\frac{\pi_R}{\pi_H} = \frac{\rho + r - \eta l}{1 - 2\rho - (1-\eta)(r+l)}$ with respect to l.

empirical literature.[43] The next section explores the case where citizens can choose which source to consume.

5.1 A Taxonomy of Source Attributes

Let $h_{ij}(c) \equiv (C'_{ij})^{-1}(c)$ be the inverse of the marginal cost of capture of source j by IP i, and suppose that Assumption I holds. For each pair (r_j, l_j), define[44]

$$b_{ij}(r_j, l_j) = \{r'_j : r'_j = h_{ij}\left(M^j B_{ij}(r'_j, l'_j; r_j, l_j)\right)\} \tag{16}$$

where $B_{ij}(r'_j, l'_j; r_j, l_j)$ is given by (9) or (10) when applied to source j. The best response functions $b_{Rj}(r_j, l_j)$ and $b_{Lj}(r_j, l_j)$ are R and L's optimal efforts on source j given that its audience expects them to exert (r_j, l_j). Thus, (r^*, l^*) is a capture equilibrium if and only if for all $j \in \{1, .., n\}$, $r^*_j = b_{Rj}(r^*_j, l^*_j)$ and $l^*_j = b_{Lj}(r^*_j, l^*_j)$. These expressions are useful because they clarify the effects of a change in a source attribute onto incentives to capture in the absence of citizens adjusting their beliefs –keeping therefore $\left(\overline{\lambda}_j(r_j, l_j), \underline{\lambda}_j(r_j, l_j)\right)$ constant. We call these, the *direct effects* of a source attribute. It is useful to classify attributes into two (mutually excludable but non complete) categories. *Vertical attributes* are those which have positive direct effects –namely, they increase the marginal return to capture– independently of the identity of the IP. In contrast, *horizontal attributes* have positive direct effects on one IP but negative or neutral effects on the opposite IP.

It is straightforward from (16) that an increase in M^j is a vertical attribute of source j. This reflects the intuition that a source with a larger audience is a more attractive target of capture because its news reaches more people thus yielding higher returns at the same effort. Similarly it is clear that lower marginal costs, resulting in higher $h_{Rj}(r_j)$ for all $r_j > 0$ and higher $h_{Lj}(l_j)$ for all $l_j > 0$ are also vertical attributes. Sources that are easier to capture, perhaps because of low journalistic integrity or inadequate funding that makes them vulnerable, should, other things equal, attract more pressure as a direct effect.

A good example of a horizontal attribute is relative marginal cost across IPs. Consider a change in source ownership to a more right-wing activist owner. Such a move would result in a reduction of $C'_{Rj}(r_j)$ for all r_j. Therefore returns to effort directly

[43] For example, Martin and McCrain (2019) suggests that audience elasticity to changes in slant brought about by changes in ownership is rather low.

[44] Assumption I guarantees that $B_{Rj}(r'_j, l'_j; r_j, l_j)$ is independent of l'_j and $B_{Lj}(r'_j, l'_j; r_j, l_j)$ independent of r'_j – see (9) and (10).

improve for R at the expense of L.

We examine now two other important attributes that are less straightforward.

Audience Ideology Consider for example a FOSD increase in $F_p^j(p)$ such that the audience of source j is more inclined to believe that $\theta = 1$, the state favored by R. Examination of (16) and (9) shows that the direct effect of audience priors hinges on

$$V_i'(\lambda) = \int (\partial v_i(\mu(\lambda, p))/\partial\lambda)\, dF_p^j(p), \tag{17}$$

where $\partial v_i(\mu(\lambda, p))/\partial\lambda$ represents $i \in \{L, R\}$'s marginal payoff from sending a more favorable message to a citizen with prior p and (17) averages this payoff across all citizens. Therefore, the shape of v_i is essential to figure out how IPs react to changes in the distribution of priors. In Appendix OA-13.1.3 we show that if $\partial v_i^2(\mu(\lambda, p))/\partial\lambda\partial p \geq 0$, then the FOSD increase in $F_p^j(p)$ we consider increases R's incentives to capture and reduces those of L. We also link this condition to the curvature of v_i and show that it holds if v_i is sufficiently convex. This is intuitive: a convex v_i means that the IP gains from changing beliefs are higher when those changed were already holding favorable beliefs to i. In other words, IPs prioritize reaching those who are already favorable to pull them towards more favorable beliefs, as opposed to reaching those who are skeptical to move them towards moderation. If v_R and v_L are sufficiently convex, then, a shift upwards of $F_p^j(p)$ must make the audience more attractive to R and less to L. The complementary logic applies if we consider a FOSD decrease in $F_p^j(p)$ or when $\partial v_i^2(\mu(\lambda, p))/\partial\lambda\partial p \leq 0$ for both IPs.

We thus have that if $\partial v_i^2(\mu(\lambda, p))/\partial\lambda\partial p \geq 0$ or $\partial v_i^2(\mu(\lambda, p))/\partial\lambda\partial p \leq 0$ for both IPs, then the priors of the audience are horizontal attributes: FOSD shifts must induce a positive direct effect on one IP and a negative direct effect on the other.

Informativeness Lemma 1 states that, for a given level of pressure, when honest coverage is more informative, IPs can better manipulate information if they win the contest. This suggests that quality of information of honest coverage may be a vertical attribute. However, this is not necessarily the case. To see this, consider capture by R. Differentiating (7), the marginal return to covertly increasing r_j is

$$\frac{\partial\pi_R^j(r_j, l_j)}{\partial r_j} V_{R,j}(\overline{\lambda}_j) + \frac{\partial\pi_L^j(r_j, l_j)}{\partial r_j} V_{R,j}(\underline{\lambda}_j) + \frac{\partial\pi_H^j(r_j, l_j)}{\partial r_j} \mathbb{E}_{H,j}\left[V_{R,j}(\lambda); p_R\right].$$

The sum of the first two terms is necessarily positive as a direct effect. The difficulty lies in evaluating the change in $\mathbb{E}_{H,j}\left[V_{R,j}(\lambda); p_R\right]$ which encapsulates the following issue: how does the IP value honest coverage as the source becomes more informative? We provide a complete analysis in Appendix OA-12.2; here it suffices it to say that R's evaluation of honest coverage may improve as it becomes more informative. For example, if R really wants to convince those who hold relatively favorable beliefs –which is the case when v_R is convex– then it will generally prefer the honest coverage from a source that is very informative: messages from such a source polarize citizens and the gains from those who become more favorable are larger than the losses from those who become opponents. In such a case, R would find it less attractive to substitute honest coverage. It is therefore intuitive that informativeness is not necessarily a vertical attribute.

5.2 Source Attributes and Competition

The direct effects spelled out in the previous subsection abstract from the fact that rational citizens should anticipate the change in IPs' incentives and revise their assessments: as discussed in Section 4.1, anticipating more intense capture generates citizen skepticism which reduces incentives to exert effort. This negative *indirect effect* can be strong enough to upturn the direct effects we described above. This highlights the importance of the strategic substitutability we have uncovered.

Vertical attributes Strategic substitutes add important nuance to comparative statics on vertical attributes. While the direct effect makes them more attractive to IPs, the indirect effect caused by skeptical citizens adjusting their expectations of capture pushes in the opposite direction. As a consequence, we need additional conditions for an unambiguous effect. Consider a parameter γ describing a vertical attribute. We say that *the direct effect dominates the indirect effect* if whenever (r^*, l^*) is an equilibrium for parameter γ, then for any $\gamma' > \gamma$ we have

$$r_j^* \leq b_{Rj}(\hat{r_j}, \hat{l_j}; \gamma') \text{ and } l_j^* \leq b_{Lj}(\hat{r_j}, \hat{l_j}; \gamma'), \text{ with } \hat{r_j} \equiv b_{Rj}(r_j^*, l_j^*; \gamma') \text{ and } \hat{l_j} \equiv b_{Lj}(r_j^*, l_j^*; \gamma').$$

Note that $\hat{r_j}$ and $\hat{l_j}$ are the change in IPs' optimal capture as a result of a higher γ while keeping fixed citizens assessments at r_j^* and l_j^* –the direct effect. The indirect effect would be the change from $(\hat{r_j}, \hat{l_j})$ to (r_j', l_j'), with $r_j' = b_{Rj}(\hat{r_j}, \hat{l_j}; \gamma')$ and $l_j' = b_{Lj}(\hat{r_j}, \hat{l_j}; \gamma')$, as citizens revise their assessment of capture under γ' and IPs best respond to this revised assessment. Then, the direct effect dominates the indirect effect whenever both IPs raise their capture levels above the initial equilibrium when citizens anticipate an upward revision of capture following an increase in the parameter. As we show next, this condition is sufficient to guarantee monotone comparative statics with vertical attributes even when efforts are strategic substitutes.

Proposition 4. *Suppose that Assumption I holds. Then, at least one IP increases its equilibrium capture effort for source j if a vertical attribute of source j increases. If, in addition, Assumption II holds and the direct effect dominates the strategic effect, then both IPs respond by increasing capture.*

This result has two important parts. First, strategic substitutes do not imply that comparative statics are entirely ambiguous: if a source is more attractive, at least one IP exerts more effort. However, unless the direct effect dominates, it is not guaranteed that both do: the other IP may decide that, given the sophisticated skepticism of citizens to higher pressure by its opponent, high effort is not warranted. This means that if one compares sources, there should not be a presumption that sources with a larger viewership (for any exogenous reason) are more balanced. Such sources attract more pressure from at least one IP but perhaps not from both.

Because the core of this framework is competition to convince audiences, intuition suggests that sources which attract large viewership should be subject to high pressure by both IP, and should therefore tend to be balanced. Under strategic substitutes, this intuition is incomplete. The model can therefore accommodate the existence of biased sources with large audiences without resorting to demand effects or to other exogenous differences across sources, such as ownership.

Horizontal Attributes In contrast, strategic substitutes exacerbate the direct effects of horizontal attributes so comparative statics are unambiguous. To state the formal result, consider a parameter ζ such that an increase in ζ has a positive direct effect on a *favored IP* and a (weakly) negative direct effect on the opponent.

Proposition 5. *Consider the model under Assumptions I and II and an equilibrium level of capture (r^*, l^*). If a horizontal attribute ζ of source j which favors R increases, then there is always an equilibrium $(\bar{r}, \bar{l})$ with $\bar{r}_j \geq r_j^*$ and $\bar{l}_j \leq l_j^*$.*

This means that across media, differences in relative costs, perhaps resulting from ownership or audience biases, can yield large differences in relative pressure and thus in expected coverage.

6 Citizens Choice of News Sources

Up to this point our analysis has considered the size and priors of a source's audience as an exogenous attribute. We now allow citizens to select among sources. To model citizens' choice, we endow them with the following decision problem: a citizen needs to either "act" ($a = 1$) or "not act" ($a = -1$), and obtains 1 if $a = 1$ and $\theta = 1$, or if $a = -1$ and $\theta = -1$; and 0 otherwise.[45] For example, acting may be choosing which party to vote, going to a demonstration, or taking some decision influenced by beliefs over the seriousness of climate change.

We associate $\lambda_{crit}(p)$ to each citizen with prior p by setting $\lambda_{crit}(p) = (1-p)/p$. Thus, $\lambda_{crit}(p)$ is the minimum likelihood ratio of a message that will lead her to choose $a = 1$. For example, citizens with $p < 1/2$ –hence, $\lambda_{crit} > 1$– do not act in the absence of news as they are sufficiently confident that $\theta = -1$. To act, they need to see strong evidence that $\theta = 1$ as offered by any message with informational content exceeding λ_{crit}. In contrast, citizens with $p > 1/2$ –so that $\lambda_{crit} < 1$– are already convinced of the need to act and they will only change their decision if they observe coverage whose interpretation falls below λ_{crit}.

A citizen's value from consuming an item is therefore intimately tied to the probability of observing a message that falls on the side of λ_{crit} that changes her decision. To see this, let $F^j(\lambda, p)$, be the equilibrium distribution of an item's coverage by source j as perceived by a $p-$citizen –see (6). The instrumental value of that citizen is

$$I^j(p) \equiv \begin{cases} \int_0^{\lambda_{crit}(p)} F^j(\lambda, p) \frac{p(1-p)}{(1-p+\lambda p)^2} d\lambda & if\ p \geq 1/2, \\ \int_{\lambda_{crit}(p)}^{\infty} \overline{F}^j(\lambda, p) \frac{p(1-p)}{(1-p+\lambda p)^2} d\lambda & if\ p < 1/2. \end{cases} \tag{18}$$

A direct implication of this expression is that for a citizen with $p > 1/2$, changes in $\overline{\lambda}$ are inconsequential: her $\lambda_{crit}(p) < 1$ and therefore $\overline{\lambda} > \lambda_{crit}(p)$. This is intuitive: this citizen obtains value from a credible message that changes her default option to choose $a = 1$. However, this value decreases and can become zero as $\underline{\lambda}$ increases: if $\underline{\lambda} \geq \lambda_{crit}(p)$, $I^j(p)$ equals 0 as all equilibrium λ are above $\lambda_{crit}(p)$. Intuitively, the source becomes useless as she cannot trust *any* of the messages that could drive her to change her action. We thus have the following result:

Lemma 2. *Let $I^j(p; (r_j, l_j))$ be the value for a citizen with prior p of consuming news*

[45] Nevertheless, it is possible to extend the analysis to a setting in which citizens also differ in ideology. See Appendix OA-14.

item j which she expects to be subject to pressure (r_j, l_j). $I^j(p;(r_j,l_j))$ is non-increasing in r_j and in l_j for every $p \in (0,1)$ if and only if Assumption II holds for item j.

This follows from the discussion above and Lemma 1. To understand sufficiency, Lemma 1 shows that under Assumption II, $\underline{\lambda}$ is increasing, and $\overline{\lambda}$ is decreasing, in both efforts so that independently of $\lambda_{crit}(p)$ more pressure cannot make item j more informative. Necessity follows as a violation of Assumption II implies that either $\underline{\lambda}$ decreases with r, thus increasing the value $I^j(p)$ for some $p < 1/2$, or $\overline{\lambda}$ increases with l, thus increasing the value $I^j(p)$ for some $p > 1/2$. As foreshadowed in Section 4.2, a violation of Assumption II implies that some rational citizens interested in figuring out the truth would have a higher willingness to pay for a more captured news item. Assumption II avoids this pathological feature and ensures that higher frequency of disinformation reduces value to rational citizens.

This is not to say that the negative impact of pressure by either IP is the same on all citizens. Different priors generate different informational needs and citizens with $p > 1/2$ are very sensitive to changes in $\underline{\lambda}$ and consequently are a lot more worried about l_j than they are about r_j. Of course, the opposite is true for citizens with $p < 1/2$. For this reason, if they have a choice, citizens sort across sources (mostly) according to their priors.

Proposition 6. *Consider two symmetric sources $F_H^1 = F_H^2 (= F_H)$ and select an equilibrium with source 1 mostly captured by R (so that $\pi_R^1 \geq \pi_L^1$) and source 2 by L (so that $\pi_L^2 \geq \pi_R^2$), while total capture is not too dissimilar in the sense that*

$$\frac{\pi_R^1}{\pi_R^2} > \frac{\pi_H^1}{\pi_H^2} > \frac{\pi_L^1}{\pi_L^2}. \tag{19}$$

We then have:

i-There are $\underline{p} \leq \overline{p}$ such that citizens with $p < \underline{p}$ choose source 2 and citizens with $p > \overline{p}$ choose source 1.

ii-If the probability of honest coverage is the same across outlets, $\pi_H^1 = \pi_H^2$, then there is $\tilde{p}$ such that citizens sort monotonically: citizens choose source 2 if $p < \tilde{p}$ and choose source 1 if $p > \tilde{p}$.

Part ii. of the proposition ensures that there is full sorting according to priors if the likelihood of honest coverage is the same across the two sources. Sorting occurs because low prior citizens obtain value from strong credible messages that the state is $\theta = 1$.

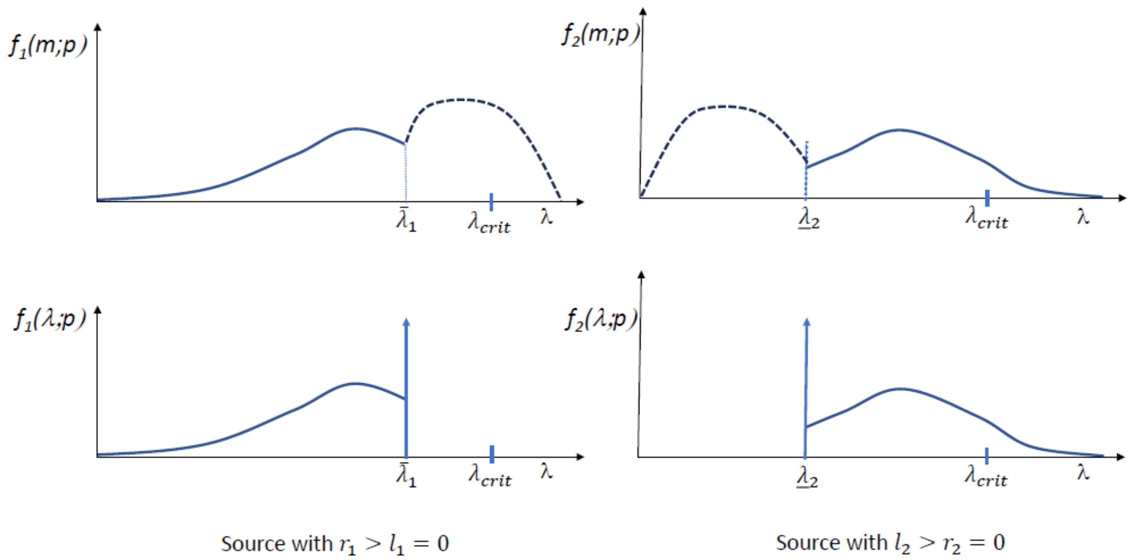

Figure 3: Choosing between Items

However, source 1 is often captured by R and consequently messages that favor $\theta = 1$ are suspect and not convincing enough. These citizens are better off watching source 2: a message with high equilibrium λ is possible, and coming from this source it would be credible enough for these citizens to change their choice of action. If total capture is the same across sources, then balance is the only difference across sources and sorting is full.

Of course, Lemma 2 indicates that citizens prefer less-captured sources. Part i. of Proposition 6 adjusts for this possibility: some citizens who are close to neutral in priors may choose to consume the opposite source on account of it being less captured.

Figure 3 shows this choice in a stylized example. Consider two sources, 1 and 2 with $r_1 > l_1 = 0$ and $l_2 > r_2 = 0$ so we have extreme horizontal differentiation. Consider a citizen with low p, skeptical of state $\theta = 1$. She therefore only values messages with $\lambda > \lambda_{crit}(p)$. Since R captures coverage with high probability in source 1, messages with $\lambda > \lambda_{crit}(p)$ are published much more frequently in source 1, as indicated by comparing the top two figures. However, as shown in the bottom figure, this high probability in turn means that $\overline{\lambda}$ is low and hence sophisticated skepticism leads the citizen to discount all such messages. So much so that no message from source 1 can convince the citizen to change her default decision: the most information she can get to update towards $\theta = 1$ in source 1 is capped at $\overline{\lambda}_1$ and she needs higher informativeness. Therefore, Source 1 is effectively useless to her. In contrast, messages with $\lambda > \lambda_{crit}(p)$ are published with lower probability in Source 2, but when they are, they create value as the citizen can trust them.

This highlights an interesting feature of our model: the exact same message conveys different information depending on the source that publishes it. A right-wing message is credible if conveyed by a left-wing source, but not credible otherwise. As citizens with opposite priors need credibility at different ends of the message distribution, they sort accordingly. This sorting effect is reminiscent of Suen (2004) but the underlying mechanism is very different. In Suen (2004) media does not lie. The paper instead focuses on the role of media as a filter of complex information. Bias in filtering can increase value for the citizen if it aligns with her informational needs. Citizens thus sort according to which bias creates more value for them. In contrast, our framework focuses on disinformation and therefore higher capture destroys value. Citizens sort as they search for the source in which the lies are less damaging to their needs.

The model also accommodates recent experimental evidence regarding the value that citizens assign to sources as a function of bias and their priors. Chopra, Haaland, and Roth (2024) show that Right-wing voters strongly reduce their demand for left-wing biased news, but not for right-wing biased news. The reverse pattern holds for left-wing voters. They interpret these as evidence supporting belief-confirmation motives. We show this is not necessarily so. Fully rational citizens in our model would act exactly as shown in the evidence: a Right wing voter (one who needs λ below $\lambda_{crit}(p)$) is indifferent about right-wing bias as $\overline{\lambda}$ is inconsequential to her value of information. However, she is very sensitive to left-wing bias as higher $\underline{\lambda}$ destroys credibility where she needs it. We note that the paper also shows that demand for left-wing biased news *does not increase* for Left-wing voters, nor do Right-wing voters increase demand for right-wing biased news. This is inconsistent with confirmation bias and with Suen (2004) insofar as it predicts that value for bias should be positive for some aligned citizens. However, it entirely fits with our model under Assumption II. Finally, the paper also shows that Right-wing voters under the right-wing bias treatment and Left-wing voters under the left-wing bias treatment both lower their rating on the accuracy of the newspaper. The fact that lower perceptions of accuracy do not reduce their demand runs counter to theories based on uncertainty over accuracy, as in Gentzkow and Shapiro (2006).

Brookman and Kalla (forthcoming) experimentally expose regular FOX news viewers to CNN in a sustained manner. Watching CNN caused substantial factual learning and a slight shift leftward in attitudes. Despite these outcomes, there was no effect on stated vote choices and when the experiment concluded, virtually all treatment subjects went back to view FOX news. These effects are again all consistent with our framework. At the margin, exposure to left-wing news shifts left the distribution of coverage and thus prompts rational voters in that direction. However, skepticism blunts the effect of this exposure so it does not affect actual political choices or informational needs. As soon as experimental compellence is over, we predict right-wing viewers go back to FOX even if they understand they learned facts about the world at CNN which FOX was not covering.

7 Robustness

We showed in our binary-state model that competing IPs resort to extreme messages which limit learning and, under Assumption II, engage in a capture game of strategic substitutes that promotes horizontal differentiation. We now test the robustness of these findings by extending the model to a finite state-space, allowing for multihoming as well as naive citizens, and expanding competition to multiple IPs.

Finite state space. Consider an extension of our model to a finite state space $\Theta \equiv \{\theta_i\}_{i=1}^{n} \subset \mathbb{R}$, $\theta_i < \theta_{i+1}$: if $\mu \in \Delta(\Theta)$ is the posterior belief of a citizen, then IPs' utility functions are $v_R(\mathbb{E}_\mu[\theta])$ and $v_L(\mathbb{E}_\mu[\theta])$ with v_R strictly increasing and v_L strictly decreasing with $|v_i'| > 0$, $i \in \{L, R\}$. Therefore, R wants to induce the highest expectation of the state on a citizen, while L wants to induce the lowest.

We explore this extension in Appendix OA-16. A key feature of Proposition 1 is that all citizens react in a systematic way to any two potential messages: if a citizen with prior p updates more after observing s' than after observing s, so did every other citizen, regardless of their prior. This consistent revision of beliefs across citizens does not hold in general for multiple states as messages may not be comparable (in the sense of Milgrom (1981), i.e., messages may not be ordered in the likelihood-ratio order).[46] Nevertheless, we show in Appendix OA-16 that prior-invariant communication featuring sender exaggeration and message clustering always exist if IPs observe the underlying state prior to selecting a coverage, and efforts remain strategic substitutes under Assumption II. However, and in contrast to the binary-state case, there may now be multiple equilibria, with some of them dependent on the citizens' prior distribution.

Multi-homing audience. A notable feature of equilibria in Proposition 1 is sender exaggeration and message clustering: IPs resort to messages above $\overline{\lambda}_j$ and below $\underline{\lambda}_j$ when capturing source j. One may conjecture that such strategy may prove counterproductive when citizens consume several sources –i.e., when they "multi-home"– as

[46] See Dixit and Weibull (2007) for an application of the failure of MLRP to political polarization.

they may grow suspicious and fear multi-capture if they systematically observe extreme messages in the same direction. Nevertheless, an IP controlling multiple sources can hide its identity from multi-homing citizens if they believe it randomizes its message independently across sources. Such independent randomizations, coupled with independent capture given efforts, prevent multi-homing citizens from interpreting the message in one source differently depending on the message in other sources –indeed, multi-homing citizens would now regard messages across sources as independent conditional on the state. What this implies is that, for the same covert level of capture, the communication strategies described in Proposition 1 remain an equilibrium if citizens multi-home, albeit now requiring independent randomizations across sources.

Appendix OA-17 explores this extension to multi-homing citizens. Besides formally proving that independent randomizations are a communication equilibrium when (a fraction or all) citizens multi-home, we show that multihoming naturally creates demand-side interdependencies across sources as multihoming citizens integrate messages from various sources when updating. However, IPs capture incentives for each source may not strengthen as IPs reach a larger, albeit better-informed, audience.

Naive citizens. Propositions 1 and 3 rely on the rational skepticism of a source's audience. This begs the question: are these results robust to the presence of unsophisticated citizens? In Appendix OA-18 we consider citizens with extreme susceptibility to manipulation: we allow a fraction $1 - \gamma < 1$ of citizens to be "naive" in that they believe all coverage to be honest. The remainder fraction γ of the audience are fully sophisticated as in previous sections.[47] Naive and rational citizens interpret the same coverage λ differently: naive citizens take it at face value and interpret λ literally, while rational citizens are wary of capture and interpret it as $\lambda_\gamma(\lambda)$.[48] We show that Proposition 3 still holds when allowing for an arbitrary fraction of naive citizens. That is, even in the presence of a large share of citizens who believe the lies they are fed, strategic IPs must still consider how sophisticated citizens update, which leads to their efforts being strategic substitutes.

[47]The presence of naive receivers in sender-receiver games forces strategic senders to trade-off pandering to naive receivers while making extreme messages less effective with sophisticated ones, and can lead to more informative communication (Kartik, Ottaviani, and Squintani (2007) and Chen (2011)). Closest to our model, Chen (2011) also allows for a fraction of senders to be honest. Unlike in our setup, however, all players share a common prior.

[48]To put it in terms of previous results, Proposition 1 indicates that when all citizens are rational (i.e., $\gamma = 1$), $\lambda_\gamma(\lambda) = \overline{\lambda}$ for $\lambda \geq \overline{\lambda}$ while $\lambda_\gamma(\lambda) = \underline{\lambda}$ for $\lambda \leq \underline{\lambda}$.

Citizens Sorting under a Common Prior. Proposition 6 shows that citizens sort according to their prior when facing asymmetrically captured sources. Is sorting a feature of belief heterogeneity? In Appendix OA-14 we show that the exact same sorting pattern obtains if citizens instead share a common prior but obtain different payoffs from their actions.

Multiple IPs. In many markets, several IPs with aligned interests but different preferences compete to shape public opinion. The model can be extended in this direction by allowing for multiple IPs classified into two classes: IPs in class $\mathscr{R}$ have preferences that are increasing in citizens' beliefs, while they are decreasing for IPs in class $\mathscr{L}$. We explore this extension in Appendix OA-19. We show that (i) communication equilibria also feature message exaggeration and clustering, although like-minded IPs may send systematically different messages; (ii) under conditions weaker than Assumption II, competitive capture is a game in strategic substitutes given citizens updated beliefs, regardless of whether IPs are like-minded or opposed; and (iii) capture has a public good component among like-minded IPs so that collusive agreements would exacerbate capture and reduce equilibrium informativeness –this holds in spite of the negative externality that a perceived increased in capture has on other like-minded IPs.

8 Conclusion

We have developed a model of competitive capture of public opinion. We show that capture leads to polarization in published news: extreme messages are observed more often. The equilibrium distribution of messages matches observed empirical distributions. Rational citizens are not deceived by this disinformation and become skeptical towards messages who would otherwise be very informative. The result is deleterious to social learning as competing pressures do not cancel each other. We also show that capturing efforts are strategic substitutes at the news-item level, which explains why competition is not driving sources toward balance. This strategic substitution amplifies horizontal differentiation when multiple information sources are present and hence contributes to segmenting the landscape into right-leaning and left-leaning sources. When we allow citizens to choose which source to consult, they sort ideologically in a manner consistent with recent experimental evidence.

In focusing on the decisions of interested parties, and on the informational consequences for citizens, we take a simplified view of the information sources themselves. In particular, sources are passive receivers of pressure by interested parties and, if they remain free of capture, they are honest conveyors of information. The rich existing literature on media capture has emphasized a trade-off between profit/viewership maximizing and yielding to pressure which we do not consider in this model. We leave for further research to study the conditions under which this trade-off reinforces or weakens the novel mechanisms we have uncovered in this paper. In pursuing this exercise, the choice set of media owners could be enriched with actions that could enhance the reputation of the source. Indeed, the cheap talk model we have developed in this manuscript is a rich and tractable canvas which can be specialized to study multiple questions such as the targeting of audiences in social media or the effectiveness of public health campaigns as a function of the existing media landscape.

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Appendix

Proof of Proposition 1. If citizens anticipate reporting strategies $\tilde{\tau}_i(m)$, $i \in \{L, R\}$'s, then after observing m, the inferred $\lambda(m) \equiv \frac{\Pr[m|\theta=1]}{\Pr[m|\theta=-1]}$ and p-citizens's posterior are

$$\lambda(m) = \frac{\pi_H(r,l)q_1(m) + \pi_R(r,l)\tilde{\tau}_R(m) + \pi_L(r,l)\tilde{\tau}_L(m)}{\pi_H(r,l)q_{-1}(m) + \pi_R(r,l)\tilde{\tau}_R(m) + \pi_L(r,l)\tilde{\tau}_L(m)}, \tag{20}$$

$$\mu(m;p) = \frac{\Pr[\theta = 1, m]}{\Pr[m]} = \frac{p\lambda(m)}{1 - p + p\lambda(m)}, \tag{21}$$

so that the difference in posteriors after observing messages m and m' is

$$\mu(m;p) - \mu(m';p) = (\lambda(m) - \lambda(m'))\, \frac{p(1-p)}{(1 - p + p\lambda(m))\,(1 - p + p\lambda(m'))}.$$

Averaging over the priors of all citizens, i's indirect utility from sending m is

$$V_i(m) \equiv \int_0^1 v_i\left(\mu(m;p)\right) dF_p(p) = \int_0^1 v_i\left(\frac{p\lambda(m)}{1 - p + p\lambda(m)}\right) dF_p(p). \tag{22}$$

If $\tau_i(m)$ is i's actual reporting strategy, then IPs' optimality requires that if $m, m' \in$ *supp* τ_i then $V_i(m) = V_i(m')$. We now show that this implies that $\lambda(m) = \lambda(m')$. Indeed, consider $i = R$ and suppose without loss that $\lambda(m) \geq \lambda(m')$. Then,

$$\begin{aligned}
0 = V_R(m) - V_R(m') &= \int_0^1 \left(v_R\left(\mu(m;p)\right) - v_R\left(\mu(m';p)\right)\right) dF_p(p) \\
&= \int_0^1 \left(\int_{\mu(m';p)}^{\mu(m;p)} v_R'\left(s\right) ds\right) dF_p(p) \geq \inf_{0\leq s\leq 1}\left(v_R'\left(s\right)\right)\left(\int_0^1 \left(\mu(m;p) - \mu(m';p)\right) dF_p(p)\right) \\
&= \inf_{0\leq s\leq 1}\left(v_R'\left(s\right)\right)\left(\lambda(m) - \lambda(m')\right)\int_0^1 \left(\frac{p(1-p)}{(1 - p + p\lambda(m))\,(1 - p + p(\lambda(m')))}\right) dF_p(p).
\end{aligned}$$

Since v_R' is bounded away from zero and the last integrand is strictly positive, we must have $\lambda(m) = \lambda(m')$. A similar argument shows that $\lambda(m) = \lambda(m')$ if $m, m' \in$ *supp* τ_L.

Note that (a) $V_R(m)$ in (22) is strictly increasing in $\lambda(m)$ while $V_L(m)$ in (22) is strictly decreasing in $\lambda(m)$, and (b) if $\tau_R(m) = \tau_L(m) = 0$ then $\lambda(m) = \lambda_H(m)$. Letting $\lambda^*(m)$ be the equilibrium likelihood ratio of message m with $\overline{\lambda} = \max_{m \in \mathscr{M}} \lambda^*(m)$ and $\underline{\lambda} = \min_{m \in \mathscr{M}} \lambda^*(m)$, then we must have $\lambda^*(m) = \overline{\lambda}$ if $m \in supp(\tau_R^*)$ while (a) implies that $m \in supp(\tau_R^*)$ only if $\lambda_H(m) \geq \overline{\lambda}$. If $\overline{m}^*$ is defined by $\lambda_H(\overline{m}^*) = \overline{\lambda}$, then $m \in supp(\tau_R^*)$ iff $m \geq \overline{m}^*$. Conversely, if $m \in supp(\tau_L^*)$ then we must have $\lambda^*(m) = \underline{\lambda}$ and $m \in supp(\tau_L^*)$ iff $\lambda_H(m) \leq \underline{\lambda}$. Thus, if $\underline{m}^*$ is defined by $\lambda_H(\underline{m}^*) = \underline{\lambda}$, then $m \in supp(\tau_R^*)$ iff $m \leq \underline{m}^*$.

If $\overline{\lambda} \neq \underline{\lambda}$, then R and L never send the same message so $\tau_R^*(m)\tau_L^*(m) = 0$ for all $m \in \mathscr{M}$. Using (20) with $\tilde{\tau}_i = \tau_R^*$ we can write

$$\frac{\pi_R(r,l)}{\pi_H(r,l)} \left(\overline{\lambda}\tau_R^*(m) - \tau_R^*(m)\right) = \left(\lambda_H(m) - \overline{\lambda}\right) q_{-1}(m), \ \ if \ \lambda_H(m) \geq \overline{\lambda}, \tag{23}$$

$$\frac{\pi_L(r,l)}{\pi_H(r,l)} \left(\tau_L^*(m) - \underline{\lambda}\tau_L^*(m)\right) = \left(\underline{\lambda} - \lambda_H(m)\right) q_{-1}(m), \ \ if \ \lambda_H(m) \leq \underline{\lambda}. \tag{24}$$

Integrating (23) over $\left\{m : \lambda_H(m) \geq \overline{\lambda}\right\}$ and using $\int_{\lambda_H(m) \geq \overline{\lambda}} \tau_R^*(m)dm = 1$ gives (3). A similar argument yields (4) from (24). The proof is complete as $\pi_H(r,l) > 0$ guarantees $\overline{\lambda} \neq \underline{\lambda}$. The right hand-side of (3) is increasing, and the left hand side is non-increasing, in $\overline{\lambda}$, thus, guaranteeing a unique solution to (3). The same argument establishes uniqueness of $\underline{\lambda}$ satisfying (4).

Proof of Lemma 1. (1) As $\pi_R(r,l)/\pi_H(r,l)$ increases in r and $\pi_L(r,l)/\pi_H(r,l)$ increases in l, the right hand sides of (3) and (4) increase with r and l, respectively. Equilibrium then requires that $\overline{\lambda}$ must decrease (as well as $\overline{m}^*$) with r, while $\underline{\lambda}$ must increase (as well as $\underline{m}^*$) with l. The same argument applies to changes in l in (3) under the condition that π_R/π_H increases in l, and to changes in r in (4) under the condition that π_L/π_H increases in r.

(2) Proposition 1 shows that $\overline{\lambda}$, $\overline{m}^*$, $\underline{\lambda}$ and $\underline{m}^*$ do not vary with F_p as the equilibrium conditions (3) and (4) do not depend on citizens' prior distribution.

(3) In Appendix OA-10 we show that (3) and (4) are equivalent to

$$\int_{\overline{\mu}(p)}^{1} \overline{F}_H^Y(\mu; p)d\mu = \frac{\pi_R(r,l)}{\pi_H(r,l)} \left(\overline{\mu}(p) - p\right), \tag{25}$$

$$\int_{0}^{\underline{\mu}(p)} F_H^Y(\mu; p)d\mu = \frac{\pi_L(r,l)}{\pi_H(r,l)} \left(p - \underline{\mu}(p)\right), \tag{26}$$

where $F_H^Y(\mu; p)$ is the distribution of posterior beliefs of a $p-$citizen, $p \in (0,1)$, when observing a coverage Y known to be honest, with $\overline{\mu}(p) \equiv \mu_H(\overline{m}^*; p)$ and $\underline{\mu}(p) \equiv \mu_H(\underline{m}^*; p)$. If honest coverage Y is Blackwell-more informative than X, then Blackwell and Girshick (1954) shows that for every $p \in (0,1), \mu' \in [0,1]$, we have

$$\int_{\mu'}^{1} \overline{F}_H^Y(\mu; p) d\mu \geq \int_{\mu'}^{1} \overline{F}_H^X(\mu; p) d\mu; \int_0^{\mu'} F_H^Y(\mu; p) d\mu \geq \int_0^{\mu'} F_H^X(\mu; p) d\mu. \quad (27)$$

Therefore, to satisfy (25), we must have a higher maximum belief $\overline{\mu}(p)$ in equilibrium under Y, and to satisfy (26) we must have lower minimum belief $\underline{\mu}(p)$. This implies that $\lambda_H(\overline{m}^*) = \overline{\lambda}$ must increase and $\lambda_H(\underline{m}^*) = \underline{\lambda}$ decrease.

We now show that the informativeness rankings of sources is preserved under capture. Suppose that honest coverage Y is Blackwell-more informative than X and let $F_\mu^j(\mu; p)$ be a $p-$citizen's posterior distribution when consuming item $j \in \{X, Y\}$ under the threat of capture, which using (6) satisfies $F_\mu^j(\mu; p) = F^j(\lambda(\mu; p); p)$ with $\lambda(\mu; p) = \frac{1-p}{p} \frac{\mu}{1-\mu}$. We now show that for all $\mu \in [0,1]$,[49]

$$\Delta(\mu) = \int_0^{\mu} F_\mu^Y(s) - F_\mu^X(s) ds \geq 0,$$

so that (27) holds and source Y's equilibrium message is Blackwell-more informative than source $X's$.[50] We already showed that for the same capture levels, $\underline{\mu}_Y \leq \underline{\mu}_X$ and $\overline{\mu}_X \leq \overline{\mu}_Y$. If $\mu < \underline{\mu}_X$ then $F_\mu^X(\mu) = 0$ and $\Delta(\mu) \geq 0$. Next, we observe that

$$\begin{aligned}\int_{\underline{\mu}_Y}^{\underline{\mu}_X} \left(\frac{\pi_L}{\pi_H} + F_H^Y(s)\right) ds &= \frac{\pi_L}{\pi_H}\left(p - \underline{\mu}_Y - (p - \underline{\mu}_X)\right) + \int_{\underline{\mu}_Y}^{\underline{\mu}_X} F_H^Y(s) ds \\ &= \int_0^{\underline{\mu}_Y} F_H^Y(s) ds - \int_0^{\underline{\mu}_X} F_H^X(s) ds + \int_{\underline{\mu}_Y}^{\underline{\mu}_X} F_H^Y(s) ds = \int_0^{\underline{\mu}_X} \left(F_H^Y(s) - F_H^X(s)\right) ds,\end{aligned}$$

[49]To streamline the exposition, we omit the dependence of functions on the prior p of the citizen and the dependence of π_i on the capture profile (r, l).

[50]As both posterior distributions have the same mean (equal to the prior p) then $\int_0^1 F_\mu^Y(s) - F_\mu^X(s) ds = 0$, so that $\int_0^\mu F_\mu^Y(s) - F_\mu^X(s) ds = \int_\mu^1 \overline{F}_\mu^Y(s) - \overline{F}_\mu^X(s) ds$. Therefore both expressions in (27) are equivalent to requiring $\Delta(\mu) \geq 0$

where we used (26) to obtain the second equality. If $\mu \in [\underline{\mu}_X, \overline{\mu}_X)$, then

$$\begin{aligned}\Delta(\mu) &= \int_{\underline{\mu}_Y}^{\underline{\mu}_X} \left(\pi_L + \pi_H F_H^Y(s)\right) ds + \int_{\underline{\mu}_X}^{\mu} \pi_H \left(F_H^Y(s) - F_H^X(s)\right) ds \\ &= \pi_H \left(\int_{\underline{\mu}_Y}^{\underline{\mu}_X} \left(\frac{\pi_L}{\pi_H} + F_H^Y(s) \right) ds + \int_{\underline{\mu}_X}^{\mu} F_H^Y(s) - F_H^X(s) ds \right) \\ &= \pi_H \int_0^{\mu} F_H^Y(s) - F_H^X(s) ds \geq 0.\end{aligned}$$

Finally, since for $\mu \in [\overline{\mu}_X, 1]$ we have $\overline{F}_\mu^X(\mu) = 0$, so $\Delta(\mu) \geq 0$ –see Footnote 50.

Proof of Proposition 2. Suppose that (i) citizens anticipate $(\tilde{r}, \tilde{l}, \tilde{\tau}_R, \tilde{\tau}_L)$, with $(\tilde{\tau}_R, \tilde{\tau}_L)$ satisfying Proposition 1 with $r = \tilde{r}$ and $l = \tilde{l}$; (ii) a $p-$citizen's posterior after observing m is $\mu^*(m;p) = \lambda^*(m)p/(\lambda^*(m)p + 1 - p)$ with $\lambda^*(m)$ satisfying Proposition 1.2; and (iii) $\overline{\lambda}$ and $\underline{\lambda}$ are consistent with $(\widetilde{r}, \widetilde{l})$ –i.e., they satisfy (3) and (4) with $r = \tilde{r}$ and $l = \tilde{l}$. Then, $i \in \{L, R\}$'s interim utility from sending m with $\lambda^*(m) = \lambda$ is

$$V_i(\lambda) \equiv M \int v_i\left(\mu^*(m;p)\right) dF_p(p) = M \int v_i\left(\frac{\lambda p}{\lambda p + 1 - p}\right) dF_p(p).$$

and R and L's expected utilities when covertly selecting r and l, followed by a sequentially rational reporting strategy, are $W_R(r, l; \tilde{r}, \tilde{l}) - C_R(r)$ and $W_L(r, l; \tilde{r}, \tilde{l}) - C_L(l)$, with $W_i(r, l; \tilde{r}, \tilde{l})$ given by (7). Therefore, R 's return from covertly increasing effort is $\frac{\partial W_R(r,l;\tilde{r},\tilde{l})}{\partial r} - C_R'(r)$ with

$$\begin{aligned}\frac{\partial W_R(r, l; \tilde{r}, \tilde{l})}{\partial r} &= \frac{\partial \pi_R(r, l)}{\partial r}\left(V_R(\overline{\lambda}) - \mathbb{E}_H\left[V_R(\lambda); p_R\right]\right) + \frac{\partial \pi_L(r, l)}{\partial r}\left(V_R(\underline{\lambda}) - \mathbb{E}_H\left[V_R(\lambda); p_R\right]\right) \\ &= \int_{\underline{\lambda}(\tilde{r},\tilde{l})}^{\overline{\lambda}(\tilde{r},\tilde{l})} V_R'(\lambda)\left(\frac{\partial \pi_R(r, l)}{\partial r} F_H(\lambda; p_R) - \frac{\partial \pi_L(r, l)}{\partial r} \overline{F}_H(\lambda; p_R)\right) d\lambda = B_R(r, l; \tilde{r}, \tilde{l}).\end{aligned}$$

as citizens' interpretation of messages only depends on the expected level of capture $(\tilde{r}, \tilde{l})$ rather than the actual level (r, l), and where we used (8) and the definition of $B_R(r, l; \tilde{r}, \tilde{l})$ in (9). Similarly, $\frac{\partial W_L(r,l;\tilde{r},\tilde{l})}{\partial l} - C_L'(l) = B_L(r, l; \tilde{r}, \tilde{l}) - C_L'(l)$.

In Appendix OA-13 we prove the existence of a pure-strategy equilibrium in efforts when $\pi_i(r,l)$ are concave in r and concave in l. In any such equilibrium (r^*, l^*),

$$r^* \in \arg\max_{r \in X_R} W_R(r, l^*; (r^*, l^*)) - C_R(r),$$
$$l^* \in \arg\max_{l \in X_L} W_L(r^*, l; (r^*, l^*)) - C_L(l).$$

Using the definitions of $B_R(r,l;\tilde{r},\tilde{l})$ and $B_L(r,l;\tilde{r},\tilde{l})$, we can express these equilibrium conditions as (11) and (12). As citizens correctly anticipate (r^*, l^*), then (3) and (4) provide the maximum and minimum equilibrium likelihood ratios.

Proof of Proposition 3. Consider the change in $B_R(r,l;\tilde{r},\tilde{l})$ –defined in (9)– if L increases capture and it is correctly anticipated by citizens,

$$\Delta_B^R \equiv \frac{\partial B_R(r,l;\tilde{r},\tilde{l})}{\partial l} + \left.\frac{\partial B_R(r,l;\tilde{r},\tilde{l})}{\partial \tilde{l}}\right|_{l=\tilde{l}} = \left.\frac{\partial^2 W_R(r,l;\tilde{r},\tilde{l})}{\partial r \partial l}\right|_{l=\tilde{l}} + \left.\frac{\partial^2 W_R(r,l;\tilde{r},\tilde{l})}{\partial r \partial \tilde{l}}\right|_{l=\tilde{l}}$$
$$= \left.\frac{\partial^2 \pi_R(r,l)}{\partial r \partial l}\left(V_R(\overline{\lambda}) - \mathbb{E}_H\left[V_R(\lambda); p_R\right]\right)\right|_{l=\tilde{l}} + \left.\frac{\partial \pi_L^2(r,l)}{\partial r \partial l}\left(V_R(\underline{\lambda}) - \mathbb{E}_H\left[V_R(\lambda); p_R\right]\right)\right|_{l=\tilde{l}}$$
$$+ \left.\frac{\partial \pi_R(r,l)}{\partial r}\left(V_R'(\overline{\lambda})\frac{\partial \overline{\lambda}}{\partial \tilde{l}} - \frac{\partial \mathbb{E}_H\left[V_R(\lambda); p_R\right]}{\partial \tilde{l}}\right)\right|_{l=\tilde{l}} + \left.\frac{\partial \pi_L(r,l)}{\partial r}\left(V_R'(\underline{\lambda})\frac{\partial \underline{\lambda}}{\partial \tilde{l}} - \frac{\partial \mathbb{E}_H\left[V_R(\lambda); p_R\right]}{\partial \tilde{l}}\right)\right|_{l=\tilde{l}}$$

Differentiating (8) we have

$$\frac{\partial \mathbb{E}_H\left[V_R(\lambda); p_R\right]}{\partial \tilde{l}} = \overline{F}_H(\overline{\lambda}; p_R) V_R'(\overline{\lambda})\frac{\partial \overline{\lambda}}{\partial \tilde{l}} + F_H(\underline{\lambda}; p_R) V_R'(\underline{\lambda})\frac{\partial \underline{\lambda}}{\partial \tilde{l}},$$

and using Assumption I we obtain

$$\Delta_B^R = V_R'(\underline{\lambda})\left(\left.\frac{\partial \pi_L(r,l)}{\partial r}\right|_{l=\tilde{l}} \overline{F}_H(\underline{\lambda}; p_R) - \left.\frac{\partial \pi_R(r,l)}{\partial r}\right|_{l=\tilde{l}} F_H(\underline{\lambda}; p_R)\right)\frac{\partial \underline{\lambda}}{\partial \tilde{l}} \tag{28}$$
$$+ V_R'(\overline{\lambda})\left(\left.\frac{\partial \pi_R(r,l)}{\partial r}\right|_{l=\tilde{l}} F_H(\overline{\lambda}; p_R) - \left.\frac{\partial \pi_L(r,l)}{\partial r}\right|_{l=\tilde{l}} \overline{F}_H(\overline{\lambda}; p_R)\right)\frac{\partial \overline{\lambda}}{\partial \tilde{l}}. \tag{29}$$

We now show that $\Delta_B^R \leq 0$. Since $\frac{\partial \pi_R(r,l)}{\partial r} > 0 \geq \frac{\partial \pi_L(r,l)}{\partial r}$, the term in parenthesis in (28) is negative while the term in parenthesis in (29) is positive. By Assumption II, $\pi_R(r,l)/\pi_H(r,l)$ increases in l so $\overline{\lambda}$ decreases, and $\underline{\lambda}$ increases, with $\tilde{l}$ –see Lemma 1.1. Therefore, Δ_B^R must be negative. A similar analysis applied to L shows that $\Delta_B^L \leq 0$.

Proof of Proposition 4. First, consider an equilibrium (r^*, l^*) and by way of contradiction suppose that both IPs decrease capture to $r' < r^*$ and $l' < l^*$ when the vertical attribute increases. A lower capture implies that lies are more informative, $\overline{\lambda}(r',l') \geq \overline{\lambda}(r^*,l^*)$ and $\underline{\lambda}(r',l') \leq \underline{\lambda}(r^*,l^*)$, which, together with Assumption I, implies that best responses increase $b_{Rj}(r',l') \geq b_{Rj}(r^*,l^*) = r^* > r'$ and $b_{Lj}(r',l') \geq b_{Lj}(r^*,l^*) = l^* > l'$, so (r',l') cannot be an equilibrium. Therefore, at least one IP must increase capture in equilibrium.

Second, suppose that Assumption I and II hold and the direct effect dominates the indirect effect. Then $b_{ij}(r_j,l_j)$ satisfies the conditions in Theorem 1 in Roy and Sabarwal (2010) that guarantee monotone comparative statics for games with strategic substitutes. Therefore, there is an equilibrium (r',l') with $r' \geq r^*$ and $l' \geq l^*$

Proof of Proposition 5. Focusing on source j,[51] define

$$\Psi_R(l) \equiv \{r : r = b_R(r,l), r \in X_R\},$$
$$\Psi_L(r) \equiv \{l : l = b_L(r,l), l \in X_L\}.$$

For instance, $\Psi_R(l)$ is R's belief-consistent best response when citizens correctly anticipate IPs' capture efforts –i.e., $\Psi_R(l)$ is the set of fixed points $r = b_R(r,l)$ parametrized by l. We note that $\Psi_R(l)$ and $\Psi_R(l)$ are functions. The fact that they are non-empty follows from applying Brouwer's fixed-point theorem to $b_R(\cdot,l)$ and $b_L(r,\cdot)$ –see Appendix OA-13 for proof of continuity of b_i– while uniqueness of solution to $r = b_R(r,l)$ ($l = b_L(r,l)$) follows from $b_R(\cdot,l)$ ($b_L(r,\cdot)$) being non-increasing. Finally, $\Psi_R(l)$ and $\Psi_R(l)$ are non-increasing under Assumptions I and II and (r^*,l^*) is an equilibrium if and only if $r^* = (\Psi_R \circ \Psi_L)(r^*)$ and $l^* = (\Psi_L \circ \Psi_R)(l^*)$.

Consider an increase in a horizontal attribute ζ that raises R's marginal gain from capture and let $b_i^\zeta(r,l)$, and $\Psi_i^\zeta(r)$ be the corresponding functions after the change in ζ. Increasing R's incentives implies $b_{Rj}^\zeta(r,l) \geq b_{Rj}(r,l)$, while (weakly) lowering $L's$ implies $b_{Lj}^\zeta(r,l) \leq b_{Lj}(r,l)$. Therefore, $\Psi_R^\zeta(l) \geq \Psi_R(l)$ and $\Psi_L^\zeta(r) \leq \Psi_L(r)$. But then,

$$\Psi_R^\zeta(\Psi_L^\zeta(r)) \geq \Psi_R(\Psi_L^\zeta(r)) \geq \Psi_R(\Psi_L(r)),$$

where the last inequality follows from $\Psi_R(\cdot)$ being non-increasing. Likewise, we have

$$\Psi_L^\zeta(\Psi_R^\zeta(l)) \leq \Psi_L(\Psi_R^\zeta(l)) \leq \Psi_L(\Psi_R(l)),$$

where the last inequality follows from $\Psi_L(\cdot)$ being non-increasing. Taken together, this

[51]To alleviate the exposition, we omit the index j in the various functions.

implies that the highest fixed point of $\Psi_R^\zeta \circ \Psi_L^\zeta$ is higher than the highest fixed point of $\Psi_R \circ \Psi_L$; while the lowest fixed point of $\Psi_L^\delta \circ \Psi_R^\delta$ is lower than the lowest fixed point of $\Psi_L \circ \Psi_R$ –see Villas-Boas (1997).

Finally, let $\overline{r} = \max\{r \in X_R : r = (\Psi_R^\zeta \circ \Psi_L^\zeta)(r)\}$ with $\bar{l} = \Psi_L^\zeta(\overline{r})$. For any equilibrium (r^*, l^*) before the change in the attribute, we have shown that $r^* \leq \overline{r}$. We now show that $\bar{l} \leq l^*$. Indeed,

$$\bar{l} = \Psi_L^\zeta(\overline{r}) \leq \Psi_L(\overline{r}) \leq \Psi_L(r^*) = l^*,$$

where the first inequality follows from the (weakly) decrease in the marginal gain to L and the second inequality from Ψ_L being non-increasing.

Proof of Lemma 2. Recall that $F^j(\lambda; p)$ is the equilibrium distribution of source j's likelihood ratios expected by a $p-$citizen –see (6)– and $F_\mu^j(\mu, p)$ the corresponding distribution over posterior beliefs. Then, if $p > 1/2$,

$$I^j(p) \equiv \int_0^{1/2} [\frac{1}{2}(1-\mu) - \frac{1}{2}\mu] dF_\mu^j(\mu, p) = \int_0^{1/2} F_\mu^j(\mu, p) d\mu = \int_0^{\lambda_{crit}(p)} \frac{F^j(\lambda, p)p(1-p)}{(1-p+\lambda p)^2} d\lambda,$$

where we made the change of variables $\lambda = \frac{\mu}{1-\mu}\frac{1-p}{p}$ to obtain the last term. This follows as the citizen will change her decision from $a = 1$ to $a = -1$ only after observing a message that leads her to a posterior belief $\mu \leq 1/2$ –i.e., a message with $\lambda \leq \lambda_{crit}(p)$. Equivalently, if $p < 1/2$ we have

$$I^j(p) \equiv \int_{\frac{1}{2}}^1 [\frac{1}{2}\mu - \frac{1}{2}(1-\mu)] dF_\mu^j(\mu, p) = \int_{\frac{1}{2}}^1 \overline{F}_\mu^j(\mu, p) dp = \int_{\lambda_{crit}(p)}^\infty \frac{\overline{F}^j(\lambda, p)p(1-p)}{(1-p+\lambda p)^2} d\lambda.$$

Let $\underline{\mu}_j(p) = \mu(\underline{\lambda}_j, p)$ and $\overline{\mu}_j(p) = \mu(\overline{\lambda}_j, p)$. Then, for any $\overline{\mu}_j(p) < \frac{1}{2} < p$,[52]

$$\begin{aligned} I^j(p) &= \int_0^{\frac{1}{2}} F_\mu^j(s, p) ds = \int_{\overline{\mu}_j(p)}^{\frac{1}{2}} \pi_L^j + \pi_H^j F_H^j(s; p) ds \\ &= \pi_L^j(\frac{1}{2} - \overline{\mu}_j(p)) + \pi_H^j \int_0^{\frac{1}{2}} F_H^j(s; p) ds - \pi_L^j(p - \overline{\mu}_j(p)) \qquad (30) \\ &= \pi_H^j \left(\int_0^{\frac{1}{2}} F_H^j(s; p) ds - \frac{\pi_L^j}{\pi_H^j}(p - \frac{1}{2}) \right). \qquad (31) \end{aligned}$$

[52]We omit the dependence of π_i^j on efforts to streamline the exposition.

This expression increases in π_H^j and decreases in π_L^j/π_H^j. If $p < \frac{1}{2} < \overline{\mu}_j(p)$,

$$I^j(p) = \int_{\frac{1}{2}}^1 \overline{F}_\mu^j(s;p)ds = \pi_H^j \left(\int_{\frac{1}{2}}^1 \overline{F}_H^j(s;p)ds - \frac{\pi_R^j}{\pi_H^j}(\frac{1}{2} - p) \right) \tag{32}$$

which increases in π_H^j and decreases in π_R^j/π_H^j. Suppose that R increases its capture effort and it is anticipated by citizens. Then (32) decreases as π_H^j decreases and π_R^j/π_H^j increases. If Assumption II holds, then (31) decreases as π_H^j decreases and π_L^j/π_H^j increases. A similar logic applies if L increases its anticipated capture. Thus, under Assumption II, $I^j(p)$ is non-increasing in either IP's efforts for every $p \in (0, 1)$.

Now suppose that Assumption II does not hold and, for instance, π_R^j/π_H^j decreases in l at (r, l). If $\underline{\lambda}$ and $\underline{\lambda}'$ are the thresholds at profiles (r, l) and (r, l'), $l' > l$, then Lemma 1 implies that $\underline{\lambda}' < \underline{\lambda}$ so any $p-$citizen satisfying[53]

$$\underline{\mu}'(p) = \frac{\underline{\lambda}'p}{\underline{\lambda}'p + (1-p)} < \frac{1}{2} < \frac{\underline{\lambda}p}{\underline{\lambda}p + (1-p)} = \underline{\mu}(p), \tag{33}$$

would have $I^j(p; (r, l')) > I^j(p; (r, l)) = 0$. Thus, an increase in capture by L raises the value of information for any p-citizen satisfying (33). A similar argument obtains if instead π_L^j/π_H^j decreases in r.

Proof of Proposition 6. Let $\Delta_F(\lambda, p) = F^1(\lambda; p) - F^2(\lambda; p)$ be the difference in a $p-$citizen's equilibrium distribution of likelihood ratios between source 1 and source 2, and $\Delta_I(p) \equiv I^1(p) - I^2(p)$ the difference in instrumental value between both sources. Then, the $p-$citizen with $p > 1/2$ will select source 1 whenever

$$\Delta_I(p) = \int_0^{\lambda_{crit}(p)} \Delta_F(\lambda, p) \frac{p(1-p)}{(1-p+\lambda p)^2} d\lambda \geq 0$$

and will consume source 2 otherwise. Similarly, a $p-$citizen with $p < 1/2$ will consume source 1 if

$$\Delta_I(p) = \int_{\lambda_{crit}(p)}^1 (-\Delta_F(\lambda, p)) \frac{p(1-p)}{(1-p+\lambda p)^2} d\lambda \geq 0.$$

Suppose $\pi_R^1 \geq \pi_L^1$, $\pi_L^2 \geq \pi_R^2$,[54] and (19) holds –so capture levels are not too dissimilar– implying that $\frac{\pi_R^1}{\pi_H^1} > \frac{\pi_R^2}{\pi_H^2}$ and $\frac{\pi_L^1}{\pi_H^1} < \frac{\pi_L^2}{\pi_H^2}$. That is, the likelihood that a high

[53]Equivalently, any $p-$citizen with $\underline{\lambda}' < \lambda_{crit}(p) < \underline{\lambda}$.

[54]To streamline the exposition, we omit the dependence of π_i^j on the capture profile (r_j, l_j).

message was sent by R rather than being honest is higher in media 1, while the likelihood that a low message is sent by L instead of being honest is higher in media 2. As $F^1_H = F^2_H \, (= F_H)$ so that $F^1_{H,-1}(\lambda) = F^2_{H,-1}(\lambda)$, (34) and (35) then implies $\overline{\lambda}_1 < \overline{\lambda}_2$ and $\underline{\lambda}_2 > \underline{\lambda}_1$. Given symmetry of sources and $\overline{\lambda}_1 < \overline{\lambda}_2$ and $\underline{\lambda}_2 > \underline{\lambda}_1$, we can write

$$\Delta_F(\lambda, p) = \begin{cases} 0 & if \quad \lambda < \underline{\lambda}_1 \\ \pi^1_H F_H(\lambda, p) + \pi^1_L & if \quad \underline{\lambda}_1 \le \lambda < \underline{\lambda}_2 \\ \left(\pi^1_H - \pi^2_H\right) F_H(\lambda, p) - \left(\pi^2_L - \pi^1_L\right) & if \quad \underline{\lambda}_2 \le \lambda < \overline{\lambda}_1 \\ 1 - \pi^2_H F_H(\lambda, p) - \pi^2_L & if \quad \overline{\lambda}_1 \le \lambda < \overline{\lambda}_2 \\ 0 & if \quad \lambda \ge \overline{\lambda}_2 \end{cases}$$

Note that $\Delta_F(\lambda, p) \ge 0$ if $\lambda < \underline{\lambda}_2$ or if $\lambda \ge \overline{\lambda}_1$. Therefore, $\Delta_I(p) \ge 0$ if $\lambda_{crit}(p) < \underline{\lambda}_2$ –i.e., if $p > 1/(1 + \underline{\lambda}_2) > 1/2$– but $\Delta_I(p) \le 0$ if $\lambda_{crit}(p) > \overline{\lambda}_1$ –i.e., if $p < 1/(1 + \underline{\lambda}_1) < 1/2$. This proves part *i*.

Suppose, in addition, that $\pi^1_H = \pi^2_H$. Then $\Delta_F(\lambda, p) = -\left(\pi^2_L - \pi^1_L\right)$ for $\underline{\lambda}_2 \le \lambda < \overline{\lambda}_1$ which does not change sign. This implies that $\Delta_I(p)$ is strictly single-crossing in p, which proves part *ii*. To see this, note that for $p > 1/2$, $\Delta_I(p)$ must be single-crossing, from positive to negative, as $\Delta_F(\lambda, p)$ changes sign at most once from positive to negative –i.e., at $p = 1/(1 + \underline{\lambda}_2)$ if $\pi^2_L \ge \pi^1_L$. Likewise, for $p < 1/2$, $\Delta_I(p)$ must be single-crossing, from positive to negative as $\Delta_F(\lambda, p)$ changes sign at most once, from negative to positive –i.e., at $p = 1/(1 + \overline{\lambda}_1)$ if $\pi^2_L \ge \pi^1_L$. Continuity of $\Delta_I(p)$ at $p = 1/2$ implies that the sign of $\Delta_I(p)$ must not change for either $\lambda_{crit} < 1$ or $\lambda_{crit} > 1$, proving that $\Delta_I(p)$ is single-crossing. □

9 Online Supplemental Appendix

This is the Online Appendix to "Competitive Capture of Public Opinion." In Section 10 we provide an alternative representation for the characterization of communication equilibria in Proposition 1 of the main text, and show that communication equilibria with informed IPs –i.e., such that they observe the underlying state after exerting capture effort but prior to selecting a message upon successful capture– still satisfy the conditions of Proposition 1.

In Section 11 we provide necessary and sufficient conditions for strategic substitutability of capture efforts under Assumption I –i.e., no complementarities in the contest success function $\pi_i(r, l)$. In Section 12 we study several source attributes and clarify when they are vertical or horizontal. We first study audience ideology and show that R (L) wants to fire up its base if its utility is an increasing and convex transformation of the odds of a high (low) state. Therefore, if both IPs have congruent preferences –so that either both want to fire-up-their-base or moderate-the-opposition– then audience ideology is a horizontal attribute: for example, a FOSD increase in citizens priors would increase R's capture incentives but reduce those of L. We then show that the quality of information of honest coverage is generically not a vertical attribute, but we nevertheless provide sufficient conditions for a positive direct effect on IPs when honest coverage becomes Blackwell-more informative.

Section 13 provides several ancillary results in the study of competitive capture of a duopoly: existence of pure-strategy capture equilibria; the global effect on capture of local asymmetries; and properties of best-responses for the linear contest model that we use in the proofs of Proposition 14. We also provide conditions so that local changes in sources lead to ripple effects in the media market when capture costs are interdependent, and, in particular, conditions so that changes in the ideology of a source's audience or the ease of capture leads to an overall more polarized media landscape.

Section 14 shows that our model of citizen sorting with heterogeneous priors can instead be framed as a model of sorting of citizens with a common prior but different preferences –possibly stemming from ideological differences. Section 15 describes basic properties of citizen behavior when a fraction of citizens sort according to each source's instrumental value of information. We also show that media markets may become less informative if the demand for information increases.

Section 16 extends our model to a finite state space and shows that if IPs observe the state prior to selecting their coverage, then we can construct equilibria that are prior-invariant, leading to the same properties as equilibria in the binary state case presented in Proposition 1 in the main text. Albeit, equilibria are no longer unique.

Finally, Section 17 extends our analysis to the case of multi-homing audiences, Section 18 provides a complete treatment of capture with naive citizens, and Section 19 explores the case with multiple IPs exerting uncoordinated effort to capture public opinion, and contrasts the equilibrium capture with a situation in which like-minded IPs can coordinate capture.

10 Communication Equilibria

The following proposition describes the bounds $\overline{\lambda}$ and $\underline{\lambda}$ defined in Proposition 1 of the main text in terms of the distribution over posteriors $\mu_H(m;p)$ induced on a p-citizen by coverage known to be honest.

Proposition 7. *For every $p-$citizen, the maximum and minimum equilibrium posteriors $\overline{\mu}(p)$ and $\underline{\mu}(p)$ satisfy*

$$\int_{\overline{\mu}(p)}^{1} \overline{F}_H(\mu;p)d\mu = \frac{\pi_R(r,l)}{\pi_H(r,l)}\left(\overline{\mu}(p) - p\right)$$
$$\int_{0}^{\underline{\mu}(p)} F_H(\mu;p)d\mu = \frac{\pi_L(r,l)}{\pi_H(r,l)}\left(p - \underline{\mu}(p)\right).$$

In particular, $\overline{\mu}(p) \equiv \mu_H(\overline{m}^*;p)$ and $\underline{\mu}(p) = \mu_H(\underline{m}^*;p)$ where $\overline{m}^*$ and $\underline{m}^*$ satisfy $\underline{\lambda} = \lambda_H(\underline{m}^*)$ and $\overline{\lambda} = \lambda_H(\overline{m}^*)$ and $\underline{\lambda}$ and $\overline{\lambda}$ are given by (3) and (4).

Proof. We will express the following equilibrium conditions –see Proposition 1–

$$\int_{\overline{\lambda}}^{\infty} \left(\lambda - \overline{\lambda}\right) dF_{H,-1}(\lambda) = \frac{\pi_R(r,l)}{\pi_H(r,l)}\left(\overline{\lambda} - 1\right), \tag{34}$$
$$\int_{0}^{\underline{\lambda}} \left(\underline{\lambda} - \lambda\right) dF_{H,-1}(\lambda) = \frac{\pi_L(r,l)}{\pi_H(r,l)}\left(1 - \underline{\lambda}\right). \tag{35}$$

in terms of posterior beliefs $\mu(m;p)$ for $p \in (0,1)$. First, we can write

$$\begin{aligned}\frac{\lambda_H(m)-\lambda_H(\overline{m}^*)}{\lambda_H(\overline{m}^*)-1}q_{-1}(m) &= \frac{1}{\lambda_H(\overline{m}^*)-1}q_1(m) - \frac{\lambda_H(\overline{m}^*)}{\lambda_H(\overline{m}^*)-1}q_{-1}(m) \\ &= \frac{p(1-\mu_H(\overline{m}^*;p))}{\mu_H(\overline{m}^*;p))-p}q_1(m) - \frac{\mu_H(\overline{m}^*;p)(1-p)}{\mu_H(\overline{m}^*;p))-p}q_{-1}(m) \\ &= \left(\frac{\mu_H(m;p))-\mu_H(\overline{m}^*;p))}{\mu_H(\overline{m}^*;p))-p}\right)\Omega_H(m;p)\end{aligned}$$

with $\Omega_H(m;p) \equiv q_1(m)p + q_{-1}(m)(1-p)$ the $p-$citizen probability density of observing m from honest coverage. Then, (34) can be expressed as

$$\int_{\{m:\mu_H(m;p)\geq\overline{\mu}(p)\}} (\mu_H(m;p)) - \overline{\mu}(p))\, \Omega_H(m;p)dm = \frac{\pi_R(r,l)}{\pi_H(r,l)}\left(\overline{\mu}(p)-1\right),$$

where $\overline{\mu}(p) \equiv \mu_H(\overline{m}^*;p))$. Integrating by parts and expressing the result in terms of $\mu = \mu_H(m;p)$ we can write

$$\int_{\overline{\mu}(p)}^1 \overline{F}_H(\mu;p)d\mu = \frac{\pi_R(r,l)}{\pi_H(r,l)}\left(\overline{\mu}(p)-p\right).$$

Conversely, from

$$\frac{\lambda_H(\underline{m}^*)-\lambda_H(m)}{1-\lambda_H(\underline{m}^*)}q_{-1}(m) = \left(\frac{\mu_H(\underline{m}^*;p)-\mu_H(m;p)}{p-\mu_H(\underline{m}^*;p)}\right)\Omega_H(m;p),$$

we have that (35) translates, after integrating by parts, to

$$\int_0^{\underline{\mu}(p)} F_H(\mu;p)d\mu = \frac{\pi_L(r,l)}{\pi_H(r,l)}\left(p-\underline{\mu}(p)\right),$$

where $\underline{\mu}(p) = \mu_H(\underline{m}^*;p))$. □

In the main text we pointed out that the communication equilibria in Proposition 1 are robust to allowing IPs to condition their message on knowledge of the item's honest coverage. We now formally prove this by considering equilibria in which IPs observe the underlying honest coverage after exerting effort but prior to selecting a message upon successful capture, and show that they still satisfy the conditions of Proposition 1.

Proposition 8. *Fix effort r and l, with $\pi_H(r,l)>0$, and let $(\overline{\lambda},\underline{\lambda})$ be the unique thresh-*

olds derived in Proposition 1. Suppose instead that IPs observe the honest coverage m^j after exerting capture effort but before selecting the coverage upon successful capture. Let $\tau_i^*(\cdot; m^j)$ be i's mixing strategy upon privately observing realization m^j of honest coverage. Then, in every communication equilibrium, we have

1. $\cup_{m^j} supp(\tau_R^*(\cdot; m^j)) = \{m : \lambda_H(m) \geq \overline{\lambda}\}$; $\cup_{m^j} supp(\tau_L^*(\cdot; m^j)) = \{m : \lambda_H(m) \leq \underline{\lambda}\}$,

2. *The equilibrium likelihood ratio of message m is given by (2), and the maximum and minimum equilibrium likelihood ratios satisfy* $\max_{m \in \mathscr{M}} \lambda^*(m) = \overline{\lambda}$ *and* $\min_{m \in \mathscr{M}} \lambda^*(m) = \underline{\lambda}$.

Proof. Suppose that R and L's strategies are $\tau_R(m; m')$ and $\tau_L(m; m')$ so that $\tau_i(m; m')$ is the probability that the i-sender sends m after the news source's honest coverage $m^j = m'$. Let $\tilde{\tau}_i(m; m')$ be citizens' assessments of these strategies. Then the perceived likelihood ratio $\lambda(m) \equiv \frac{\Pr[m|\theta=1]}{\Pr[m|\theta=0]}$ is

$$\lambda(m) = \frac{\pi_H(r,l)q_1(m) + \pi_R(r,l)\int \tilde{\tau}_R(m;m')q_1(m')dm' + \pi_L(r,l)\int \tilde{\tau}_L(m;m')q_1(m')dm'}{\pi_H(r,l)q_{-1}(m) + \pi_R(r,l)\int \tilde{\tau}_R(m;m')q_{-1}(m')dm' + \pi_L(r,l)\int \tilde{\tau}_L(m;m')q_{-1}(m')dm'}. \tag{36}$$

Note that the difference between the posterior beliefs of a $p-$citizen after observing m still satisfies

$$\mu(m;p) - \mu(m';p) = (\lambda(m) - \lambda(m'))\frac{p(1-p)}{(1-p+p\lambda(m))\,(1-p+p\lambda(m'))}.$$

Let

$$V_i(m) \equiv \int_0^1 v_i\left(\mu(m;p)\right) dF_p(p) = \int_0^1 v_i\left(\frac{p\lambda(m)}{1-p+p\lambda(m)}\right) dF_p(p). \tag{37}$$

If $\tau_i(m; m')$ are IPs actual strategies, then IPs' optimality requires that if $m_1, m_2 \in$ *support* $\tau_i(\cdot, m')$ then $V_i(m_1) = V_i(m_2)$, $i \in \{L, R\}$. By the same argument for the case in which IPs do not observe the honest coverage, this required that $\lambda(m_1) = \lambda(m_2)$.

Let $\lambda^*(m)$ be the equilibrium likelihood ratio of message m with $\widetilde{\lambda} = \max_{m \in \mathscr{M}} \lambda^*(m)$ Note that (i) $V_R(m)$ in (37) is strictly increasing in $\lambda(m)$ while $V_L(m)$ in (37) is strictly decreasing in $\lambda(m)$; and (ii) if $\tau_R(m; m') = \tau_L(m; m') = 0$ for all $m' \in \mathscr{M}$ then $\lambda(m) = \lambda_H(m)$. Therefore, from (i) we must have that if $m \in supp(\tau_R^*(\cdot, m'))$ then $\lambda^*(m) = \widetilde{\lambda}$ while (ii) implies that $m \in supp(\tau_R^*(\cdot, m'))$ only if $\lambda_H(m) \geq \widetilde{\lambda}$. Finally, we reach a contradiction if $m \notin \cup_{m^j=m'} supp(\tau_R^*(\cdot;m'))$ and $\lambda_H(m) > \widetilde{\lambda}$ as then we must have $\lambda^*(m) = \lambda_H(m) > \widetilde{\lambda} = \max_{m\in\mathscr{M}} \lambda^*(m)$. Therefore, we must have $\cup_{m^j} supp(\tau_R^*(\cdot;m^j)) = \{m : \lambda_H(m) \geq \widetilde{\lambda}\}$ and $m \in supp(\tau_R^*(\cdot,m'))$ iff $\lambda_H(m) \geq \widetilde{\lambda}$. We can apply a similar argument to L by defining $\underset{\sim}{\lambda} = \min_{m\in\mathscr{M}} \lambda^*(m)$. Then again we reach a contradiction if $m \notin \cup_{m^j=m'} supp(\tau_L^*(\cdot;m'))$ and $\lambda_H(m) < \underset{\sim}{\lambda}$ as then we must have $\lambda^*(m) = \lambda_H(m) < \underset{\sim}{\lambda} = \min_{m\in\mathscr{M}} \lambda^*(m)$. Therefore, we must have $\cup_{m^j} supp(\tau_L^*(\cdot;m^j)) = \{m : \lambda_H(m) \leq \underset{\sim}{\lambda}\}$.

We now show that $\widetilde{\lambda} = \overline{\lambda}$ and $\underset{\sim}{\lambda} = \underline{\lambda}$. Looking at $\widetilde{\lambda}$, we can rewrite (36) for all m such that $\lambda_H(m) \geq \widetilde{\lambda}$

$$\frac{\pi_R(r,l)}{\pi_H(r,l)} \left(\widetilde{\lambda} \int_{\mathscr{M}} \tau_R(m;m')q_{-1}(m')dm' - \int_{\mathscr{M}} \tau_R(m;m')q_1(m')dm' \right) = \left(\lambda_H(m) - \widetilde{\lambda} \right) q_{-1}(m),$$

and integrating over all $\left\{ m : \lambda_H(m) \geq \widetilde{\lambda} \right\}$ and noting that

$$\int_{\left\{m:\lambda_H(m)\geq\widetilde{\lambda}\right\}} \int_{\mathscr{M}} \tau_R(m;m')q_\theta(m')dm'dm = \int_{\mathscr{M}} \left(\int_{\left\{m:\lambda_H(m)\geq\widetilde{\lambda}\right\}} \tau_R(m;m')dm \right) q_\theta(m')dm' =$$
$$= \int_{\mathscr{M}} q_\theta(m')dm' = 1$$

gives

$$\frac{\pi_R(r,l)}{\pi_H(r,l)} \left(\widetilde{\lambda} - 1 \right) = \int_{\widetilde{\lambda}}^{\infty} \left(\lambda - \widetilde{\lambda} \right) dF_{H,-1}(\lambda),$$

which is the same as (3) which uniquely defines $\overline{\lambda}$. Therefore we must have $\widetilde{\lambda} = \overline{\lambda}$ (3). A similar argument applied to $\left\{ m : \lambda_H(m) \leq \underset{\sim}{\lambda} \right\}$ shows that $\underset{\sim}{\lambda} = \underline{\lambda}$. □

11 Necessary and Sufficient Conditions for Strategic Substitutability

In Proposition (3) in the main text we showed that capture of a single news source is a game in strategic substitutes as long as there are no interaction effects in $\pi_i(r,l)$ –i.e., if Assumption I holds– and increased capture by one IP does not reduce the odds of capture by the other IP relative to honest coverage –i.e., if Assumption II holds. These assumptions rely solely on properties of the contest success functions as they are independent of the characteristics of the news source and of its audience. We can express marginal success probabilities as $\frac{\partial \pi_L}{\partial r} = -\alpha \frac{\partial \pi_R}{\partial r}$ and $\frac{\partial \pi_H}{\partial R} = -(1-\alpha)\frac{\partial \pi_R}{\partial r}$, as well as $\frac{\partial \pi_R}{\partial l} = -\beta \frac{\partial \pi_L}{\partial l}$ and $\frac{\partial \pi_H}{\partial l} = -(1-\beta)\frac{\partial \pi_L}{\partial l}$. Then, Assumption II can be equivalently expressed in terms of limits on the crowding-out effect of capture α and β,

$$\frac{\partial}{\partial r}\left(\frac{\pi_L}{\pi_H}\right) \geq 0 \Leftrightarrow \alpha \leq \frac{\pi_L}{1-\pi_R},$$
$$\frac{\partial}{\partial l}\left(\frac{\pi_R}{\pi_H}\right) \geq 0 \Leftrightarrow \beta \leq \frac{\pi_R}{1-\pi_L}.$$

In words, the crowding-out effect of one IP on the other IP's success probability must be sufficiently small, with this upper limit based only on the success probabilities of both IPs. Intuitively, increasing capture by either IP must have a smaller *business-stealing effect* than the effect on the probability of *aggregate capture*. If $\pi_R(r,l) = r$ and $\pi_L(r,l) = l$, then this is always satisfied for all capture levels, as $L/R-$capture only reduces honest reporting, so that $\alpha = \beta = 0$.

We now generalize this insight and show that strategic substitutability holds under more general conditions. We provide necessary and sufficient conditions for capture of a single news item to be a game in strategic substitutes expressed in terms of bounds on the crowding-out effect of capture.

Proposition 9. *Suppose that Assumption I holds. For each $(r,l;\tilde{r},\tilde{l}) \in (X_R \times X_L)^2$ with associated sequentially-rational thresholds $\underline{\lambda}$ and $\overline{\lambda}$, define for $i \in \{r,l\}$,*[55]

$$M^i_{\overline{\lambda}} \equiv V_i'(\overline{\lambda})(\overline{\lambda}-1)\frac{\left|\frac{\partial \pi_R}{\partial i} + \frac{\partial \pi_H}{\partial i}\overline{F}_H(\overline{\lambda};p_i)\right|}{\frac{\pi_R}{\pi_H} + \overline{F}_{H,-1}(\overline{\lambda};p_i)}, \tag{38}$$

$$M^i_{\underline{\lambda}} \equiv V_i'(\underline{\lambda})(1-\underline{\lambda})\frac{\left|\frac{\partial \pi_L}{\partial i} + \frac{\partial \pi_H}{\partial i}F_H(\underline{\lambda};p_i)\right|}{\frac{\pi_L}{\pi_H} + F_{H,-1}(\underline{\lambda};p_i)}, \tag{39}$$

and $\kappa_i \equiv \frac{M^i_{\underline{\lambda}}}{M^i_{\overline{\lambda}}}$. If $\alpha \equiv -\frac{\partial \pi_L/\partial r}{\partial \pi_R/\partial r}$ ($\beta \equiv -\frac{\partial \pi_R/\partial l}{\partial \pi_L/\partial l}$) is the crowding-out effect of R (L) on $L's$ ($R's$) winning probability, then capture of a news item is a game in strategic substitutes if and only if for all $(r,l;\tilde{r},\tilde{l}) \in (X_R \times X_L)^2$ we have

$$\alpha \leq \frac{\pi_L + \frac{1}{\kappa_L}(1-\pi_L)}{1-\pi_R+\frac{1}{\kappa_L}\pi_R}, \tag{40}$$

$$\beta \leq \frac{\pi_R + \kappa_R(1-\pi_R)}{1-\pi_L+\kappa_R\pi_L}. \tag{41}$$

[55] To improve exposition, we omit the dependence of functions on $(r,l;\tilde{r},\tilde{l})$ when this dependence is clear.

In particular, if $\kappa_R \geq 1$ and $\kappa_L \leq 1$ for all $(r, l; \tilde{r}, \tilde{l}) \in (X_R \times X_L)^2$ then capture is a game of strategic substitutes regardless of the size of the crowding out effect α and β.

Proof. Let $W_R(r, l; \tilde{r}, \tilde{l}) - C_R(r)$ and $W_L(r, l; \tilde{r}, \tilde{l}) - C_L(l)$ be R and L's expected utility when they covertly invest r and l in capturing the item, followed by a sequentially rational reporting strategy where citizens anticipate capture $\tilde{r}$ and $\tilde{l}$ -see (7) in the main text. Then, for example for R we have

$$\frac{\partial W_R(r, l; \tilde{r}, \tilde{l})}{\partial r} = \frac{\partial \pi_R(r, l)}{\partial r} V_i(\overline{\lambda}) + \frac{\partial \pi_L(r, l)}{\partial r} V_i(\underline{\lambda}) + \frac{\partial \pi_H(r, l)}{\partial r} \mathbb{E}_H \left[V_i(\lambda); p_R \right].$$

as citizens' interpretation of messages only depends on the expected level of capture $(\tilde{r}, \tilde{l})$ rather than the actual level (r, l). Consider the change in $R's$ incentives to increase r when citizens (correctly) anticipate a higher capture level by L

$$\begin{aligned}
&\left.\frac{\partial^2 W_R(r, l; \tilde{r}, \tilde{l})}{\partial r \partial l}\right|_{l=\tilde{l}} + \left.\frac{\partial^2 W_R(r, l; \tilde{r}, \tilde{l})}{\partial r \partial \tilde{l}}\right|_{l=\tilde{l}} \\
=& \underbrace{\left.\frac{\partial^2 \pi_R(r, l)}{\partial r \partial l}\right|_{l=\tilde{l}} \left[V_R(\overline{\lambda}) - \mathbb{E}_H \left[V_R(\lambda); p_R \right] \right]}_{C_{\overline{\lambda}}} \\
&+ \underbrace{\left.\frac{\partial \pi_L^2(r, l)}{\partial r \partial l}\right|_{l=\tilde{l}} \left[V_R(\underline{\lambda}) - \mathbb{E}_H \left[V_R(\lambda); p_R \right] \right]}_{C_{\underline{\lambda}}} \\
&+ \underbrace{\left[\left.\frac{\partial \pi_R(r, l)}{\partial r}\right|_{l=\tilde{l}} + \left.\frac{\partial \pi_H(r, l)}{\partial r}\right|_{l=\tilde{l}} \overline{F}_H(\overline{\lambda}; p_R) \right] V_R'(\overline{\lambda}) \frac{\partial \overline{\lambda}}{\partial \tilde{l}}}_{I_{\overline{\lambda}}} \\
&+ \underbrace{\left[\left.\frac{\partial \pi_L(r, l)}{\partial r}\right|_{l=\tilde{l}} + \left.\frac{\partial \pi_H(r, l)}{\partial r}\right|_{l=\tilde{l}} F_H(\underline{\lambda}; p_R) \right] V_R'(\underline{\lambda}) \frac{\partial \underline{\lambda}}{\partial \tilde{l}}}_{I_{\underline{\lambda}}}
\end{aligned}$$

The first two terms in the right hand side ($C_{\overline{\lambda}}$ and $C_{\underline{\lambda}}$) capture the complementarities in the contest success function holding constant citizens' beliefs of the levels of capture. Term $C_{\overline{\lambda}}$ represents the second-order marginal effect on $R's$ winning probability weighted by the gain from replacing the honest reporting, while $C_{\underline{\lambda}}$ captures the same effect coming from $L's$ winning probability weighted by the loss to R when L wins and replaces the honest reporting's message. The last two terms ($I_{\overline{\lambda}}$ and $I_{\underline{\lambda}}$) are the informational effects on R's incentives: they represent the change in R's marginal gain that derive solely from the change in citizens' beliefs, and it balances the utility change from inducing the favorable message $\overline{\lambda}$ multiplied by its marginal likelihood (term $I_{\overline{\lambda}}$) with the change when the unfavorable message $\underline{\lambda}$ is induced, multiplied by its marginal likelihood (term $I_{\underline{\lambda}}$).

It is clear that the nature of the contest success function (in particular the sign of $\frac{\partial^2 \pi_i(r,l)}{\partial r \partial l}$) affects the variation in R's incentives with L's anticipated capture. To concentrate on the interactions that are purely informational, we adopt Assumption I so that $\frac{\partial^2 \pi_i(r,l)}{\partial r \partial l} = 0$ for $i \in \{R, L, H\}$ (so that term $C_{\overline{\lambda}}$ and $C_{\underline{\lambda}}$ are identically zero).

For given $(r, l; \tilde{r}, \tilde{l})$, with associated equilibrium sequentially-rational thresholds $\underline{\lambda}$ and $\overline{\lambda}$,[56] strategic substitutability requires that

$$\left[\frac{\partial \pi_R}{\partial r}\bigg|_{l=\tilde{l}} + \frac{\partial \pi_H}{\partial r}\bigg|_{l=\tilde{l}} \overline{F}_H(\overline{\lambda}) \right] V_R'(\overline{\lambda}) \frac{\partial \overline{\lambda}}{\partial \tilde{l}} + \left[\frac{\partial \pi_L}{\partial r}\bigg|_{l=\tilde{l}} + \frac{\partial \pi_H}{\partial r}\bigg|_{l=\tilde{l}} F_H(\underline{\lambda}) \right] V_R'(\underline{\lambda}) \frac{\partial \underline{\lambda}}{\partial \tilde{l}} \leq 0, \tag{42}$$

$$\left[\frac{\partial \pi_R}{\partial l}\bigg|_{r=\tilde{r}} + \frac{\partial \pi_H}{\partial l}\bigg|_{r=\tilde{r}} \overline{F}_H(\overline{\lambda}) \right] V_L'(\overline{\lambda}) \frac{\partial \overline{\lambda}}{\partial \tilde{r}} + \left[\frac{\partial \pi_L}{\partial l}\bigg|_{r=\tilde{r}} + \frac{\partial \pi_H}{\partial l}\bigg|_{r=\tilde{r}} F_H(\underline{\lambda}) \right] V_L'(\underline{\lambda}) \frac{\partial \underline{\lambda}}{\partial \tilde{r}} \leq 0, \tag{43}$$

Differentiating $\overline{\lambda}$ and $\underline{\lambda}$ in Proposition 1.3 of the main text we have for $i \in \{r, l\}$,

$$\begin{aligned}
\frac{\partial \overline{\lambda}}{\partial \tilde{i}} &= -\frac{\overline{\lambda} - 1}{\frac{\pi_R}{\pi_H} + \overline{F}_{H,-1}(\overline{\lambda})} \frac{\partial}{\partial i} \left(\frac{\pi_R}{\pi_H} \right) \bigg|_{i=\tilde{i}} \\
\frac{\partial \underline{\lambda}}{\partial \tilde{i}} &= -\frac{1 - \underline{\lambda}}{\frac{\pi_L}{\pi_H} + \overline{F}_{H,-1}(\underline{\lambda})} \frac{\partial}{\partial i} \left(\frac{\pi_L}{\pi_H} \right) \bigg|_{i=\tilde{i}}
\end{aligned}$$

Replacing these expressions in (42) and (43) and using the definition of $M^i_{\overline{\lambda}}$ and $M^i_{\underline{\lambda}}$ in (38) and (39), we obtain that capture of a single news item is a game in strategic substitutes if and only if

$$\frac{-\frac{\partial}{\partial l} \left(\frac{\pi_R(r,l)}{\pi_H(r,l)} \right)}{\frac{\partial}{\partial l} \left(\frac{\pi_L(r,l)}{\pi_H(r,l)} \right)} \leq \frac{M^R_{\underline{\lambda}}}{M^R_{\overline{\lambda}}} = \kappa_R. \tag{44}$$

$$\frac{-\frac{\partial}{\partial r} \left(\frac{\pi_L(r,l)}{\pi_H(r,l)} \right)}{\frac{\partial}{\partial r} \left(\frac{\pi_R(r,l)}{\pi_H(r,l)} \right)} \leq \frac{M^L_{\overline{\lambda}}}{M^L_{\underline{\lambda}}} = \frac{1}{\kappa_L}. \tag{45}$$

[56]To improve exposition, we omit the arguments of functions when these arguments are clear from the context.

Finally, note that we can express the lhs of (44) and (45) in terms of the crowding-out effect of capture α and β

$$\frac{-\frac{\partial}{\partial l}\left(\frac{\pi_R(r,l)}{\pi_H(r,l)}\right)}{\frac{\partial}{\partial l}\left(\frac{\pi_L(r,l)}{\pi_H(r,l)}\right)} = \frac{\beta\pi_H - (1-\beta)\pi_R}{\pi_H + (1-\beta)\pi_L},$$
$$\frac{-\frac{\partial}{\partial r}\left(\frac{\pi_L(r,l)}{\pi_H(r,l)}\right)}{\frac{\partial}{\partial r}\left(\frac{\pi_R(r,l)}{\pi_H(r,l)}\right)} = \frac{\alpha\pi_H - (1-\alpha)\pi_R}{\pi_H + (1-\alpha)\pi_R}.$$

Then, (44) and (45) are equivalent to

$$\frac{\beta\pi_H - (1-\beta)\pi_R}{\pi_H + (1-\beta)\pi_L} \leq \kappa_R \Leftrightarrow \beta \leq \frac{\pi_R + \kappa_R(1-\pi_R)}{1-\pi_L+\kappa_R\pi_L},$$
$$\frac{\alpha\pi_H - (1-\alpha)\pi_R}{\pi_H + (1-\alpha)\pi_R} \leq \frac{1}{\kappa_L} \Leftrightarrow \alpha \leq \frac{\pi_L + \frac{1}{\kappa_L}(1-\pi_L)}{1-\pi_R+\frac{1}{\kappa_L}\pi_R}.$$

□

To explain Proposition 9, consider the capture incentives of, say, R. The crowding-out effect α plays two roles. First, the value of α affects the marginal probability of inducing the favorable interpretation $\overline{\lambda}$ or the unfavorable $\underline{\lambda}$.[57] Second, it dictates how citizens revise their interpretation of messages in light of an increase in $R-$capture. Indeed, while citizens always become more skeptical of high messages, so that $\partial\overline{\lambda}/\partial r \leq 0$, citizens also become skeptical of low messages if α is sufficiently low (in fact, if $\alpha \leq \pi_L/(1-\pi_R)$). Moreover, even if $\alpha > \pi_L/(1-\pi_R)$ we would have that $R's$ best response is decreasing in L's capture if (40) holds. This conditions ensures, for instance, that the effect of $R-$capture on $R-$lies' is more pronounced than on $L-$lies' –i.e., it ensures that $\partial\overline{\lambda}/\partial r < \partial\underline{\lambda}/\partial r$.

Proposition 9 provides some sufficient conditions for strategic substitutes. First, if $\kappa_R \geq 1$ and $\kappa_L \leq 1$ then the rhs of (40) and (41) are larger than 1. If this holds for all feasible capture levels then capture is a game of strategic substitutes regardless of the size of the crowding out effect α and β. Second, note that $\frac{\pi_L}{1-\pi_R}$ is a lower bound on the rhs of (40) (and $\frac{\pi_R}{1-\pi_L}$ is a lower bound on the rhs of (41)). This confirms that we have a game in strategic substitutes regardless of the properties of the information

[57]Indeed, the marginal probability of inducing citizens to interpret the message as $\overline{\lambda}$ or $\underline{\lambda}$ is $\frac{\partial\pi_R}{\partial r} + \frac{\partial\pi_H}{\partial r}\overline{F}_H(\overline{\lambda};p_R) = \frac{\partial\pi_R}{\partial r}\left(1-(1-\alpha)\overline{F}_H(\overline{\lambda};p_R)\right)$ and $\frac{\partial\pi_L}{\partial i} + \frac{\partial\pi_H}{\partial i}F_H(\underline{\lambda};p_R) = -\frac{\partial\pi_R}{\partial r}\left(\alpha+(1-\alpha)F_H(\underline{\lambda};p_R)\right)$.

source and its audience as long as IPs increased capture does not decrease the other IPs success odds relative to honest reporting.

Finally, Proposition 9 also hints to necessary and sufficient conditions for capture to be a game in strategic complements, which would require both inequalities (40) and (41) to be reversed. These conditions are, however, more stringent; for example, these conditions require that $\kappa_R < 1$ and $\kappa_L > 1$ for all feasible capture levels. This is impossible to be satisfied if zero capture is possible for both IPs, as in this case κ_R and κ_L take arbitrarily large and small positive values.

12 Source Attributes: Audience Ideology and Source Informativeness

In this Section we study conditions under which audience ideology is a horizontal attribute of a source, and conditions for the quality of honest coverage to be a vertical attribute.

12.1 Audience Ideology and IPs incentives: Firing up the Base versus Demobilizing the Opposition

How an IP's incentives vary with audience priors depends on the priorities of the IP. This is intuitive: an IP which wants to prevent the opposition from coalescing against its preferred policies needs to reach opponents and demobilize them. In contrast, an IP which wants to incite action needs to reach already favorable citizens and further radicalize them. In this section we show that our framework captures this prioritization of audience segments through features of IP's preferences.

To fix language, we say that an IP wants to *fire up the base* if incentives to capture increase when facing a crowd of convinced partisans –i.e., low p for L and high p for R– and an IP wants to *demobilize the opposition* if incentives are stronger with a crowd of opposite partisanship. Formally, R (L) wants to fire up its base if $B_R(r, l; \tilde{r}, \tilde{l})(B_L(r, l; \tilde{r}, \tilde{l}))$, defined in (9), increases when $F_p(p)$ increases (decreases) in the FOSD sense, with a similar definition for the case in which it wants to demobilize the opposition. Note that, if both IPs have congruent preferences –so that either both want to fire-up-their-base or moderate-the-opposition– then audience ideology is a horizontal attribute: for instance, a FOSD increase in citizens priors would increase R's capture incentives but reduce those of L.

Inspection of (9) shows that audience prior distribution affects capture incentives only through

$$V_i'(\lambda) = \int_0^1 \left(\partial v_i(\mu(\lambda, p))/\partial\lambda\right) dF_p(p). \tag{46}$$

For $i = R$, $\partial v_R(\mu(\lambda, p))/\partial\lambda$ represents R's marginal payoff from sending a more favorable message to a citizen with prior p and (46) averages this payoff across all citizens. Therefore, R wants to fire up its base if $\partial v_R(\mu(\lambda, p))/\partial\lambda$ increases in p, while it wants to demobilize the opposition if $\partial v_R(\mu(\lambda, p))/\partial\lambda$ decreases in p. Likewise, L wants to fire up its base (demobilize the opposition) if $-\partial v_L(\mu(\lambda, p))/\partial\lambda$ decreases (increases) in p. It follows that in both cases, $i \in \{L, R\}$ wants to fire up its base if and only if $\partial v_i^2(\mu(\lambda, p))/\partial\lambda\partial p \geq 0$. The next proposition links these conditions to the curvature of v_i.

Lemma 3. *Given a news-source's honest-coverage $F_{H,\theta}$ and its audience's prior distribution F_p, let $[\underline{\mu}, \overline{\mu}]$ be the range of posterior beliefs induced if coverage is known to be honest. There are constants $\underline{K}_i$ and $\overline{K}_i$, $i \in \{R, L\}$, with $\underline{K}_R = -\overline{K}_L = K(\overline{\mu})$ and $\overline{K}_R = -\underline{K}_L = K(\underline{\mu})$ where $K(\mu) = \mu/(1-\mu) - (1-\mu)/\mu$, and such that*

I- $i \in \{L, R\}$ wants to fire up its base if $\frac{v_i''(\mu)}{|v_i'(\mu)|} > \underline{K}_i$, $\mu \in [\underline{\mu}, \overline{\mu}]$.

II- $i \in \{L, R\}$ wants to demobilize the opposition if $\frac{v_i''(\mu)}{|v_i'(\mu)|} < \overline{K}_i$, $\mu \in [\underline{\mu}, \overline{\mu}]$.

Proof. With $\mu = \mu(\lambda, p)$ to simplify notation, we show that under (I), $\partial^2 v_i(\mu)/\partial\lambda\partial p > 0$, while under (II) we have $\partial^2 v_i(\mu)/\partial\lambda\partial p < 0$. Differentiating $v_i(\mu)$ twice,

$$\frac{\partial^2 v_i(\mu)}{\partial\lambda\partial p} = v_i''(\mu)\frac{\partial\mu}{\partial\lambda}\frac{\partial\mu}{\partial p} + v_i'(\mu)\frac{\partial^2\mu}{\partial\lambda\partial p}.$$

Using $\frac{\partial\mu}{\partial\lambda} = \frac{p(1-p)}{(\lambda p+1-p)^2}$, $\frac{\partial\mu}{\partial p} = \frac{\lambda}{(\lambda p+1-p)^2}$ and $\frac{\partial^2\mu}{\partial\lambda\partial p} = \frac{1-p-\lambda p}{(\lambda p+1-p)^3}$, we can write

$$\begin{aligned}\frac{\partial^2 v_i(\mu)}{\partial\lambda\partial p} &= v_i''(\mu)\frac{\lambda p(1-p)}{(\lambda p+1-p)^4} + v_i'(\mu)\frac{1-p-\lambda p}{(\lambda p+1-p)^3} \\ &= \frac{\lambda p(1-p)}{(\lambda p+1-p)^4}\left(v_i''(\mu) - K(\mu)v_i'(\mu)\right),\end{aligned}$$

with $K(\mu) = \frac{\lambda p}{1-p} - \frac{1-p}{\lambda p} = \frac{\mu}{1-\mu} - \frac{1-\mu}{\mu}$ the difference between the odds of a high state and a low state. As $K(\mu)$ is increasing in μ, we have $K(\mu) \in \left[K(\underline{\mu}), K(\overline{\mu})\right]$ with $[\underline{\mu}, \overline{\mu}]$ the range of posteriors of citizens when coverage is known to be honest.

Consider first R. As $v_R'(\mu) > 0$, then $\partial^2 v_R(\mu)/\partial\lambda\partial p > 0$ if $\min_{\mu\in[\underline{\mu},\overline{\mu}]} \frac{v_R''(\mu)}{v_R'(\mu)} > \max_{\mu\in[\underline{\mu},\overline{\mu}]} K(\mu) = K(\overline{\mu})$ while $\partial^2 v_R(\mu)/\partial\lambda\partial p < 0$ if $\max_{\mu\in[\underline{\mu},\overline{\mu}]} \frac{v_R''(\mu)}{v_R'(\mu)} < \min_{\mu\in[\underline{\mu},\overline{\mu}]} K(\mu) =$

$K(\underline{\mu})$. Turning next to L, we have $v_L'(\mu) < 0$ so that $\partial^2 v_L(\mu)/\partial\lambda\partial p > 0$ if $\min_{\mu\in[\underline{\mu},\overline{\mu}]} \frac{v_L''(\mu)}{|v_L'(\mu)|} > \max_{\mu\in[\underline{\mu},\overline{\mu}]} -K(\mu) = -K(\underline{\mu})$ while $\partial^2 v_L(\mu)/\partial\lambda\partial p < 0$ if $\max_{\mu\in[\underline{\mu},\overline{\mu}]} \frac{v_L''(\mu)}{|v_L'(\mu)|} < \min_{\mu\in[\underline{\mu},\overline{\mu}]} -K(\mu) = -K(\overline{\mu})$. □

As this lemma shows, if v_i is sufficiently convex, then i is mostly concerned about firing up its base, while if v_i is sufficiently concave, it mostly wants to demobilize the opposition. This is intuitive: for R the gain from raising the beliefs of the public is higher (lower) for those holding very favorable beliefs if v_R is convex (concave). Additional conditions are needed to account for the fact that a higher λ has a smaller (larger) effect on citizens posteriors if citizens hold a higher (lower) prior belief. Notwithstanding, we next show that convexity in the odds of a favorable state are sufficient to guarantee that IPs want to fire up their base.

Lemma 4. *Suppose that $v_R = g_R(\mu/(1-\mu))$ and $v_L = g_L((1-\mu)/\mu)$, with g_i, $i \in \{L, R\}$, increasing and convex. Then both IPs want to fire up their base.*

Proof. We can express the odds of the high state as $\mu/(1-\mu) = \lambda p/(1-p)$. Then,

$$\begin{aligned}\frac{\partial^2 v_R(\mu)}{\partial\lambda\partial p} &= \frac{1}{(1-p)^2}\left(g_R''\left(\frac{\lambda p}{1-p}\right)\frac{\lambda p}{1-p} + g_R'\left(\frac{\lambda p}{1-p}\right)\right) \\ &= \frac{1}{(1-p)^2}\left.\frac{d\left(g_R'(x)x\right)}{dx}\right|_{x=\frac{\lambda p}{1-p}}.\end{aligned}$$

If $g_R'(x)x$ is increasing, then R wants to fire up its base, while it wants to demobilize the opposition if $g_R'(x)x$ is decreasing. A sufficient condition for an increasing $g_R'(x)x$ is that g_R is convex. The same analysis applies to L once we observe that

$$\begin{aligned}\frac{\partial^2 v_L(\mu)}{\partial\lambda\partial p} &= \frac{1}{\lambda^2 p^2}\left(g_L''\left(\frac{1-p}{\lambda p}\right)\frac{1-p}{\lambda p} + g_L'\left(\frac{1-p}{\lambda p}\right)\right) \geq 0 \\ &= \frac{1}{\lambda^2 p^2}\left.\frac{d\left(g_L'(x)x\right)}{dx}\right|_{x=\frac{1-p}{\lambda p}}.\end{aligned}$$

□

12.2 Source Informativeness

Under what conditions do IPs' capture incentives increase when the source becomes more informative? In other words, when is the quality of honest coverage a vertical attribute of a source? To answer this question, we consider a news source with an audience of fixed size. The direct effect of a more informative source depends on the change in the highest and lowest credible messages, but also on how each IP's payoff depends on the quality of information of honest coverage .

To see this, consider the marginal return to R from increasing capture

$$\frac{\partial W_R(r,l;\tilde{r},\tilde{l})}{\partial r} = \frac{\partial \pi_R(r,l)}{\partial r} V_R(\overline{\lambda}) + \frac{\partial \pi_L(r,l)}{\partial r} V_R(\underline{\lambda}) + \frac{\partial \pi_H(r,l)}{\partial r} \mathbb{E}_H\left[V_R(\lambda); p_R\right], \quad (47)$$

when citizens anticipate capture levels $(\tilde{r},\tilde{l})$ –which determine $\overline{\lambda}$, $\underline{\lambda}$ and $\mathbb{E}_H\left[V_R(\lambda); p_R\right]$. If honest coverage becomes more Blackwell-informative, then for the same anticipated capture levels $\overline{\lambda}$ increases and $\underline{\lambda}$ decreases–see Lemma 1.3.[58] Focusing on the first two terms of (47) and noting that $\frac{\partial \pi_R(r,l)}{\partial r} > 0 > \frac{\partial \pi_L(r,l)}{\partial r}$, we see that $V_R(\overline{\lambda})$ increases and $V_R(\underline{\lambda})$ so that $\frac{\partial W_R(r,l;\tilde{r},\tilde{l})}{\partial r}$ increases.

The difficulty lies in evaluating the change in $\mathbb{E}_H\left[V_R(\lambda); p_R\right]$. There are two main difficulties in signing the effect on $\mathbb{E}_H\left[V_R(\lambda); p_R\right]$. First, the equilibrium message under honest coverage is not necessarily Blackwell-more informative –see Section 12.2.1– making it hard to evaluate $\mathbb{E}_H\left[V_R(\lambda); p_R\right]$ even if all players (citizens and IPs) share the same prior and $V_R(\lambda)$ is convex/concave. Second, even if the honest message leads in equilibrium to more dispersed (in the monotone convex order) posteriors for a $p-$citizen, the $p-$citizens's posteriors may not be more dispersed if their likelihood is being evaluated by R who has a different prior belief p_R –see Section 12.2.2. We expand on these two difficulties in Sections 12.2.1 and 12.2.2, and offer sufficient conditions in Section 12.2.3 for the quality of information of honest coverage to be a vertical attribute.

12.2.1 Equilibrium informativeness of honest coverage

Let M_H^j be the equilibrium citizens' interpretation of messages from honest coverage of source $j \in \{X, Y\}$ given fixed levels of capture (r, l). We now show by example that it is not true that M_H^Y is Blackwell more informative than M_H^X if Y is Blackwell-more informative than X. To see this, consider the distribution of posterior beliefs induced in equilibrium on a $p-$citizen by M_H^j,

$$\tilde{F}_M^j(\mu) = \begin{cases} 0 & \text{if } \mu < \underline{\mu}_j, \\ F_H^j(\mu) & \text{if } \underline{\mu}_j \leq \mu < \overline{\mu}_j, \\ 1 & \text{if } \mu \geq \overline{\mu}_j. \end{cases}$$

[58] In fact, Lemma 1.3 shows that the equilibrium message is more Blackwell-informative.

Let $\Delta^M(\mu) = \int_0^\mu \tilde{F}_M^Y(s) - \tilde{F}_M^j(s)ds$. We now show that we can have $\Delta^M(\mu) < 0$ for some $\mu \in [0,1]$ so that posteriors under M_H^Y are not more dispersed (in the monotone convex order) than under M_H^X. From (26) and noting that the same capture levels are applied to both sources, we have

$$\int_0^{\underline{\mu}_Y} F_H^Y(s)ds = \int_0^{\underline{\mu}_X} \frac{p-\underline{\mu}_Y}{p-\underline{\mu}_X} F_H^X(s)ds,$$

so that

$$\int_{\underline{\mu}_Y}^{\underline{\mu}_X} F_H^Y(s)ds = \int_0^{\underline{\mu}_X} F_H^Y(s)ds - \int_0^{\underline{\mu}_Y} F_H^Y(s)ds = \int_0^{\underline{\mu}_X} \left(F_H^Y(s) - \frac{p-\underline{\mu}_Y}{p-\underline{\mu}_X} F_H^X(\mu) \right) ds$$

This implies that for $\mu \in [\underline{\mu}_X, \overline{\mu}_X)$, we have

$$\begin{aligned} \Delta^M(\mu) &= \int_{\underline{\mu}_Y}^{\underline{\mu}_X} F_H^Y(s)ds + \int_{\underline{\mu}_X}^{\mu} F_H^Y(s) - F_H^X(s)ds \\ &= \int_0^{\underline{\mu}_X} \left(F_H^Y(s) - \frac{p-\underline{\mu}_Y}{p-\underline{\mu}_X} F_H^X(\mu) \right) ds + \int_{\underline{\mu}_X}^{\mu} F_H^Y(s) - F_H^X(s)ds = \\ &= \frac{\underline{\mu}_Y - \underline{\mu}_X}{p-\underline{\mu}_X} \int_0^{\underline{\mu}_X} F_H^X(\mu)ds + \int_0^{\mu} F_H^Y(s) - F_H^X(s)ds \end{aligned}$$

The first term is negative whenever $\underline{\mu}_Y < \underline{\mu}_X$ while the second term is non-negative if Y is Blackwell-more informative than X. Therefore, any posterior $\mu \in [\underline{\mu}_X, \overline{\mu}_X)$ such that $\int_0^\mu F_H^Y(s) - F_H^X(s)ds = 0$ would have $\Delta^M(\mu) < 0$, implying that M_H^Y cannot be more informative than M_H^X.

12.2.2 Source of Informativeness with Heterogenous Priors

An IP's payoff if (unbeknownst to citizens) the source is not captured depends on the induced beliefs in the citizens. Fixing capture levels for both IPs, if both citizens and IPs have the same prior belief p, and the honest coverage of source $j \in \{X, Y\}$ leads to a distribution of posterior beliefs $\tilde{F}_M^j(\mu, p)$ when observed by a $p-$citizen, then $i \in \{L, R\}$'s payoff is simply $\mathbb{E}_H[V_i; p] = M \int_0^1 v_i(\mu) d\tilde{F}_M^j(\mu, p)$, with M the size of the audience. Then, if honest coverage Y is Blackwell-more informative than X, then $\tilde{F}_M^X(\mu, p)$ second order stochastically dominates $\tilde{F}_M^Y(\mu, p)$ so that $i's$ payoff from honest coverage increases if its payoff v_i is convex, and decreases if it is concave, when moving from source X to source Y. This is the case because both citizens and IPs attach the same probability to every message that leads citizens to a particular posterior μ.

Suppose instead that citizens are heterogeneous and their prior is distributed according to F_p. Furthermore, suppose R's prior is p_R and let $\mu(\mu_R, p, p_R)$ be a $p-$citizen posterior belief if she observes a signal that would have lead R to posterior μ_R. Then, R's expected utility conditional on (unbeknownst to citizens) honest coverage is

$$\int_0^1 \left(\int_0^1 v_R(\mu(\mu_R, p, p_R))dF_p(p)\right) d\tilde{F}_M^Y(\mu_R, p_R) \tag{48}$$

Our goal is to derive conditions for this expected payoff to increase or decrease when the audience is exposed to a Blackwell-more informative honest coverage.

First, we can write (see Alonso and Câmara (2016))

$$\mu(\mu_R, p, p_R) = \frac{1}{1 + \frac{1-\mu_R}{\mu_R}\frac{p_R}{1-p_R}\frac{1-p}{p}}$$

and define $\hat{V}_R(\mu_R; p, p_R) \equiv v_R\left(\frac{1}{1+\frac{1-\mu_R}{\mu_R}\frac{p_R}{1-p_R}\frac{1-p}{p}}\right)$. Then, if for all $p \in supp\ F_p$, $\hat{V}_R(\mu_R; p, p_R)$ is convex (concave) in μ_R then (48) increases (decreases) when citizens are exposed to a Blackwell-more informative message. The following lemma provides conditions for the convexity/concavity of $\hat{V}_R(\mu_R; p, p_R)$.

Lemma 5. Let $\underline{p}$ and $\overline{p}$ be the minimum and maximum prior belief in the support of F_p and suppose that $v_R' > 0$ and $\underline{p} \leq p_R \leq \overline{p}$. $\hat{V}_R(\mu_R; p, p_R)$ is concave in μ_R if and only if

$$\frac{v_R''(\mu)}{v_R'(\mu)} \leq 2\frac{\underline{p} - p_R}{p_R(1-\underline{p})}$$

while $\hat{V}_R(\mu_R; p, p_R)$ is convex in μ_R if and only if

$$\frac{v_R''(\mu)}{v_R'(\mu)} \geq 2\frac{\overline{p} - p_R}{p_R(1-\overline{p})}.$$

Proof. To simplify exposition, let $x \equiv \frac{1-\mu_R}{\mu_R}$ and $y \equiv \frac{p_R}{1-p_R}\frac{1-p}{p}$, so that $\hat{V}_R = v_R\left(\frac{1}{1+xy}\right)$

and $dx/d\mu_R = -1/(\mu_R)^2$. Differentiating twice we obtain

$$\begin{aligned}\frac{d^2\hat{V}_R}{d\mu_R{}^2} &= v_R''(\mu)\left(\frac{y}{(1+xy)^2}\frac{1}{\mu_R^2}\right)^2 + v_R'(\mu)\left(\frac{2y^2}{(1+xy)^3}\frac{1}{\mu_R^4} - \frac{y}{(1+xy)^2}\frac{2}{\mu_R^3}\right)\\ &= \frac{2y}{(1+xy)^2}\frac{1}{\mu_R^3}\left(v_R''(\mu)\left(\frac{y}{2(1+xy)^2\mu_R}\right) + v_R'(\mu)\left(\frac{y-(1+xy)\mu_R}{(1+xy)\mu_R}\right)\right)\\ &= \frac{2y}{(1+xy)^2}\frac{1}{\mu_R^3}\left(v_R''(\mu)\left(\frac{y}{2(1+xy)^2\mu_R}\right) - v_R'(\mu)\left(\frac{1-y}{1+xy}\right)\right)\end{aligned}$$

Therefore, we have $\frac{d^2\hat{V}_R}{d\mu_R^2} \leq 0$ if and only if

$$\frac{v_R''(\mu)}{v_R'(\mu)} \leq \frac{2(1-y)(\mu_R + (1-\mu_R)y)}{y} = 2\frac{p-p_R}{p_R(1-p)}(\mu_R + (1-\mu_R)y)$$

Since $\underline{p} \leq p_R \leq \overline{p}$, then we have

$$\min_{p\in suppF_p, \mu_R\in[0,1]} 2\frac{p-p_R}{p_R(1-p)}(\mu_R + (1-\mu_R)y) = 2\frac{\underline{p}-p_R}{p_R(1-\underline{p})}$$

$$\max_{p\in suppF_p, \mu_R\in[0,1]} 2\frac{p-p_R}{p_R(1-p)}(\mu_R + (1-\mu_R)y) = 2\frac{\overline{p}-p_R}{p_R(1-\overline{p})}$$

□

12.2.3 Quality of Honest Coverage as a Vertical Attribute

To sidestep the two difficulties outlined in Sections 12.2.1 and 12.2.2, the next proposition provides sufficient conditions such that the direct effect of moving to a more informative source is positive. We assume that, for the particular capture levels, honest coverage M_H^j is more informative, and appeal to condition (49) below that guarantees a decrease in the expected payoff $\mathbb{E}_H[V_R(\lambda); p_R]$ when R faces a heterogeneous audience and M_H^j is more informative.

Proposition 10. *Suppose that information source Y is Blackwell-more informative than X and let p_R be R's prior and $\underline{p} = min\{p : p \in supp\, F_p\}$. Fixing an anticipated level of expected capture (r, l), suppose that (a) the equilibrium honest coverage M_H^Y is Blackwell-more informative than M_H^X, and (b) v_R satisfies*

$$\frac{v_R''(\mu)}{v_R'(\mu)} \leq 2\frac{\underline{p}-p_R}{p_R(1-\underline{p})}. \tag{49}$$

Then, R's marginal benefit from capture at (r, l) is higher for source Y than for source X.

Proof. We can write $\mathbb{E}_H [V_R(\lambda); p_R]$ in terms of the posterior beliefs of a citizen with the same prior as R

$$\mathbb{E}_H [V_R(\lambda); p_R] = \int_0^1 \left(\int_0^1 v_R(\mu(\mu_R, p, p_R)) dF_p(p) \right) d\tilde{F}_M^j(\mu_R, p_R) \tag{50}$$

where $\mu(\mu_R, p, p_R)$ is the posterior of a $p-$citizen after observing a message from the honest sender that leads a p_R-citizen to posterior μ_R and $j \in \{X, Y\}$ denotes the information source, and $\tilde{F}_M^j(\mu, p)$ is the distribution of posterior beliefs induced by honest coverage on a $p-$citizen. To sign the change in $\mathbb{E}_H [V_R(\lambda); p_R]$ we build on two observations. First, by assumption (a), the posterior $\mu(\mu_R, p, p)$ if R has the same prior as the $p-$citizen and $\tilde{F}_M^j(\mu, p)$ is larger (in the monotone convex order) under Y than under X. Second, if (49) holds, then the function $Q(\mu_R) \equiv \int_0^1 v_R(\mu(\mu_R, p, p_R)) dF_p(p)$ is concave–see Lemma 5. Since $\tilde{F}_M^X(\mu, p_R)$ dominates $\tilde{F}_M^Y(\mu, p_R)$ in the sense of second-order stochastic dominance –see Blackwell and Girshick (1954)– then (50) is smaller for $j = Y$ than for $j = X$. □

To understand the change in capture incentives in Proposition 10, consider R's marginal payoff (47). A more informative source makes favorable lies more beneficial and unfavorable lies more damaging –as, for a given profile of anticipated capture levels, it increases $\overline{\lambda}$ and decreases $\underline{\lambda}$. This is a force towards incentivizing capture by R . As increasing capture reduces the probability of honest coverage, (47) increases when the expected payoff if the honest sender controls the message decreases for R. Given assumption (a) in Proposition 10, this would be the case if R's payoff $v_R(\mu)$ is concave and all citizens share R's prior belief. Condition (49) guarantees that R's payoff is concave when accounting for the fact that citizens have heterogeneous priors which differ from those of R.

13 Competitive Capture and Polarization across Sources

We explore several equilibrium consequences of competitive capture for an exogenous, possibly heterogeneous, audience for each source –thus abstracting from demand-side effects coming from citizens' sorting.

First, we show that the existence of a pure-strategy equilibrium in capture efforts for multiple information sources is guaranteed under similar conditions as in Proposition

2 in the main text. We show this result for a general continuous and convex costs of capture $C_R(r)$ and $C_R(l)$.

Proposition 11. ***(Existence of pure-strategy capture equilibria)*** *Consider a market with n different news sources. IPs have (i) continuous utilities $v_i(\mu)$, $\mu \in [0,1], i \in \{R, L\}$; (ii) continuous and convex costs of capture $C_R(r)$ and $C_R(l)$ with $r \in \Pi_{j=1}^n X_R^j$, and $l \in \Pi_{j=1}^n X_L^j$; and (iii) for each source $j \in \{1, ..., n\}$, the probability of state $S^j = i$, $\pi_i^j(r_j, l_j)$, is continuous and concave in r_j and concave in l_j with $\pi_H^j(r_j, l_j) > 0$ for $r_j \in X_R^j, l_j \in X_L^j$. Then, there is an equilibrium with pure-strategies capture efforts (r^*, l^*).*

Proof. Suppose that R selects $r = (r_j)_{j=1}^n$; L selects $l = (l_j)_{j=1}^n$; and citizens have an assessment of IPs' capture strategies $(\tilde{r}, \tilde{l})$ and an assessment of reporting strategies $(\tilde{\tau}_R, \tilde{\tau}_L)$ that is consistent with Proposition 1 in the main text given $(\tilde{r}, \tilde{l})$. Then, the payoffs to each IP are $W_R(r, l; \tilde{r}, \tilde{l}) - C_R(r)$ and $W_L(r, l; \tilde{r}, \tilde{l}) - C_L(l)$, where

$$W_R(r, l; \tilde{r}, \tilde{l}) = \sum_{j=1}^n \left(\pi_R^j(r_j, l_j) V_R^j(\overline{\lambda}_j) + \pi_L^j(r_j, l_j) V_R^j(\underline{\lambda}_j) + \pi_H^j(r_j, l_j) \mathbb{E}_H^j \left[V_R^j(\lambda); p_R\right]\right),$$
$$W_L(r, l; \tilde{r}, \tilde{l}) = \sum_{j=1}^n \left(\pi_R^j(r_j, l_j) V_L^j(\overline{\lambda}_j) + \pi_L^j(r_j, l_j) V_L^j(\underline{\lambda}_j) + \pi_H^j(r_j, l_j) \mathbb{E}_H^j \left[V_L^j(\lambda); p_L\right]\right),$$

with $\overline{\lambda}_j$ and $\underline{\lambda}_j$ satisfying (34) and (35) with $r = \tilde{r}_j$, $l = \tilde{l}_j$, and $V_i^j(\lambda) \equiv \int_0^1 v_i\left(\mu^*(\lambda; p)\right) dF_p^j(p)$, $i \in R, L$. We can then define i's best-response correspondence given citizens' assessment $(\tilde{r}, \tilde{l})$,

$$\tilde{\Psi}_R(r, l; \tilde{r}, \tilde{l}) \equiv \{r : W_R(r, l; \tilde{r}, \tilde{l}) - C_R(r) \geq W_R(r', l; \tilde{r}, \tilde{l}) - C_R(r'), r' \in \Pi_{j=1}^n X_R^j\},$$
$$\tilde{\Psi}_L(r, l; \tilde{r}, \tilde{l}) \equiv \{l : W_L(r, l; \tilde{r}, \tilde{l}) - C_L(l) \geq W_L(r, l'; \tilde{r}, \tilde{l}) - C_L(l'), l' \in \Pi_{j=1}^n X_L^j\},$$

and the belief-consistent best-response correspondence

$$\tilde{\Psi}(r, l) \equiv \{\tilde{\Psi}_R(r, l; r, l), \tilde{\Psi}_L(r, l; r, l)\}.$$

Note that (r^*, l^*) is a pure-strategy-in-capture-efforts equilibrium if and only if $(r^*, l^*) \in \tilde{\Psi}(r^*, l^*)$. We will apply standard existence results in continuous games with quasiconcave payoffs (see, Debreu (1952), Glicksberg (1952) and Fan (1952)) to show that $\tilde{\Psi}$ has a fixed point.

First, we establish that $W_i(r,l;\tilde{r},\tilde{l})$ is continuous at each $(r,l;\tilde{r},\tilde{l})$, and that $W_R(W_L)$ is concave in $r(l)$. For continuity, it suffices to show that $V_i^j(\overline{\lambda}_j)$, $V_i^j(\underline{\lambda}_j)$ and $\mathbb{E}_H^j\left[V_i^j(\lambda);p_i\right]$ are continuous. Define the functions

$$\overline{Q}_j(\lambda) \equiv \frac{\int_\lambda^\infty \overline{F}_{H,-1}^j(\lambda')d\lambda'}{\lambda - 1}; \underline{Q}_j(\lambda) \equiv \frac{\int_0^\lambda F_{H,-1}^j(\lambda')d\lambda'}{1-\lambda}.$$

Note that $\overline{Q}_j(\lambda) \in \mathbb{R}_{>0}$ is continuous and strictly decreasing for $\lambda > 1$, while $\underline{Q}_j(\lambda) \in \mathbb{R}_{>0}$ is continuous and strictly increasing for $0 \leq \lambda < 1$, thus both possessing a continuous inverse in $\mathbb{R}_{>0}$. The equilibrium thresholds (34-35) imply

$$V_i^j(\overline{\lambda}_j) = V_i^j(\overline{Q}_j^{-1}(\frac{\pi_R^j(r_j,l_j)}{\pi_H^j(r_j,l_j)})),$$
$$V_i^j(\underline{\lambda}_j) = V_i^j(\underline{Q}_j^{-1}(\frac{\pi_L^j(r_j,l_j)}{\pi_H^j(r_j,l_j)})),$$

which are continuous as the composition of continuous functions –as $\pi_H^j(r_j,l_j) > 0$ for $r_j \in X_R^j, l_j \in X_L^j$. Concavity of $W_R(W_L)$ in $r(l)$ follows immediately from concavity of $\pi_i^j(r_j,l_j)$ with respect to $r_j(l_j)$. Therefore, continuity and convexity of $C_R(r)$ and $C_L(l)$ establishes continuity and concavity of $W_R(r,l;\tilde{r},\tilde{l}) - C_R(r)$ and $W_L(r,l;\tilde{r},\tilde{l}) - C_L(l)$.

As X_R^j and X_L^j are compact and convex for each $j = 1,..,n$, continuity of $W_i - C_i$ implies that $\tilde{\Psi}_R(r,l;\tilde{r},\tilde{l})$ and $\tilde{\Psi}_L(r,l;\tilde{r},\tilde{l})$ are upper-hemicontinuous and concavity of $W_R - C_R$ and $W_L - C_L$ imply that they are convex-valued. Upper-hemicontinuity is preserved when restricting attention to the subset $\{(r,l;\tilde{r},\tilde{l}) : l = \tilde{l}\}$ and $\{(r,l;\tilde{r},\tilde{l}) : r = \tilde{r}\}$. Therefore, $\tilde{\Psi}(r,l)$ is non-empty, convex-valued and upper-hemicontinuous and Kakutani's fixed-point theorem guarantees the existence of a fixed point. □

13.1 Source Attributes and Polarization with Interdependent Costs

Information landscapes such as media markets tend to feature sources with polarized slants. A number of existing theories address this stylized fact. We are interested in examining whether competitive capture is conducive to horizontal differentiation. We focus on IP strategies as markers of source polarization. In particular, consider two information sources and let $r = (r_1, r_2)$ and $l = (l_1, l_2)$. Our measure of polarization $\mathscr{P}_I(r,l)$, compares the relative ideological leanings of each source stemming from capture:

$$\mathscr{P}_I(r,l) \equiv \left| \frac{r_1}{l_1} - \frac{r_2}{l_2} \right|.$$

Consider an environment with two information sources and an equilibrium capture (r^*, l^*) with $r_1^*/l_1^* \geq r_2^*/l_2^*$. It is a direct corollary of Proposition 5 that if source 1 experiences a change in an horizontal attribute which favors R, polarization will be higher. It also follows from Proposition 4 that a vertical change can lead as well to an increase in polarization if the indirect effect dominates and therefore one IP does not match the increase in effort by the other.

These results are immediate in the additively separable environment we consider because the effect of changes is circumscribed to source 1 and there is no reason for r_2 or l_2 to change. However, it is interesting to also consider the effect of cost interdependencies that would naturally arise as one IP considers deploying limited resources across information sources. We examine this case in this Section. We first show in Section 13.1.1 that localized asymmetries in an otherwise symmetric landscape of information sources typically result in equilibria in which each source is unbalanced. The intuition is stark in the case in which one source experiences a change in an horizontal attribute: we will not only have the effects discussed above, but both IP now adjust their capture levels in the other sources so as to equalize marginal costs and marginal returns.

We also explore the effect of changes in horizontal attributes in the face of cost interdependencies in Section 13.1.3. Cost interdependencies help rationalize the results in Martin and McCrain (2019). The paper empirically shows that as Sinclair buys a new source, the coverage of this source tilts rightwards. This is consistent with Proposition 5. Interestingly, the paper also suggests that the coverage of other sources in the same media market tilt leftwards. This makes sense in a world where costs are not separable: R increases effort in the Sinclair-acquired source and potentially reduces it in the other sources.[59] Strategic substitution implies that L pivots in the opposite direction. In sum, the combination of strategic substitution and the need to equalize marginal returns across sources implied by cost interdependencies contributes to exacerbating polarization as both push in the direction of horizontal differentiation.

[59]There is an implied income effect in the cost reduction to R which needs to be taken into account. Please see Proposition 13 for a formal statement.

13.1.1 Ripple Effects in Media Markets

We formally establish our claim that strategic substitutability is a force leading to horizontal differentiation. Specifically, we show that local asymmetries in an otherwise symmetric landscape can nevertheless result in each source being differentially captured by one IP. For simplicity, we explore this under the assumption that costs are interdependent and there is no crowding out of IPs. That is, we assume that R's costs are $C_R(\sum_{j=1}^{n} \beta_R^j r_j)$ and L's are $C_L(\sum_{j=1}^{n} \beta_L^j l_j)$ with C_R and C_L satisfying standard Inada conditions,[60] and we assume that $\pi_R^j(r_j, l_j) = r_j$ and $\pi_L^j(r_j, l_j) = l_j$.

Proposition 12. *Consider the linear-contest model with symmetric costs, $C_R = C_L$ and $\beta_j^R = \beta_j^L$, $j \in \{1, ..., n\}$, and $\pi_R^j(r_j, l_j) = r_j$ and $\pi_L^j(r_j, l_j) = l_j$. Suppose that there are $n-1$ symmetric information sources, with $B_{Rj}(\tilde{r}_j, \tilde{l}_j; \tilde{r}_j, \tilde{l}_j) = B_{Lj}(\tilde{r}_j, \tilde{l}_j; \tilde{r}_j, \tilde{l}_j)$ if and only if $\tilde{r}_j = \tilde{l}_j$, $j \in \{1, ..., n-1\}$. Assume source n instead is such that $B_{Rn}(\tilde{r}_n, \tilde{l}_n; \tilde{r}_n, \tilde{l}_n) \neq B_{Ln}(\tilde{r}_n, \tilde{l}_n; \tilde{r}_n, \tilde{l}_n)$ for $\tilde{r}_n = \tilde{l}_n$. Then, in every equilibrium in which source n is captured we have $r_j^* \neq l_j^*$ for every captured source $j \in \{1, ..., n-1\}$.*

Proof. For any equilibrium level of capture $(r^*, l^*) = ((r_j^*)_{j=1}^n, (l_j^*)_{j=1}^n)$, let $\hat{r} = \sum_{j=1}^n \beta_j^R r_j^*$ and $\hat{l} = \sum_{j=1}^n \beta_j^L l_j^*$. Also, we abbreviate $B^{Rj}(\tilde{r}_j, \tilde{l}_j; \tilde{r}_j, \tilde{l}_j)$ to $B^{Rj}(\tilde{r}_j, \tilde{l}_j)$ whenever citizens' assessments are correct. Applying to the case of interdependent costs the equilibrium conditions given citizens' consistent beliefs in Proposition 2 in the main text requires that (i) for each source in which $r_j^* > 0$ ($l_j^* > 0$) we must have

$$B_{Rj}(r_j^*, l_j^*) = \beta_j^R C_R'(\hat{r}) \ (B_{Lj}(r_j^*, l_j^*) = \beta_j^L C_L'(\hat{l})) \tag{51}$$

and (ii) for each source for which $r_j^* = 0$ ($l_j^* = 0$) we must have

$$B_{Rj}(r_j^*, l_j^*) \leq \beta_j^R C_R'(\hat{r})(B_{Lj}(r_j^*, l_j^*) \leq \beta_j^L C_L'(\hat{l})).$$

Consider an equilibrium capture profile (r^*, l^*) and suppose that either $r_n^* > 0$ or $l_n^* > 0$. By contradiction, suppose that $r_j^* = l_j^* > 0$ for some $j \in \{1, .., n-1\}$. Then, symmetry of costs and (51) requires $C_R'(\hat{r}) = C_L'(\hat{l})$, and strict convexity of C_i implies that $\hat{r} = \hat{l}$. It also implies that if source $j' \in \{1, .., n-1\}$ is captured –i.e., if $r_{j'}^* > 0$ or $l_{j'}^* > 0$– then we must have $r_{j'}^* = l_{j'}^*$ –a consequence of (51) and the assumption that symmetric returns $B_{Rj'}(r_{j'}^*, l_{j'}^*) = B_{Lj'}(r_{j'}^*, l_{j'}^*)$ imply equal capture levels $r_{j'}^* = l_{j'}^*$. Therefore, for every $j' \in \{1, .., n-1\}$ we must have $r_{j'}^* = l_{j'}^*$. Finally, since $\beta_n^R = \beta_n^L$

[60] In particular, we assume $C_i'(x) > 0, C_i''(x) > 0$, and $\lim_{x \to 0} C'(x) = 0$ and $\lim_{x \to 1} C'(x) = \infty$.

we must also have that $r_n^* = \left(\hat{r} - \sum_{j=1}^{n-1} \beta_j^R r_j^*\right) / \beta_n^R = \left(\hat{l} - \sum_{j=1}^{n-1} \beta_j^L l_j^*\right) / \beta_n^L = l_n^*$. But then, the optimality condition (51) cannot be satisfied for source n as if $r_n^* = l_n^*$, then

$$\beta_R^n C_R'(\hat{r}) = B_{Rn}(r_n^*, l_n^*) \neq B_{Ln}(r_n^*, l_n^*) = \beta_L^n C_L'(\hat{l})$$

but symmetric costs implies $\beta_R^n C_R'(\hat{r}) = \beta_L^n C_L'(\hat{l})$, thus reaching a contradiction. □

In words, even if IPs are locked into capturing $n-1$ news sources with symmetric returns, asymmetric returns in one source push IPs to exert unbalanced efforts for every captured source. This proposition follows from the fact that each IP equalizes marginal expected returns across all sources it tries to capture. For example, consider R: if $\hat{r} = \sum_{j=1}^{n} \beta_j^R r_j^*$ is the weighted average of R's capture efforts, then we must have

$$(1/\beta_j^R) B_{Rj}(r_j^*, l_j^*) = (1/\beta_k^R) B_{Rk}(r_k^*, l_k^*) = C_R'(\hat{r})$$

whenever $r_j^*, r_k^* > 0$. Return equalization implies that changes in the returns to capturing one source affect the level of effort exerted in capturing every other source. Any horizontal difference in a source therefore has a ripple effect in equilibrium to all sources. In summary, local differences in returns to capture lead through equilibrium effects to global differences in the effort Is devote to each source. Therefore, we expect asymmetries in capture to be pervasive, and balanced efforts by opposed I for a given information source to be extremely infrequent.

13.1.2 Properties of Belief-Consistent Best Responses

We establish some basic properties of belief-consistent best responses for the case of duopoly. These lemma is used in the proof of Proposition 13 below.

Let,

$$\tilde{\Psi}_R(r, l; \tilde{r}, \tilde{l}) \equiv \{r : W_R(r, l; \tilde{r}, \tilde{l}) - C_R(r) \geq W_R(r', l; \tilde{r}, \tilde{l}) - C_R(r'), r' \in X_R\}, \tag{52}$$

$$\tilde{\Psi}_L(r, l; \tilde{r}, \tilde{l}) \equiv \{l : W_L(r, l; \tilde{r}, \tilde{l}) - C_L(l) \geq W_L(r, l'; \tilde{r}, \tilde{l}) - C_L(l'), l' \in X_L\}, \tag{53}$$

$$\Psi_R(l) = \{r : r = \tilde{\Psi}_R(r, l; r, l), r \in X_R\}, \tag{54}$$

$$\Psi_L(r) = \{l : r = \tilde{\Psi}_L(r, l; r, l), l \in X_L\}. \tag{55}$$

so that $\Psi_R(l)$ and $\Psi_L(r)$ are the best-response correspondence by R and L when citizens correctly anticipate both Is capture efforts[61]. To explicitly characterize, say, $\Psi_R(l)$, let

[61]So $\Psi_R(l)$ ($\Psi_L(l)$) is the set of fixed points of $\tilde{\Psi}_R(\cdot, l; \cdot, l)$ ($\tilde{\Psi}_L(r, \cdot; r, \cdot)$).

$h_i(c) = (C_i')^{-1}(c)$ be the inverse of the marginal cost for $i \in \{R, L\}$. Given $l = (l_1, l_2)$, suppose, for example, that $\left(1/\beta_1^R\right) B_{R1}(0, l_1) > \left(1/\beta_2^R\right) B_{R2}(0, l_2)$. Then, the conditions defining any $r \in \Psi_R(l)$ are

$$\beta_1^R r_1 = h_R(\left(1/\beta_1^R\right) B_{R1}(r_1, l_1)) > h_R(\left(1/\beta_2^R\right) B_{R2}(0, l_2)), if\ r_2 = 0, \tag{56}$$

$$\beta_1^R r_1 + \beta_2^R r_2 = h_R(\left(1/\beta_1^R\right) B_{R1}(r_1, l_1)) = h_R(\left(1/\beta_2^R\right) B_{R2}(r_2, l_2)), if\ r_2 > 0. \tag{57}$$

The first lemma shows that each IP's best response to a rotation in the strategy of the other IP –i.e., increasing one capture effort but lowering the other– is itself a rotation of opposite sign. The second lemma provides simple comparative statics on Ψ_R and Ψ_L with changes in the reach of a source or the cost of capturing that source.

Lemma 6. ***(Rotations are best-responses)*** *With $\Psi_R(l)$ and $\Psi_L(r)$ defined by (54) and (55), let $r = (r_1, r_2)$, $l = (l_1, l_2), r' = (r_1', r_2')$, and $l' = (l_1', l_2')$.*

i-If $l_1' \geq (\leq) l_1$, $l_2' \leq (\geq) l_2$, $r \in \Psi_R(l)$ and $r' \in \Psi_R(l')$, then $r_1' \leq (\geq) r_1$ and $r_2' \geq (\leq) r_2$.

ii-If $r_1' \geq (\leq) r_1$, $r_2' \leq (\geq) r_2$, $l \in \Psi_R(r)$ and $l' \in \Psi_R(r')$, then $l_1' \leq (\geq) l_1$ and $l_2' \geq (\leq) l_2$.

Proof. We prove this lemma for case (i) as case (ii) follows along similar arguments, and only for the counterclockwise rotation ($l_1' \leq l_1, l_2' \geq l_2$) as the clockwise case follows similarly.

Select an $r \in \Psi_R(l)$ and suppose that $l_1' \leq l_1$ and $l_2' \geq l_2$, we will show that for any $r' \in \Psi_R(l')$, we have $r_1' \geq r_1, r_2' \leq r_2$. First, suppose by way of contradiction that $r_1' < r_1$. As $B_{Rj}(r_j, l_j)$ is non-increasing in r_j and l_j –see Proposition 3 in the main text– and $l_1' \leq l_1$, then we must have $B_{R1}(r_1', l_1') \geq B_{R1}(r_1, l_1)$. If $r_1' = 0$, then (57) implies that

$$\beta_2^R r_2' = h_R(\left(1/\beta_2^R\right) B_{R2}(r_2', l_2')) > h_R(\left(1/\beta_1^R\right) B_{R1}(0, l_1')) \geq h_R(\left(1/\beta_1^R\right) B_{R1}(r_1, l_1)) = \beta_1^R r_1 + \beta_2^R r_2, \tag{58}$$

which implies that $r_2' > r_2$. Since $r_2' > r_2$ and $l_2' \geq l_2$ imply that $B_{R2}(r_2', l_2') \leq B_{R2}(r_2, l_2)$, then we must have

$$\beta_2^R r_2' = h_R(\left(1/\beta_2^R\right) B_{R2}(r_2', l_2')) \leq h_R(\left(1/\beta_2^R\right) B_{R2}(r_2, l_2)) = \beta_1^R r_1 + \beta_2^R r_2,$$

but this expression is incompatible with (58), reaching a contradiction.

If instead $r_1' > 0$, then r_1' satisfies (57) and $B_{R2}(r_2', l_2') = \left(\beta_2^R / \beta_1^R\right) B_{R1}(r_1', l_1') \leq \left(\beta_2^R / \beta_1^R\right) B_{R1}(r_1, l_1) = B_{R2}(r_2, l_2)$ implying that $r_2' \leq r_2$ as $l_2' \geq l_2$. But then, we reach a contradiction as r' cannot be optimal since

$$\beta_1^R r_1' + \beta_2^R r_2' < \beta_1^R r_1 + \beta_2^R r_2 = h_R(\left(1/\beta_1^R\right) B_{R1}(r_1, l_1)) \leq h_R(\left(1/\beta_1^R\right) B_{R1}(r_1', l_1')).$$

Second, suppose that $r_2' > r_2$. Then $B_{R2}(r_2', l_2') \leq B_{R1}(r_1, l_1)$ as $l_2' \geq l_2$. Since $r_2' > 0$, it must satisfy (57), so we must have $B_{R1}(r_1', l_1') \leq B_{R1}(r_1, l_1)$ implying that $r_1' \geq r_1$ as $l_1' \leq l_1$. But then, we reach a contradiction as r' cannot be optimal since

$$\beta_1^R r_1' + \beta_2^R r_2' > \beta_1^R r_1 + \beta_2^R r_2 = h_R(\left(1/\beta_1^R\right) B_{R1}(r_1, l_1)) \geq h_R(\left(1/\beta_1^R\right) B_{R1}(r_1', l_1)).$$

□

Lemma 7. ***(Comparative Statics-Direct Effect)*** *Consider an equilibrium* (r^*, l^*) *and suppose that either (a) both IPs want to fire-up-the-base (demobilize the opposition) and* $F_1^p(p)$ *increases (decreases) in the FOSD sense, or (b) R's cost parameters change according to* $\tilde{\beta}_1^R = \beta_1^R - \delta_1$ *and* $\tilde{\beta}_2^R = \beta_2^R + \delta_2$, $\delta_1, \delta_2 > 0$, *with* $\delta_2/\delta_1 = r_1^*/r_2^*$. *Let* $\Psi_R^\delta(l)$ *and* $\Psi_L^\delta(r)$ *be the best response correspondences after the change in parameters. Then for any* $\overline{r} = (\overline{r}_1, \overline{r}_2) \in \Psi_R^\delta(l^*)$ *and* $\overline{l} = (\overline{l}_1, \overline{l}_2) \in \Psi_L^\delta(r^*)$, *we have* $\overline{r}_1 \geq r_1^*$, $\overline{r}_2 \leq r_2^*$, $\overline{l}_1 \leq l_1^*$, *and* $\overline{l}_2 \geq l_2^*$.

Proof. Consider first case (a) with $F_1^p(p)$ increasing in the FOSD sense, and let $B_{Rj,\delta}(r_1, l_1)$, $j \in \{R, L\}$, be the marginal gain after the change in source 1's reach. As both IPs want to fire-up-their-base, then we must have that $B_{R1,\delta}(r_1, l_1) \geq B_{Rj}(r_1, l_1)$ and $B_{Lj,\delta}(r_1, l_1) \leq B_{L1}(r_1, l_1)$. But then, conditions (56-57) imply that for any $r \in \Psi_R(l)$ and $r' \in \Psi_R^\delta(l)$, we must have $r_1' \geq r_1$ and $r_2' \leq r_2$ –see proof of Proposition 5. Similarly for L, we must have that for any $l \in \Psi_L(r)$ and $l' \in \Psi_L^\delta(r)$, $l_1' \leq l_1$ and $l_2' \geq l_2$.

Consider now case (b) with an initial equilibrium (r^*, l^*) and a change $\tilde{\beta}_1^R = \beta_1^R - \delta_1$ and $\tilde{\beta}_2^R = \beta_2^R + \delta_2$. The condition $\delta_2/\delta_1 = r_1^*/r_2^*$ implies that the cost of capture under r^* remains invariant since

$$\tilde{\beta}_1^R r_1^* + \tilde{\beta}^R r_2^* = \beta_1^R r_1^* + \beta_2^R r_2^*. \tag{59}$$

Suppose that $r_1^*, r_2^* > 0$, so that (57) holds for r^* and let $\overline{r} \in \Psi_R^\delta(l^*)$. We prove the claim by contradiction. To derive a contradiction, suppose that $0 < \overline{r}_1 < r_1^*$. Then

$B_{R1}(\overline{r}_1, l_1^*) \geq B_{R1}(r_1^*, l_1^*)$. The optimality condition (57) then implies

$$\begin{aligned}
\tilde{\beta}_1^R C_R' \left(\tilde{\beta}_1^R \overline{r}_1 + \tilde{\beta}_2^R \overline{r}_2 \right) &\geq \beta_1^R C_R' \left(\beta_1^R r_1^* + \beta_2^R r_2^* \right) \\
\implies \tilde{\beta}_1^R \overline{r}_1 + \tilde{\beta}_2^R \overline{r}_2 &\geq \beta_1^R r_1^* + \beta_2^R r_2^* \\
\implies \tilde{\beta}_1^R \overline{r}_1 + \tilde{\beta}_2^R \overline{r}_2 &\geq \tilde{\beta} r_1^* + \tilde{\beta}_2^R r_2^* \\
\implies \tilde{\beta}_2^R \overline{r}_2 &\geq \underbrace{\tilde{\beta}_1^R (r_1^* - \overline{r}_1)}_{>0} + \beta_2^R r_2^* \\
\implies \overline{r}_2 &> r_2^*,
\end{aligned}$$

where the first implication follows from convexity of C_R and $\tilde{\beta}_1^R < \beta_1^R$, and the second implication uses (59). As $\overline{r}_2 > r_2^*$, then we must have $B_{R2}(\overline{r}_2, l_2^*) \leq B_{R1}(r_2^*, l_2^*)$. But this leads to a contradiction as $\tilde{\beta}_2^R > \beta_2^R$ and $\tilde{\beta}_1^R \overline{r}_1 + \tilde{\beta}_2^R \overline{r}_2 \geq \beta_1^R r_1^* + \beta_2^R r_2^*$ imply that

$$\tilde{\beta}_2^R C_R' \left(\tilde{\beta}_1^R \overline{r}_1 + \tilde{\beta}_2^R \overline{r}_2 \right) > \beta_2^R C_R' \left(\beta_1^R r_1^* + \beta_2^R r_2^* \right) = B_{R2}(r_2^*, l_2^*) \geq B_{R2}(\overline{r}_2, l_2^*),$$

and $\overline{r}_2$ cannot be optimal.

Similarly, if we suppose that $\overline{r}_2 > r_2^*$ then $B_{R2}(\overline{r}_2, l_2^*) \leq B_{R2}(r_2^*, l_2^*)$, and the condition (57) implies that

$$\begin{aligned}
\tilde{\beta}_2^R C_R' \left(\tilde{\beta}_1^R \overline{r}_1 + \tilde{\beta}_2^R \overline{r}_2 \right) &\leq \beta_2^R C_R' \left(\beta_1^R r_1^* + \beta_2^R r_2^* \right) \\
\implies \tilde{\beta}_1^R \overline{r}_1 + \tilde{\beta}_2^R \overline{r}_2 &\leq \beta_1^R r_1^* + \beta_2^R r_2^* \\
\implies \tilde{\beta}_1^R \overline{r}_1 &\leq \underbrace{\tilde{\beta}_2^R (r_2^* - \overline{r}_2)}_{<0} + \beta_1^R r_1^* \\
\implies \overline{r}_1 &< r_1^*.
\end{aligned}$$

As $\overline{r}_1 < r_1^*$, then we must have $B_{R1}(\overline{r}_1, l_1^*) \geq B_{R1}(r_1^*, l_1^*)$. But this leads to a contradiction as $\tilde{\beta}_1^R < \beta_1^R$ and $\tilde{\beta}_1^R \overline{r}_1 + \tilde{\beta}_2^R \overline{r}_2 \leq \beta_1^R r_1^* + \beta_2^R r_2^*$ imply that

$$\tilde{\beta}_1^R C_R' \left(\tilde{\beta}_1^R \overline{r}_1 + \tilde{\beta}_2^R \overline{r}_2 \right) < \beta_1^R C_R' \left(\beta_1^R r_1^* + \beta_2^R r_2^* \right) = B_{R1}(r_1^*, l_1^*) \leq B_{R1}(\overline{r}_1, l_1^*),$$

and $\overline{r}_1$ cannot be optimal $\square$

13.1.3 Source Attributes and Polarization

We show that increases in a horizontal attribute that locally favors the dominant IP lead to more polarized news sources. To dot this, we first introduce two measures of polarization. Consider a model with two information sources and let $r = (r_1, r_2)$ and $l = (l_1, l_2)$. Our first measure of polarization, $\mathscr{P}_G(r, l)$, compares the capturing strategy by each IP across both sources, and is defined by

$$\mathscr{P}_G(r, l) \equiv \left| \frac{r_1}{r_2} - \frac{l_1}{l_2} \right|.$$

Our second measure of polarization, $\mathscr{P}_I(r, l)$, compares the relative ideological leanings of each source stemming from capture, and is defined by

$$\mathscr{P}_I(r, l) \equiv \left| \frac{r_1}{l_1} - \frac{r_2}{l_2} \right|.$$

In both cases, we say that sources become more polarized if either $\mathscr{P}_G(r, l)$ or $\mathscr{P}_I(r, l)$ increases. While similar, these two measures have two notable differences. First, $\mathscr{P}_I(r, l)$ scales proportionally when R scales all their capture efforts –that is, when the R switches to a strategy $\alpha r = (\alpha r_1, \alpha r_2)$ with $\alpha > 0$– but inversely in the case of scaling by the L. In contrast, $\mathscr{P}_G(r, l)$ controls for size effects as it is scale-invariant. Second, $\mathscr{P}_G(r, l)$ is more descriptive of differences in SIGs' behavior across sources, while $\mathscr{P}_I(r, l)$ compares the relative $R-$tilt in ideology across sources.

As the next proposition shows, local changes that affect SIGs asymmetrically can lead to more polarization under either measure.

Proposition 13. *Consider the linear-contest model with two information sources and an equilibrium level of capture (r^*, l^*) with $r_1^*/r_2^* > l_1^*/l_2^*$. Suppose that either*

a-both SIGs want to fire-up-the-base (demobilize the opposition) and $F_1(p)$ increases (decreases) in the FOSD sense, or

b-the $R-SIG'$s cost parameters change according to $\tilde{\beta}_1^R = \beta_1^R - \delta_1$ and $\tilde{\beta}_2^R = \beta_2^R + \delta_2$, $\delta_1, \delta_2 > 0$, with $\delta_2/\delta_1 = r_1^*/r_2^*$.

Then there is an equilibrium level of capture $(\bar{r}^*, \bar{l}^*)$ such that $\mathscr{P}_G(\bar{r}^*, \bar{l}^*) \geq \mathscr{P}_G(r^*, l^*)$ and $\mathscr{P}_I(\bar{r}^*, \bar{l}^*) \geq \mathscr{P}_I(r^*, l^*)$.

Proof of Proposition 13. Given an equilibrium (r^*, l^*), define the set of counter-rotations

$$T^*(r^*, l^*) \equiv \{(r, l) : r_1 \geq r_1^*, r_2 \leq r_2^*, l_1 \leq l_1^*, l_2 \geq l_2^*\}$$

which is a non-empty, compact and convex set. Let Ψ_i^δ be the best response correspondence defined in (54) and (55) after the change in parameters (either change in

$F_1(p)$, or the change in cost parameters). We will use two lemmas that we proved above (*Rotations are Best Responses* and *Comparative Statics-Direct Effect*). Lemma *Rotations are Best Responses* shows that each IP's best response to a rotation in the strategy of the other IP –i.e., increasing one capture effort but lowering the other– is itself a rotation of opposite sign. Technically, we show that if $l_1' \geq (\leq) l_1$, $l_2' \leq (\geq) l_2$, $r \in \Psi_R(l)$ and $r' \in \Psi_R(l')$, then $r_1' \leq (\geq) r_1$ and $r_2' \geq (\leq) r_2$. This establishes that $(\Psi_R^\delta(l^*), \Psi_L^\delta(r^*)) \subset T^*(r^*, l^*)$.

Furthermore, Lemma *Comparative Statics-Direct Effect* provides simple comparative statics on best responses. In particular, fixing $\bar{r} \in \Psi_R^\delta(l^*)$ and $\bar{l} \in \Psi_L^\delta(r^*)$, this lemma guarantees that for any $(r', l') \in T^*(r^*, l^*)$ and $(r'', r'') \in (\Psi_R^\delta(r'), \Psi_L^\delta(l'))$ we must have $r_1'' \geq \bar{r}_1, r_2'' \leq \bar{r}_2, l_1'' \leq \bar{l}_1$, and $l_2'' \geq \bar{l}_2$ so that $(\Psi_R^\delta(r'), \Psi_L^\delta(l')) \subset T^*(r^*, l^*)$. Finally, continuity of Ψ_i and Ψ_i^δ follows from continuity of the best response correspondence $\tilde{\Psi}_R(r, l; \tilde{r}, \tilde{l})$ and $\tilde{\Psi}_L(r, l; \tilde{r}, \tilde{l})$ in (52-53). Therefore, the best response correspondence satisfies the conditions of Kakutani's fixed-point theorem so that a fixed point exists that is a counter-rotation of IPs strategies. The proof is then complete once we observe that if $r_1^*/r_2^* > l_1^*/l_2^*$, then any $\tilde{r}$ and $\tilde{l}$ satisfying

$$\tilde{r}_1 \geq r_1^*, \tilde{r}_2 \leq r_2^*, \tilde{l}_1 \leq l_1^*, \tilde{l}_2 \geq l_2^*$$

must necessarily satisfy $\mathscr{P}_G(\tilde{r}, \tilde{l}) \geq \mathscr{P}_G(r^*, l^*)$ and $\mathscr{P}_I(\tilde{r}, \tilde{l}) \geq \mathscr{P}_I(r^*, l^*)$. □

Local changes in source characteristics that favor the dominant IP in that source spread in equilibrium to widen polarization across sources. To see this, consider first case (b) which describes a reduction in the relative cost of capturing source 1 for the R, keeping invariant the cost of capture under strategy $r^* = (r_1^*, r_2^*)$ to ensure that there are no "wealth" effects.[62] The direct effect of such cost shift leads R to increase capture in source 1 and to decrease it in source 2, holding constant L's strategy. Strategic substitutability implies that the indirect effect generates a reinforcing response: the L decreases capture in source 1 and increases it in source 2. As we had $r_1^*/r_2^* > l_1^*/l_2^*$, both IPs adjust their strategy through a rotation (increasing effort in one source, reducing it in the other) but in opposite directions, increasing both measures of polarization.

Case (a) differs from case (b) as both IPs are directly affected by the change in audience. Consider the case in which both IP want to fire up their base. As the audience

[62]More specifically, it rules out the possibility that marginal costs are simultaneously reduced (or increased) for both sources after the change in cost parameters.

of source 1 shifts in favor R, its incentives to capture source 1 increase at the same time that L's weaken. The direct effect of the shift thus leads R to increase capture in source 1, while the L reduces it. The effect on source 2 operates in the opposite direction as both IP equalize expected returns. Strategic substitutability again reinforces both moves as a second order effect. Thus, we have again a rotation in the strategies of IPs that increases media polarization.

Both cases illustrate our main insight in this Section: strategic substitutability is a force towards increased polarization across sources by amplifying local differences in the returns to capture.

14 Sorting with a Common Prior and Heterogeneous Preferences

Suppose that all citizens share a common prior p but differ in their payoffs from acting/not-acting: an $\alpha-$citizen obtains $1-\alpha$ if $a=1$ and $\theta=1$; α if $a=-1$ and $\theta=-1$; and 0 otherwise. We let $F_\alpha(\alpha)$ be the distribution of α in the audience of the source.

Note that an $\alpha-$citizen will select $a=1$ whenever her posterior $\mu \geq \alpha$. This implies that if $p<\alpha$, then this citizen selects $a=-1$ in the absence of information and will select $a=1$ when the equilibrium informational content of the message $\lambda^*(m) \geq \lambda_{crit}(\alpha)$, where

$$\frac{\alpha}{1-\alpha} = \lambda_{crit}(\alpha)\frac{p}{1-p}.$$

So, similar to the case of heterogeneous priors, λ_{crit} is the minimum informational content of a message that will lead a citizen with threshold α to act. If $p>\alpha$ then this citizen selects $a=1$ in the absence of additional information and will change her decision to $a=-1$ only if $\lambda^*(m) \leq \lambda_{crit}(\alpha)$.

Recall that $F^j_\mu(\mu,p)$ is the distribution over posterior beliefs of a citizen consuming source j, where p is now citizens' common prior. We can derive the value of information for an α-citizen when consuming source j. First, if $p>\alpha$ then

$$\begin{aligned} I^j(\alpha) &\equiv \int_0^\alpha [\alpha(1-\mu)-(1-\alpha)\mu]dF^j_\mu(\mu,p) = \int_0^\alpha (\alpha-\mu)dF^j_\mu(\mu,p) = \int_0^\alpha F^j_\mu(\mu,p)d\mu \\ &= \int_0^{\lambda_{crit}(\alpha)} F^j(\lambda,p)\frac{p(1-p)}{(1-p+\lambda p)^2}d\lambda, \end{aligned}$$

where we made the change of variables $\lambda = \frac{\mu}{1-\mu}\frac{1-p}{p}$ to obtain the last term, and we used $\lambda_{crit}(\alpha) = \frac{\alpha}{1-\alpha}\frac{1-p}{p}$. This follows as the citizen will change her decision from $a = 1$ to $a = -1$ only after observing a message that leads her to a posterior belief $\mu \leq \alpha$ –i.e., a message with $\lambda \leq \lambda_{crit}(\alpha)$. Equivalently, if $p < \alpha$

$$I^j(\alpha) \equiv \int_\alpha^1 [(1-\alpha)\mu - \alpha(1-\mu)]dF^j_\mu(\mu, p) = \int_\alpha^1 \overline{F}^j_\mu(\mu, p)dp = \int_{\lambda_{crit}(\alpha)}^\infty \overline{F}^j(\lambda, p)\frac{p(1-p)}{(1-p+\lambda p)^2}d\lambda.$$

Note that these expressions are identical to the case of common preferences and heterogenous priors if we replace $\lambda_{crit}(p)$ in (18) with $\lambda_{crit}(\alpha)$. In other words, the sorting behavior of a $p'-$citizen in our original model –that approves whenever her posterior exceeds 1/2– is the same as an $\alpha-$citizen when all citizens share the same common prior p if

$$\lambda_{crit}(p') = \lambda_{crit}(\alpha) \Rightarrow \alpha = \frac{1}{1 + \frac{(1-p)p'}{(1-p')p}}.$$

Therefore, all our insights on citizens with heterogeneous priors sorting across sources carry over, mutantis mutandi, if we instead assume that they share a common prior but have heterogenous preferences.

15 Citizens' Sorting Across Information Sources

In this Section we expand on the analysis in Section 6 of the main text to explore the impact of increasing the fraction of citizens that sort according to instrumental value. In Section 6 of the main text, we showed that citizens that value information sort across sources (mostly) according to their priors: citizens with extreme priors will prefer the ideologically-aligned source, while if sources share the same informativeness and the likelihood of honest coverage is the same, then all citizens sort monotonically. That is, if some $p-$citizen prefers the left-dominated source, then so do all citizens with $p' \leq p$, while if a $p-$citizen prefers the right-dominated source, then so do all citizens with $p' \geq p$.

This sorting effect is reminiscent of Suen (2004) but we obtain it in a model without filtering in which sources can freely transmit information. In fact, while in Suen (2004) bias is valuable to consumers, in our model the value of information for *all* citizens diminishes with increased capture –see Lemma 2.

However, the fact that capture reduces the value of information does not mean that increasing demand for information reduces slant. The following proposition describes a situation in which the opposite is true.

Proposition 14. *Suppose that Assumptions I and II hold and* $v_R = g(\frac{\mu}{1-\mu})$ *and* $v_L = g(\frac{1-\mu}{\mu})$ *with* g *increasing and convex and there are two symmetric information sources with* $F^1_{H,\theta} = F^2_{H,\theta} (= F_{H,\theta})$*. Suppose that for* $\rho \in [0,1)$ *there is an asymmetric equilibrium with* $\bar{\lambda}_1$ $(\underline{\lambda}_2)$ *the highest (lowest) likelihood ratio in media 1 (media 2) which is dominated by* R (L)*. Furthermore, there are two equally sized subgroups of citizens* A *and* B*, with priors satisfying*

$$p_k \geq \frac{1}{1+\underline{\epsilon}} > \frac{1}{1+\underline{\lambda}_2} \text{if } k \in A; \; p_k \leq \frac{1}{1+\bar{\epsilon}} < \frac{1}{1+\bar{\lambda}_1} \text{if } k \in B, \tag{60}$$

and citizens equally likely to consume either source if they do not value information. Then, marginally increasing ρ *increases source polarization.*

Proof. Let $I^j(p)$ be the instrumental value of source i for a citizen with prior p which is given in the main text by (31) if $p > \alpha$ and by (32) if $p < \alpha$. Note that the assumptions on v_i imply that both IPs want to fire up their base –see Lemma 4. The equilibrium thresholds $\bar{\lambda}_1$ and $\underline{\lambda}_2$ ensure that the instrumental value of source 1 relative to source 2, $\Delta_I(p) = I^1(p) - I^2(p)$, is positive for $p \geq 1/(1+\underline{\epsilon}) > 1/(1+\underline{\lambda}_2)$ and negative for $p \leq 1/(1+\bar{\epsilon}) < 1/(1+\bar{\lambda}_1)$ –see the proof of Proposition 6. As any citizen in A (B) satisfies $p \geq 1/(1+\underline{\epsilon})$ $(p \leq 1/(1+\bar{\epsilon}))$, then all citizens in A (B) prefer to consume source 1 (2) if they were to sort according to instrumental value. Note that since $\bar{\lambda}_1$ and $\underline{\lambda}_2$ vary smoothly with ρ, marginally increasing ρ will respect these inequalities, so that any citizen in A (B) that sorts according to instrumental value will consume source 1 (2).

Let $F^A_p(p) = \Pr[p' \leq p|A]$ and $F^B_p(p) = \Pr[p' \leq p|B]$ be the distribution of priors of citizens in groups A and B. Then, the audience of sources 1 and 2 are

$$F^1_p(p) = \frac{1+\rho}{2} F^A_p(p) + \frac{1-\rho}{2} F^B_p(p), \tag{61}$$

$$F^2_p(p) = \frac{1-\rho}{2} F^A_p(p) + \frac{1+\rho}{2} F^B_p(p). \tag{62}$$

This follows as citizens that do not sort according to instrumental value are equally likely to choose either source, while those that sort according to instrumental value do not vary the source they patronize after the increase in ρ. Note also that, as the sizes of both groups are the same, the total mass of citizens in both sources is the same. As citizens sorting preferences did not change, then increasing ρ leads to a FOSD increase in F^1_p in (61) and a FOSD decrease in F^2_p in (62).

As both IPs want to fire up their base, this increases R's incentives to capture source

1, and lowers its incentives to capture source 2, while it decreases $L's$ incentives to capture source 2, and lowers its incentives to capture source 1. Under Assumption I and II, Proposition 13 shows that this leads to a new equilibrium where the equilibrium level of $R-$capture increases in source 1, and decreases in source 2, while L-capture increases in source 2 and decreases in source 1, thus increasing both measures of polarization $\mathscr{P}_G(r,l)$ and $\mathscr{P}_I(r,l)$. $\square$

Condition (60) ensures that citizens who value information (a proportion ρ of the population) sort according to group membership –citizens in A patronizing source 1; those in B selecting source 2– and a marginal increase in ρ will not affect this sorting behavior. The rest of the audience, a fraction $1-\rho$ which do not value information, is spread equally across both sources independent of their prior.

Now consider an increase in ρ. As more citizens now value information, sorting increases: the proportion of citizens in A choosing source 1 and the proportion of citizens in B choosing source 2 both go up. As g is convex enough, Lemma 4 establishes that IPs want to fire up their bases. The sorting described means that R can reach more of its base in source 1 (and less in source 2) and vice versa for L. Both IPs thus rotate their capturing efforts in opposite directions: R increases capture in 1 and reduces it in 2 and L moves in the opposite direction. The fact that capturing efforts are strategic substitutes –guaranteed by Assumptions I and II– further reinforces this dynamic.

As a consequence, as more citizens demand information, the system reacts with more polarization. Slant therefore increases even though the public has higher value for unbiased information. In fact, it is easy to construct examples where citizens are worse off as a result of endogenous sorting if overall capture increases sufficiently. There are limits to this result –for example, we do not consider entry of new information sources as a result of this demand– but it is a cautionary tale on the presumption that slant is driven by lack of interest in knowing the true state of the world.

16 Finite State Space

Consider a finite state space $\Theta \equiv \{\theta_k\}_{k=1}^n \subset \mathbb{R}$, $\theta_k < \theta_{k+1}$. Citizens have heterogeneous prior beliefs $p \in \Delta(\Theta)$, with a fraction $H(p)$ of citizens with priors $p' \leq p$ and M the total mass of citizens. The two IPs, R and L, have opposed preferences: if μ is the posterior belief of a citizen, then IPs utility functions are $v_R(\mathbb{E}_\mu[\theta])$ and $v_L(\mathbb{E}_\mu[\theta])$ with v_R strictly increasing and v_L strictly decreasing with $|v_i'| > 0$, $i \in \{L, R\}$. Therefore, R wants to induce the highest possible expectation of the state on a citizen, while the

L wants to induce the lowest.[63]

We will show that prior-invariant communication equilibrium are still possible with multiple states, albeit communication equilibria are no longer essentially unique. Focusing on this prior-invariant equilibria, all our results concerning the returns to capture, strategic substitutability, and equilibrium capture of multiple sources carry through to a finite state-space.

16.1 Prior-invariant Communication equilibria

A key feature of our binary state model is that all citizens react in a systematic way to any two potential messages: if a citizen with prior p revises its posterior belief more after observing s' than after observing s, so does every other citizen with a possibly different prior. This consistent revision of beliefs across citizens –a feature that follows as all messages are comparable, in the sense of Milgrom (1981), irrespective of IPs reporting– allowed us to rank any two messages independent of IPs equilibrium reporting and implied that IPs preferences over messages were independent of the audiences' prior-belief distribution.

The following lemma extends this property of consistent updating to the case of a finite state space.

Lemma 8. *Consider signal S with $q(s|\theta) \equiv \Pr[s|\theta]$, $s \in S$, $\theta \in \Theta$, and define the symmetric matrix $M(s', s)$, $s', s \in S$ by*

$$m_{kl} = \frac{\theta_k - \theta_l}{2}(q(s'|\theta_k)q(s|\theta_l) - q(s|\theta_k)q(s'|\theta_l)).$$

If $p, p' \in \Delta(\theta)$ are two arbitrary priors and $\Pr_p[s], \Pr_{p'}[s] > 0$, then

$$(\mathbb{E}_p[\theta|s'] - \mathbb{E}_p[\theta|s])\,(\mathbb{E}_{p'}[\theta|s'] - \mathbb{E}_{p'}[\theta|s]) > 0 \iff (pM(s', s)p^T)(p'M(s', s)(p')^T) > 0 \tag{63}$$

[63] By redefining the state to be $g(\theta)$, with g strictly increasing, our model accommodates IPs seeking to maximize/minimize the expectation of any increasing function of the state.

Proof. We have

$$\begin{aligned}\mathbb{E}_p[\theta|s'] - \mathbb{E}_p[\theta|s] &= \frac{\sum_{k\in I}\theta_k q[s'|\theta_k]p_k}{\sum_{k\in I} q[s'|\theta_k]p_k} - \frac{\sum_{l\in I}\theta_l q[s|\theta_l]p_l}{\sum_{l\in I} q[s|\theta_l]p_l} \\ &= \frac{\sum_{k\in I}\theta_k q[s'|\theta_k]p_k \sum_{l\in I} q[s|\theta_l]p_l - \sum_{l\in I}\theta_l q[s|\theta_l]p_l \sum_{k\in I} q[s'|\theta_k]p_k}{\left(\sum_{k\in I} q[s'|\theta_k]p_k\right)\left(\sum_{l\in I} q[s|\theta_l]p_l\right)} \\ &= \frac{pM(s',s)p^T}{\left(\sum_{k\in I} q[s'|\theta_k]p_k\right)\left(\sum_{l\in I} q[s|\theta_l]p_l\right)}\end{aligned}$$

from which (63) follows. □

This lemma implies that whenever the restriction of $M(s', s)$ to $\Delta(\theta)$ is indefinite, then we can partition $\Delta(\Theta)$ into two sets, Δ^+ and Δ^-, so that after observing s' citizens with a prior $p \in \Delta^+$ will infer a higher expected state than after observing s, while citizens with $p \in \Delta^-$ will infer a lower expected state. Finally, we can recover the result in Milgrom (1981) as MLRP is a necessary and sufficient condition for either Δ^+ or Δ^- to be empty for any s' and s. Indeed, MLRP would then make all terms in m_{ij} of the same sign (positive if $s' > s$ and negative if $s' > s$) so that $M(s', s)$ is either positive or negative semidefinite.

We now turn our attention to studying communication equilibria in a finite state space. While equilibrium always exists irrespective of the information structure of the honest coverage, requiring higher signals to be more indicative of a higher state, in the sense of MLRP, allows us to construct equilibria with similar properties as in the binary state case. Let

$$\lambda_H(s, \theta_k, \theta_1) = \frac{\Pr[s|\theta_k]}{\Pr[s|\theta_1]}$$

be the likelihood ratio that signal s is observed in state θ_k relative to state θ_1 and that MLRP implies that $\lambda_H(s, \theta_k, \theta_1)$ is increasing in s. Equilibria will depend on what IPs can condition their reporting after capture. In this sense, we have three possibilities

1. IPs observe neither the source's honest coverage, nor the state when selecting a message after successful capture. In this case, their reporting strategy will be of the form $\tau_i(s)$.

2. IPs observe the source's honest coverage s after exerting capture effort, but before selecting a message. In this case, their reporting strategy will be of the form $\tau_i(s|s')$ where s' is the source's honest coverage.

3. IPs observe the realized state θ after exerting capture effort, but before selecting a message. In this case, their reporting strategy will be of the form $\tau_i(s|\theta)$.

Our goal is to find sufficient conditions such that communication equilibria exist with the appealing properties of the binary state case:

1. **Sender exaggeration and Message clustering**: Only extreme messages are jammed by IPs.

2. **Prior-invariance**: Communication equilibria remain equilibria for any possible distribution of citizens' priors.

While equilibria satisfying (1) are easy to construct, they may not be robust to changes in citizen's priors and, hence, computationally hard. We focus, therefore, on equilibria that satisfy (2) that, as the next lemma shows, implies equalizing all likelihood ratios for extreme messages

Lemma 9. *Consider strategies $\tau_i(s|\cdot)$ that depend on the information available to IPs when submitting reports and suppose that $\pi_H(r,l) > 0$. A communication equilibrium, with equilibrium likelihood ratio $\lambda^*(s,\theta_k,\theta_1) \equiv \frac{\Pr[s|\theta_k]}{\Pr[s|\theta_1]}$, satisfies message clustering and prior invariance, if and only if there exist $\overline{s}$ and $\underline{s}$ such that*

(i) For all $\theta_k > \theta_1$ and $s, s' \in \{s > \overline{s}\}$ ($s, s' \in \{s < \underline{s}\}$), $\lambda^*(s,\theta_k,\theta_1) = \lambda^*(s',\theta_k,\theta_1)$.

(ii) For all $\theta_k > \theta_1$ and $s > \overline{s}$, $\lambda^*(s,\theta_k,\theta_1) > \lambda_H(\overline{s},\theta_k,\theta_1)$, and for all $s < \underline{s}$, $\lambda^*(s,\theta_k,\theta_1) < \lambda(\underline{s},\theta_k,\theta_1)$.

Proof. We first prove necessity. Note that if $\pi_H(r,l) > 0$, then R and L will never send the same message with positive probability. IPs indirect utility from sending message $\tilde{s}$ is

$$V_i(\tilde{s}) = \int_{\Delta(\Theta)} v_i(\mathbb{E}_{\mu(\tilde{s},p)}[\theta])dH(p)$$

In equilibrium, $V_i(s) = V_i(s')$ for all $s, s' \in support(\tau_i^*)$. Taking $H(p)$ to be concentrated on every $p \in \Delta(\Theta)$ and noting that $v_i' > 0$ implies that $\mathbb{E}_{\mu(s,p)}[\theta] = \mathbb{E}_{\mu(s',p)}[\theta]$. Using lemma 1, this means that the matrix $M(s', s)$ is identically zero, so that we must have that likelihood ratios are the same for both signals, i.e., $\lambda^*(s,\theta_k,\theta_1) = \lambda^*(s',\theta_k,\theta_1)$ for all $\theta_k > \theta_1$. Sufficiency is immediate. □

16.2 Communication equilibria–Ignorant IPs

We first show that if IPs have no information, they are not able in equilibrium to equalize likelihood ratios for extreme messages so that any communication equilibrium is not robust to arbitrary changes in citizens' prior distribution.

Proposition 15. *Suppose that IPs observe nothing. Then generically there are no prior invariant equilibria if* $card(\Theta) > 2$.

Proof. Let $q_i(s) \equiv \Pr[s|\theta_i]$. From Lemma 9, in a prior invariant equilibrium we must have that for any $s, s' \in supp(\tau_R^*)$,[64]

$$\lambda^*(s,\theta_k,\theta_1) = \lambda^*(s',\theta_k,\theta_1) \to \frac{\pi_H q_k(s) + \pi_R \tau_R^*(s)}{\pi_H q_1(s) + \pi_R \tau_R^*(s)} \equiv \nu_R(\theta_k),\ s \in supp(\tau_R^*)$$

Solving for $\tau_R^*(s)$ we must then have

$$\tau_R^*(s) = \frac{\pi_H}{\pi_R}\frac{q_k(s) + \nu_R(\theta_k) q_1(s)}{\nu_R(\theta_k) - 1}$$

Since $\tau_R^*(s)$ does not depend on $\theta_k > \theta_1$ then the quantity

$$\frac{\tau_R^*(s)}{q_1(s)}\frac{\pi_R}{\pi_H} = \frac{\lambda_H(s,\theta_k,\theta_1) + \nu_R(\theta_k)}{\nu_R(\theta_k) - 1}$$

should be constant across all $\theta_k \neq \theta_1$. This implies that for any $\theta_{k'} > \theta_1$, $\theta_{k'} \neq \theta_k$,

$$\nu_R(\theta_k) = \frac{\lambda_H(s,\theta_k,\theta_1) + \frac{\lambda_H(s,\theta_{k'},\theta_1)+\nu_R(\theta_{k'})}{\nu_R(\theta_{k'})-1}}{\frac{\lambda_H(s,\theta_{k'},\theta_1)+\nu_R(\theta_{k'})}{\nu_R(\theta_{k'})-1} - 1} = \frac{\lambda_H(s,\theta_{k'},\theta_1) + \nu_R(\theta_{k'}) + \lambda_H(s,\theta_k,\theta_1)\left(\nu_R(\theta_{k'}) - 1\right)}{\lambda_H(s,\theta_{k'},\theta_1) + \nu_R(\theta_{k'}) - \left(\nu_R(\theta_{k'}) - 1\right)}$$

As the left hand side is independent of the realization s, numerator and denominator must be proportional so that likelihood ratios must be a linear function of each other, i.e., $\lambda_H(s,\theta_{k'},\theta_1) = \alpha_1 + \alpha_2 \lambda_H(s,\theta_k,\theta_1)$ for some α_1 and α_2 satisfying the above. This can only be satisfied by a non-generic choice of $q_k(s)$. □

16.3 Communication equilibria–IPs learn the state

We now show that if IPs observe the state prior to selecting their report, then they can mix their messages in a way that all jammed messages carry the same information. Unlike the binary state, however, such prior-invariant equilibria are no longer unique.

[64] To streamline the exposition, we omit the dependence of π_i on the capture efforts of IPs.

Proposition 16. *Consider a single news source, fix a profile* (r, l) *and let* $\pi_i(r, l)$ *be the probability that* $i \in \{L, R\}$ *captures the source with* $\pi_H(r, l) > 0$*. Suppose that IPs observe the state* $\theta \in \Theta$ *prior to submitting a message and let* $\tau_i(s|\theta)$ *denote their state-contingent reporting strategy. Then, there exist (not necessarily unique)* $\overline{s}$ *and* $\underline{s}$*, and a communication equilibrium such that*

1. $s \in supp(\tau_R^*)$ *only if* $s \geq \overline{s}$; $s \in supp(\tau_L^*)$ *only if* $s \leq \underline{s}$.

2. *The equilibrium likelihood ratios of message* $\lambda^*(s, \theta_k, \theta_1) = \frac{\Pr[s|\theta_k]}{\Pr[s|\theta_1]}$ *satisfy*

$$\lambda^*(s, \theta_k, \theta_1) = \begin{cases} \frac{\Pr[s \leq \underline{s}|\theta_k] + \frac{\pi_R}{\pi_H}}{\Pr[s \leq \underline{s}|\theta_1] + \frac{\pi_R}{\pi_H}} < \frac{\pi[\underline{s}|\theta_k]}{\pi[\underline{s}|\theta_1]} & \text{if } s \leq \underline{s} \\ \lambda_H(s, \theta_k, \theta_1) & \text{if } \underline{s} < s < \overline{s}, \\ \frac{\Pr[s \geq \overline{s}|\theta_k] + \frac{\pi_R}{\pi_H}}{\Pr[s \geq \overline{s}|\theta_1] + \frac{\pi_R}{\pi_H}} > \frac{\pi[\overline{s}|\theta_k]}{\pi[\overline{s}\theta_1]} & \text{if } s \geq \overline{s} \end{cases}$$

3. *The equilibrium is invariant to the distribution* $H(p)$ *of citizen's priors.*

Proof. We will abbreviate the likelihood of capture $\pi_i(r, l)$ given capture pressure (r, l) to π_i. Suppose that R and L's strategies are $\tau_R(s|\theta)$ and $\tau_L(s|\theta)$. Then,

$$\lambda^*(s, \theta_k, \theta_1) = \frac{\pi_H q_i(s) + \pi_R \tau_R(s|\theta_k) + \pi_L \tau_L(s|\theta_k)}{\pi_H q_1(s) + \pi_R \tau_R(s|\theta_1) + \pi_L \tau_L(s|\theta_1)}.$$

We now construct an equilibrium that satisfies properties 1, 2 and 3 in the Proposition by constructing strategies for each IP consistent with 1 and 2 and verify that they constitute an equilibrium. We focus on R for convenience as the analysis for L is analogous.

Fix $\overline{s}$ and $\underline{s}$ with $\overline{s} > \underline{s}$, and suppose that $supp(\tau_R^*) = \{s \geq \overline{s}\}$. As described in Lemma 9, any prior-invariant communication equilibrium must equate the likelihood ratios for jammed messages. Therefore, the perceived likelihood ratio must be the same for all $s > \overline{s}$

$$\lambda^*(s, \theta_k, \theta_1) = \frac{\pi_H q_k(s) + \pi_R \tau_R^*(s|\theta_k)}{\pi_H q_1(s) + \pi_R \tau_R^*(s|\theta_1)} \equiv \nu_R(\theta_k; \overline{s}). \tag{64}$$

which requires

$$q_k(s) + \frac{\pi_R}{\pi_H} \tau_R^*(s|\theta_k) = \nu_R(\theta_k; \overline{s}) \left(q_1(s) + \frac{\pi_R}{\pi_H} \tau_R^*(s|\theta_1) \right) \tag{65}$$

Integrating over $\{s \geq \overline{s}\}$ and noting that $\int_{\{s\geq\overline{s}\}} \tau_R^*(s|\theta_k)ds = 1$ for each $\theta_k \in \Theta$, we can solve for $\nu_R(\theta_k;\overline{s})$,

$$\nu_R(\theta_k;\overline{s}) \equiv \frac{\Pr[s \geq \overline{s}|\theta_k] + \frac{\pi_R}{\pi_H}}{\Pr[s \geq \overline{s}|\theta_1] + \frac{\pi_R}{\pi_H}}.$$

For any $s > \overline{s}$, we can obtain $\tau_R^*(s|\theta_k)$ from $\tau_R^*(s|\theta_1)$ by solving for $\tau_R^*(s|\theta_k)$ in (65)

$$\tau_R^*(s|\theta_k) = \nu_R(\theta_k;\overline{s})\tau_R^*(s|\theta_1) + \frac{\pi_H}{\pi_R}\left(\nu_R(\theta_k;\overline{s})q_1(s) - q_k(s)\right). \tag{66}$$

$$= \nu_R(\theta_k;\overline{s})\left(\tau_R^*(s|\theta_1) + \frac{\pi_H}{\pi_R}q_1(s)\left(1 - \frac{\lambda_H(s,\theta_k,\theta_1)}{\nu_R(\theta_k;\overline{s})}\right)\right) \tag{67}$$

Letting

$$t_R(s|\theta_k) \equiv \left(\frac{\lambda_H(s,\theta_k,\theta_1)}{\nu_R(\theta_k;\overline{s})} - 1\right),$$

the non-negativity constraint $\tau_R^*(s|\theta_k) \geq 0$ requires

$$\tau_R^*(s|\theta_1) \geq \underline{\tau}_R(s|\theta_1) \equiv \max_{k\in\{1,\ldots,n\}}\{0, \frac{\pi_H}{\pi_R}t_R(s|\theta_k)q_1(s)\}. \tag{68}$$

MLRP implies that $t_R(s|\theta_i)$ is strictly increasing in s and, by construction, $\underline{\tau}_R(s|\theta_1) \geq 0$. Finally, define $\widehat{s}(\overline{s})$ by

$$\widehat{s}(\overline{s}) \equiv \max\{s : \int_{\{s'\geq s\}} \underline{\tau}_R(s'|\theta_1)ds = 1\}.$$

As (68) only imposes a lower bound on $\tau_R^*(s|\theta_1)$, then for any $s' \geq \widehat{s}$ we can find a mixing $\tau_R^*(s|\theta_1)$ (and thus mixings $\tau_R^*(s|\theta_k)$ following (66)) such that all likelihood ratios are equalized, i.e., (64) holds, under the assumption that the support is $\{s \geq s'\}$ and such that $\int_{\{s\geq s'\}} \tau_R^*(s|\theta_1)ds = 1$. Finally, to guarantee prior-invariance we need to guarantee that $\lambda^*(s,\theta_k,\theta_1) \geq \lambda_H(\overline{s},\theta_k,\theta_1)$ for any $s > \overline{s}$ – see Lemma 9. This requires that for all $\theta_k > \theta_1$ we have $\nu_R(\theta_k;\overline{s}) \geq \lambda_H(\overline{s},\theta_k,\theta_1)$ which implies

$$\left(\frac{\Pr[s \geq \overline{s}|\theta_k]}{\Pr[s \geq \overline{s}|\theta_1]} - \lambda_H(\overline{s},\theta_k,\theta_1)\right)\Pr[s \geq \underline{s}|\theta_1] \geq \frac{\pi_R}{\pi_H}\left(\lambda_H(\overline{s},\theta_k,\theta_1) - 1\right) \tag{69}$$

Define $\overline{S}$ be the set of values $\overline{s}$ such that (69) holds for all $\theta_k > \theta_1$. This set is nonempty: the lhs of (69) is always positive (an implication of strict MLRP) while the rhs of (69) is increasing in $\overline{s}$ and negative for low enough $\overline{s}$. Therefore, any $\overline{s}$ such that $\overline{s} \in \overline{S}$ and $\overline{s} \geq \widehat{s}(\overline{s})$ allows for the existence of $\tau_R^*(s|\theta_k)$ satisfying (69) and

(64) and constituting a prior-invariant equilibrium. Alas, nothing in this construction guarantees that the resulting $\overline{s}$ is unique. $\square$

To sum up, allowing for a finite state space opens the door for IPs reporting equilibria, or the source's honest coverage, that are not necessarily ordered according to MLRP, implying that messages would polarize citizens (some updating upwards but other updating downwards– see Dixit and Weibull (2007) and equilibria that is not robust to changes in the citizens prior belief. If IPs cannot observe the state, then generically we cannot have prior-invariant equilibria. However, prior invariant equilibria are possible if the source's honest coverage satisfies MLRP and IPs observe the state. However, in this case prior-invariant equilibria may not be unique. Thus, this extension to a finite state space would also require an equilibrium selection criteria to argue why and how citizens and IPs can coordinate on prior-invariant equilibria and, among all available, select the most informative one (i.e., the one with the highest $\overline{s}$ and lowest $\underline{s}$) it it exists.

17 Multi-homing Audience

We now extend our model to allow (a fraction or all) citizens to consume several sources –i.e., to "multi-home." We first solve for an equilibrium of the communication subgame when IPs select messages based on the sources that they control mindful of some citizens observing all (or some) of their chosen messages. We then show that multi-homing citizens naturally create demand-side interdependencies across captured sources and discuss conditions for the presence of multihoming citizens to increase IPs' capture incentives.

Let us briefly describe our main insights when citizens multi-home. Regarding communication, a notable feature of equilibria when citizens single-home is sender exaggeration and message clustering: IPs resort to messages above $\overline{\lambda}_j$ and below $\underline{\lambda}_j$ when controlling source j. One may conjecture that such strategy may prove counterproductive when citizens multi-home as rational citizens may grow suspicious and fear multi-capture if they observe systematically extreme messages in the same direction. Nevertheless, a IP that simultaneously controls multiple sources can hide its identity from multi-homing citizens if these citizens believe that the IP randomizes its message independently across sources. Since capture is independent across sources for fixed capture levels, independent randomizations prevent multi-homing citizens from interpreting the message in one source differently as function of the message in the other source

–indeed, in this case multi-homing citizens simply regard each message as independent conditional on the state. What this implies is that, for the same covert level of capture, the strategies employed in the case that citizens single-home remain an equilibrium if citizens multi-home, albeit now requiring independent randomizations across sources.

How would a multi-homing citizen update her beliefs after inferring likelihood λ_j from the message in source j? As IPs randomize independently across sources, then updating by a multihoming citizen observing all sources in a set S would be equivalent to updating after observing a single source with $\lambda = \Pi_{i \in S} \lambda_i$. This multiplicative interpretation of likelihood ratios creates demand-side interdependencies among sources as the value for an IP of controlling one source now depends on which other messages multi-homing citizens are exposed to. We show that if IPs' payoffs are sufficiently convex (concave) over messages, then multi-homing agents create payoff complementarities (substitutabilities) between sources.

Finally, do IPs' capture incentives sharpen with multihoming citizens? As citizens explore other sources beyond their home source, the reach of sources increase and so does the returns to controlling any particular source. However, IPs now face better informed citizens –i.e., those that also consume other sources– so their benefit from persuading them depends on the informativeness of these other sources and the IP's own preferences. We show that if both IPs' utility and marginal utility over messages of a source are convex, then R's best response in each source to any profile of L's capture is higher when citizens multi-home and consume all sources.

17.1 Communication equilibria with multihoming citizens

A notable feature of equilibria in the communication subgame when citizens single-home is that IPs resort to extreme messages. This strategy may prove counterproductive when citizens multi-home as rational citizens may grow suspicious and fear multi-capture if they systematically observe extreme messages in the same direction. Nevertheless, an IP controlling multiple sources can hide its identity from multi-homing citizens if these citizens believe that the IP randomizes its message independently across sources. In fact, for the same covert level of capture, the strategies employed in the case that citizens single-home, albeit now requiring independent randomization across sources, remain an equilibrium if citizens multi-home. For simplicity, we prove this claim for the duopoly case. The oligopoly case follows from a similar reasoning.

Proposition 17. *Suppose that R and L exert covert pressure (r_1, r_2) and (l_1, l_2) in* *sources 1 and 2, citizens single–home, and let* $\tau_R^{*i}(m_i)$ *and* $\tau_S^{*i}(m_i)$ *be R and L's equilibrium communication strategies in source* $j \in \{1,2\}$ *as described in Proposition 1 in the main text. Suppose that a fraction of citizens multi-home (so that they watch the message of both sources). For the same levels of covert pressure, let* $\tau_i^{Sj}(m_j)$ *be i's communication strategy,* $i \in \{R, L\}$*, when it only controls source j and* $\tau_i^M(m_1, m_2)$ *its strategy if it controls both sources. Then* $\tau_i^{Sj}(m_j) = \tau_i^{*j}(m_j)$ *and* $\tau_i^M(m_1, m_2) = \tau_i^{*1}(m_1)\tau_i^{*2}(m_2)$ *is an equilibrium of the communication subgame with multihoming citizens.*

Proof. Let $F_{p,j}^S(p)$ be the prior distribution of citizens that only consume source $j \in \{1,2\}$, while $F_p^M(p)$ is the prior distribution for those citizens that multihome –i.e., that consume both sources. To simplify notation, for $i \in \{R, L, H\}$ we abbreviate $\pi_i^j(r_j, l_j)$ to π_i^j , and let $\lambda_j^*(m_j)$ be citizens equilibrium inference after observing the message of source i when all citizens single-home and anticipate IPs' strategies $\tau_R^{*j}(m_j)$ and $\tau_S^{*j}(m_j)$ with $\overline{\lambda}_j$ and $\underline{\lambda}_j$ the maximum and minimum equilibrium likelihood ratios –see Proposition 1 in the main text.

Let $\Pr_j(m_j|\theta)$ be the state-contingent probability of observing message m_j in source j. Then,

$$Pr_j(m_j|\theta) = \pi_H^j q_\theta^j(m_j) + \pi_L^j(1-\pi_L^k)\tau_L^{Sj}(m_j) + \pi_L^j \pi_L^k \tau_L^M(m_j|m) + \pi_R^j(1-\pi_R^k)\tau_R^{Sj}(m_j) + \pi_R^j \pi_R^k \tau_R^M(m_j|m)$$

where $\tau_i^M(m_j|m)$ is the marginal probability $\tau_i^M(m_j|m) = \int \tau_i^M(m_1, m_2) dm_j$. This follows as now there are five different potential senders: H, single-homing L and R, and multi-homing L and R. Likewise, let $Pr_M((m_1, m_2)|\theta)$ be the state-contingent probability of observing message (m_1, m_2) by a citizen that multi-homes. Then,

$$\begin{aligned} Pr_M((m_1, m_2)|\theta) = {} & \pi_H^1 \left(\pi_H^2 q_\theta^1(m_1) q_\theta^2(m_2) + \pi_L^2 q_\theta^1(m_1)\tau_L^{S2}(m_2) + \pi_R^2 q_\theta^1(m_1)\tau_R^{S2}(m_2)\right) \\ & + \pi_R^1 \left(\pi_H^2 \tau_R^{S1}(m_1) q_\theta^2(m_2) + \pi_L^2 \tau_R^{S1}(m_1)\tau_L^{S2}(m_2) + \pi_R^2 \tau_R^M(m_1, m_2)\right) \\ & + \pi_L^1 \left(\pi_H^2 \tau_L^{S1}(m_1) q_\theta^2(m_2) + \pi_L^2 \tau_L^M(m_1, m_2) + \pi_R^2 \tau_L^{S1}(m_1)\tau_R^{S2}(m_2)\right). \end{aligned}$$

Again, this follows as a multihoming citizen should consider the possibility that either both sources remain honest, each is captured by a different sender, or they are both captured by the same IP. In terms of inference, a citizen exposed only to source j interprets message m_j as

$$\lambda_j^S(m_i) = \frac{\Pr_j(m_j|\theta = 1)}{\Pr_j(m_j|\theta = -1)}$$

while a citizen that consumes both sources interprets message (m_1, m_2) as

$$\lambda^M(m_1, m_2) = \frac{\Pr_M((m_1, m_2)|\theta = 1)}{\Pr_M((m_1, m_2)|\theta = -1)}.$$

We now show that for the same covert capture efforts, $\tau_R^{Sj}(m_j) = \tau_R^{*j}(m_j)$, $\tau_L^{Sj}(m_i) = \tau_L^{*j}(m_j)$, $\tau_R^M(m_1, m_2) = \tau_R^{*1}(m_1)\tau_R^{*2}(m_2)$, and $\tau_L^M(m_1, m_2) = \tau_L^{*1}(m_1)\tau_L^{*2}(m_2)$ constitute an equilibrium of the communication subgame when a fraction (or all) citizens multi-home, regardless of the identity of those citizens. To do this, we first evaluate citizens equilibrium updating and then turn to IPs best response given citizens' updating.

Consider first single-home citizens' updating given IPs reporting strategies $\tau_i^{Sj}(m_j)$ and τ_i^M. Looking for instance to R's reporting strategy, for any $m_j \in supp\, \tau_R^{*j}(m_j)$ –so that $\lambda_H^j(m_j) \geq \overline{\lambda}_j$– we have that $m_j \notin supp\, \tau_L^{*j}(m_j)$ so that using $\tau_R^M(m_1, m_2) = \tau_R^{*1}(m_1)\tau_R^{*2}(m_2)$ we get

$$\begin{aligned}\lambda_j^S(m_j) &= \frac{\pi_H^j q_\theta^j(m_i) + \pi_R^j(1 - \pi_R^k)\tau_R^{Sj}(m_j) + \pi_R^j \pi_R^k \tau_R^M(m_j|m)}{\pi_H^j q_\theta^j(m_i) + \pi_R^j(1 - \pi_R^k)\tau_R^{Sj}(m_j) + \pi_R^j \pi_R^k \tau_R^M(m_j|m)} = \\ &= \frac{\pi_H^j q_\theta^j(m_j) + \tau_R^{*j}(m_j)}{\pi_H^j q_\theta^j(m_j) + \tau_R^{*j}(m_j)} = \overline{\lambda}_j.\end{aligned}$$

Applying a similar reasoning to L's reporting we conclude that $\lambda_j^S(m_i) = \lambda_j^*(m_j)$ –i.e., the equilibrium inference of single-homing citizens remains the same if IPs randomized their message independently when they capture both sources.

Turning to citizens that multihome, and looking for instance to $R's$ reporting strategy, then for any message $(m_1, m_2) \in supp\, \tau_R^M(m_1, m_2) = supp\, \tau_R^{*1}(m_1) \times supp\, \tau_R^{*2}(m_2)$ we have

$$\begin{aligned}\Pr_M((m_1, m_2)|\theta) &= \pi_H^1 \left(\pi_H^2 q_\theta^1(m_1) q_\theta^2(m_2) + \pi_R^2 q_\theta^1(m_1)\tau_R^{S2}(m_2)\right) \\ &+ \pi_R^1 \left(\pi_H^2 \tau_R^{S1}(m_1) q_\theta^2(m_2) + \pi_R^2 \tau_R^M(m_1, m_2)\right) \\ &= \pi_H^1 \left(\pi_H^2 q_\theta^1(m_1) q_\theta^2(m_2) + \pi_R^2 q_\theta^1(m_1)\tau_R^{*2}(m_2)\right) \\ &+ \pi_R^1 \left(\pi_H^2 \tau_R^{*1}(m_1) q_\theta^2(m_2) + \pi_R^2 \tau_R^{*1}(m_1)\tau_R^{*2}(m_2)\right) \\ &= \left(\pi_H^1 q_\theta^1(m_1) + \pi_R^1 \tau_R^{*1}(m_1)\right)\left(\pi_H^2 q_\theta^2(m_2) + \pi_R^2 \tau_R^{*2}(m_2)\right),\end{aligned}$$

so that

$$\lambda^M(m_1,m_2) = \frac{\left(\pi_H^1 q_1^1(m_1) + \pi_R^1\tau_R^{*1}(m_1)\right)\left(\pi_H^2 q_1^2(m_2) + \pi_R^2\tau_R^{*2}(m_2)\right)}{\left(\pi_H^1 q_{-1}^1(m_1) + \pi_R^1\tau_R^{*1}(m_1)\right)\left(\pi_H^2 q_{-1}^2(m_2) + \pi_R^2\tau_R^{*2}(m_2)\right)}$$
$$= \lambda_1^*(m_1)\lambda_2^*(m_2) = \overline{\lambda}_1\overline{\lambda}_2.$$

Applying a similar reasoning to L's reporting we conclude that for any $(m_1,m_2) \in$ *supp* $\tau_L^M(m_1,m_2) =$ *supp* $\tau_L^{*1}(m_1) \times$ *supp* $\tau_L^{*2}(m_2)$ then $\lambda^M(m_1,m_2) = \lambda_1^*(m_1)\lambda_2^*(m_2)$. Finally for any $(m_1,m_2) \notin$ *supp* $\tau_R^M(m_1,m_2) \cup$ *supp* $\tau_L^M(m_1,m_2)$ citizens see each message as independent of each other and update accordingly, so again $\lambda^M(m_1,m_2) = \lambda_1^*(m_1)\lambda_2^*(m_2)$. In summary, as IPs randomize independently across sources when they capture both of them, a citizen consuming both channels treats both signals as conditionally independent observations of the state.

It remains to show that these strategies are optimal for the IPs given citizens updating. For simplicity, consider R as L's analysis is analogous, and suppose that it only controls only source j. Then, its indirect utility from message m_j given citizens inference is

$$V_R^j(m_j) = \int_0^1 v_R\left(\frac{p\lambda_j^*(m_i)}{1-p+p\lambda_j^*(m_i)}\right)dF_{p,j}^S(p) + \int_0^1 \mathbb{E}_{m_{k,k\neq j}}[v_R\left(\frac{p\lambda_1^*(m_1)\lambda_1^*(m_2)}{1-p+p\lambda_1^*(m_1)\lambda_1^*(m_2)}\right)]dF_p^M(p).$$

By a similar argument as in the proof of Proposition 1 in the main text, we have that $V_R^j(m_j') = V_R^j(m_j)$ if and only if $\lambda_j^*(m_j') = \lambda_j^*(m_j)$. Therefore, R cannot gain by switching to a message that generates an inference larger than $\overline{\lambda}_j$. The same logic applies to L when it controls only one source.

Finally, suppose that R controls both sources. Then the indirect utility from message (m_1,m_2) is

$$V_R^M(m_1,m_2) = \int_0^1 v_R\left(\frac{p\lambda_1^*(m_1)}{1-p+p\lambda_1^*(m_1)}\right)dF_{p,1}^S(p) + \int_0^1 v_R\left(\frac{p\lambda_2^*(m_2)}{1-p+p\lambda_2^*(m_2)}\right)dF_{p,2}^S(p)$$
$$+ \int_0^1 v_R\left(\frac{p\lambda_1^*(m_1)\lambda_2^*(m_2)}{1-p+p\lambda_1^*(m_1)\lambda_2^*(m_2)}\right)]dF_p^M(p)$$

Again, for fixed m_k we have that $V_R^j(m_j',m_k) = V_R^i(m_j,m_k)$ if and only if $\lambda_j^*(m_j') = \lambda_j^*(m_j)$. Therefore, for any message m_k, R cannot improve to a message that generates an inference larger than $\overline{\lambda}_j$. The same logic applies to L so that independently randomizing across sources –while sending extreme messages in both– is indeed optimal when controlling both sources. □

Therefore, fixing a capture level, and the equilibrium reporting strategy $\tau_R^{*j}(m_j)$ and $\tau_S^{*j}(m_j)$ when citizens only chose a single-outlet, IPs can still maintain the same reporting in equilibrium as long as they report independently across sources when they control multiple sources.

As the event of capture is independent across sources given capture efforts, it makes sense for IPs to randomize independently so as to minimize the likelihood of their message being detected and labeled as "suspect". In fact, efforts to appear unbiased may prove suboptimal: a IP controlling two sources could send a "credible" message in source 1 (i.e., a message that only would be observed if the sender is honest) in the hope of making the message in source 2 "more credible." However, this would not change the likelihood that citizens attach to source 2 being captured if they expect IPs to treat captured sources independently.

Importantly, given that IPs randomized independently across sources, the equilibrium interpretation of the news for a fixed level of capture does not depend on the number and characteristics of citizens that multi-home. The incentives to capture do, however, as now IPs have the opportunity to "double-hit" a multihoming citizen with the same extreme message, as we discuss next.

17.2 Demand-side interdependencies with multihoming citizens.

To gain some intuition in the simplest possible setting, consider a duopoly where *all* citizens observe the message of both sources (all citizens multi-home); the contest success function is $\pi_R^j(r_j, l_j) = r_j$ and $\pi_L^j(r_j, l_j) = l_j$; and marginal costs of capture are independent across sources. For given profiles of capture efforts (r_1, r_2) and (l_1, l_2), let $\overline{\lambda}_j$ and $\underline{\lambda}_j$, be the highest and smallest credible likelihood ratios in source j – as given by the equilibrium in Proposition 17.

Let λ_j^H be the random variable denoting the interpretation of an honest message in the captured source j and consider the expected utility of R from capture efforts (r_1, r_2) and (l_1, l_2) given sequentially rational messages and citizens' anticipating these efforts $W_R(r_1, r_2, l_1, l_2) - C_1(r_1) - C_2(r_2)$ where

$$\begin{aligned} W_R(r_1, r_2, l_1, l_2) \equiv\ & r_1 r_2 V_R(\overline{\lambda}_1\overline{\lambda}_2) + r_1 l_2 V_R(\overline{\lambda}_1\underline{\lambda}_2) + r_1(1 - r_2 - l_2)\mathbb{E}_{\lambda_2^H}[V_R(\overline{\lambda}_1\lambda_2^H)] \\ & + l_1 r_2 V_R(\underline{\lambda}_1\overline{\lambda}_2) + l_1 l_2 V_R(\underline{\lambda}_1\underline{\lambda}_2) + l_1(1 - r_2 - l_2)\mathbb{E}_{\lambda_2^H}[V_R(\underline{\lambda}_1\lambda_2^H)] \\ & + (1 - r_1 - l_1) r_2 \mathbb{E}_{\lambda_1^H}[V_R(\lambda_1^H\overline{\lambda}_2)] + (1 - r_1 - l_1) l_2 \mathbb{E}_{\lambda_1^H}[V_R(\lambda_1^H\underline{\lambda}_2)] \\ & + (1 - r_1 - l_1)(1 - r_2 - l_2)\mathbb{E}_{\lambda_1^H,\lambda_2^H}[V_R(\lambda_1^H\lambda_2^H)]. \end{aligned} \tag{70}$$

Then,

$$\frac{\partial^2 W_R}{\partial r_1 \partial r_2} = V_R(\overline{\lambda}_1\overline{\lambda}_2) - \mathbb{E}_{\lambda_2^H}[V_R(\overline{\lambda}_1\lambda_2^H)] - \Big(\mathbb{E}_{\lambda_1^H}[V_R(\lambda_1^H\overline{\lambda}_2)] - \mathbb{E}_{\lambda_1^H,\lambda_2^H}[V_R(\lambda_1^H\lambda_2^H)]\Big) \tag{71}$$

$$= \mathbb{E}_{\lambda_1^H,\lambda_2^H}[V_R(\overline{\lambda}_1\overline{\lambda}_2) - V_R(\overline{\lambda}_1\lambda_2^H) - \big(V_R(\lambda_1^H\overline{\lambda}_2) - V_R(\lambda_1^H\lambda_2^H])\big)] \tag{72}$$

where we use the fact that citizens do not observe the increase in efforts (so that $\overline{\lambda}_j$ and $\underline{\lambda}_j$ remain unchanged). Note that $\mathbb{E}_{\lambda_1^H}[V_R(\lambda_1^H\overline{\lambda}_2)] - \mathbb{E}_{\lambda_1^H,\lambda_2^H}[V_R(\lambda_1^H\lambda_2^H)]$ is the incremental gain to the $R-$ of controlling source 2 when source 1 remains honest, while $V_R(\overline{\lambda}_1\overline{\lambda}_2) - \mathbb{E}_{\lambda_2^H}[V_R(\overline{\lambda}_1\lambda_2^H)]$ is also the gain of controlling source 2, albeit once it also controls source 1. It is clear that (71) is positive whenever $V_R(\lambda_1\lambda_2)$ is supermodular in λ_1 and λ_2 and negative whenever $V_R(\lambda_1\lambda_2)$ is submodular. Since

$$\frac{\partial^2 V_R(\lambda_1\lambda_2)}{\partial\lambda_1\partial\lambda_2} = \lambda_1\lambda_2 V_R''(\overline{\lambda}_1\overline{\lambda}_2) + V_R'(\overline{\lambda}_1\overline{\lambda}_2)$$

then $R's$ marginal return from capturing one source increases (decreases) with capture of the other if V_R is convex (sufficiently concave).

Likewise for L we have

$$\frac{\partial^2 W_L}{\partial l_1 \partial l_2} = V_L(\underline{\lambda}_1\underline{\lambda}_2) - \mathbb{E}_{\lambda_2^H}[V_L(\underline{\lambda}_1\lambda_2^H)] - \Big(\mathbb{E}_{\lambda_1^H}[V_L(\lambda_1^H\underline{\lambda}_2)] - \mathbb{E}_{\lambda_1^H,\lambda_2^H}[V_L(\lambda_1^H\lambda_2^H)]\Big),$$

which is again positive whenever $V_L(\lambda_1\lambda_2)$ is supermodular in λ_1 and λ_2 and negative whenever $V_L(\lambda_1\lambda_2)$ is submodular. Therefore, $L's$ marginal return from capturing one source increases (decreases) with capture of the other if V_R is sufficiently convex (concave).

17.3 Incentives to capture sources with multihoming citizens.

To gain some intuition, we compare a duopoly where all citizens are assigned to a single source (single-homing case) with a duopoly where all citizens observe the message of both sources (all citizens multi-home). To simplify the exposition, consider again the linear example with $\pi_R^j(r_j, l_j) = r_j$ and $\pi_L^j(r_j, l_j) = l_j$, and the case of independent marginal costs of capture across sources. For simplicity, we assume that the distribution of prior beliefs in both sources is the same $F_{p,1} = F_{p,2}$. This also means that if M_i is the size of the audience ascribed to source j under single-homing, and $V_i^{S_j}(\lambda)$ and $V_i^M(\lambda)$ is $i's$ payoff when citizens observe message λ under single-homing and multi-homing, then if all citizens multi-home then $V_i^{S_j}(\lambda) = M_j V_i(\lambda)$ and $V_i^M(\lambda) = (M_1 + M_2)V_j(\lambda)$.

Given profiles of capture efforts (r_1, r_2) and (l_1, l_2), let $\overline{\lambda}_j$ and $\underline{\lambda}_j$, be the highest and smallest credible likelihood ratios in source j. The expected payoff to R from capture efforts (r_1, r_2) and (l_1, l_2) given sequentially rational messages and citizens' anticipating these efforts under single-homing is $W_R^S(r_1, r_2, l_1, l_2) - C_1(r_1) - C_2(r_2)$ with

$$\begin{aligned} W_R^S(r_1, r_2, l_1, l_2) = {} & r_1 M_1 V_R(\overline{\lambda}_1) + l_1 V_R(\underline{\lambda}_1) + (1 - r_1 - l_1)\mathbb{E}_{\lambda_1^H}[V_R(\lambda_2^H)] \\ & + r_2 M_2(\overline{\lambda}_2) + l_2 M_2 V_R(\underline{\lambda}_2) + (1 - r_2 - l_2) M_2 \mathbb{E}_{\lambda_2^H}[V_R(\lambda_2^H)], \end{aligned} \tag{73}$$

while the payoff under multi-homing is given by (70).

To describe the marginal returns to capture, say, in source 1, let $J(\alpha; \lambda_1) = V_R(\alpha\overline{\lambda}_1) - V_R(\alpha\lambda_1)$ be R's gain from controlling source 1 when citizens have observed message α in the other source and the honest reporting in source 1 would have sent message λ_1. Note that for single-homing agents, $\alpha = 1$ as they are uninformed prior to consuming source 1. Differentiating (70) and (73) and using the definition of $J(\alpha; \lambda_1)$ yields

$$\begin{aligned} \frac{\partial W_R^S}{\partial r_1} &= M_1 \mathbb{E}_{\lambda_1^H}[J(1; \lambda_1^H)] \\ \frac{\partial W_R^M}{\partial r_1} &= (M_1 + M_2)\mathbb{E}_{\lambda_1^H}[\mathbb{E}_{\lambda_2^H}\left[r_2 J(\overline{\lambda}_2; \lambda_1^H) + l_2 J(\underline{\lambda}_2; \lambda_1^H) + (1 - r_2 - l_2) J(\lambda_2^H; \lambda_1^H)\right]] \end{aligned}$$

As R-capture only crowds-out honest reporting, the marginal returns to increasing R-capture in source 1 derive from replacing the honest message λ_1^H with $\overline{\lambda}_1$. There are two key differences when citizens multihome. First, the reach of source 1 increases as citizens multihome –from M_1 to $M_1 + M_2$– so that R can reach all citizens simply by capturing source 1. This unambiguously increases capture incentives. Second, citizens consuming source 1 are no longer "uninformed" so that the R must account for their prior information, which depends on the message observed in source 2 and, thus, on its level of capture. This is the channel through which multihoming citizens create demand-side interdependencies in capture. This channel, however, may exacerbate or ameliorate capture incentives.

Under multi-homing, an IP reaches a larger, albeit better-informed, audience. The following provides sufficient conditions for the presence of multi-homing citizens to exacerbate the $R-$s capture incentives.

Proposition 18. *Suppose that $F_{p,1} = F_{p,2}$ and source j has a mass M_j of citizens. If $V_R(\lambda)$ and $V_R'(\lambda)$ are convex, then R's best response to L's capture profile is larger under multi-homing than under single-homing.*

Proof. First, recall that the equilibrium likelihood ratio λ_2^* satisfies $\mathbb{E}[\lambda_2^*] = \mathbb{E}[\lambda_2^*|\theta = -1](1-p) + \mathbb{E}[\lambda_2^*|\theta = 1]\,p \geq 1$.

Since $J(\alpha; \lambda_1) = V_R(\alpha\overline{\lambda}_1) - V_R(\alpha\lambda_1)$, then

$$\frac{\partial J}{\partial \alpha} = \overline{\lambda}_1 V_R'(\alpha\overline{\lambda}_1) - \lambda_1 V_R'(\alpha\lambda_1)$$
$$\frac{\partial^2 J}{\partial \alpha^2} = \left(\overline{\lambda}_1\right)^2 V_R''(\alpha\overline{\lambda}_1) - (\lambda_1)^2 V_R''(\alpha\lambda_1)$$

therefore, for any $\lambda_1 \leq \overline{\lambda}_1$, $\frac{\partial J}{\partial \alpha} \geq 0$ if $V_R'(\lambda)$ is increasing, and $\frac{\partial^2 J}{\partial \alpha^2} \geq 0$ if $V_R''(\lambda)$ is increasing. Given the assumptions in the proposition, $J(\alpha; \lambda_1)$ is an increasing and convex function in α for any $\lambda_1 \leq \overline{\lambda}_1$.

If $J(\alpha; \lambda_1)$ is convex, then

$$r_2 J(\overline{\lambda}_2; \lambda_1^H) + l_2 J(\underline{\lambda}_2; \lambda_1^H) + (1 - r_2 - l_2) J(\lambda_2^H; \lambda_1^H) \geq J(r_2\overline{\lambda}_2 + l_2\underline{\lambda}_2 + (1 - r_2 - l_2)\lambda_2^H; \lambda_1^H)$$

and Jensen's inequality yields

$$\begin{aligned} \mathbb{E}\left[J(r_2\overline{\lambda}_2 + l_2\underline{\lambda}_2 + (1 - r_2 - l_2)\lambda_2^H; \lambda_1^H)\right] &\geq J(\mathbb{E}\left[r_2\overline{\lambda}_2 + l_2\underline{\lambda}_2 + (1 - r_2 - l_2)\lambda_2^H)\right]; \lambda_1^H) \\ &\geq J(1; \lambda_1^H) \end{aligned}$$

where the last inequality uses the fact that $J(\alpha; \lambda_1)$ is increasing in α and $\mathbb{E}[\lambda_2^*] \geq 1$. Therefore,

$$\frac{\partial W_R^M}{\partial r_1} \geq (M_1 + M_2) J(1; \lambda_1^H) - C_1'(r_1) \geq M_1 \mathbb{E}_{\lambda_1^H}[J(1; \lambda_1^H)] - C_1'(r_1) = \frac{\partial W_R^S}{\partial r_1}.$$

□

18 Naive citizens

The results we present in the main text rely fundamentally on the rational skepticism of an information source's audience. This begs the question: are these results robust to the presence of unsophisticated citizens? In this section we consider citizens with extreme susceptibility to manipulation. More precisely, we allow for a fraction $1-\gamma < 1$ of citizens to be "naive" in that they believe all coverage to be honest. The remainder fraction γ of the audience are fully sophisticated as in previous sections.

Naive and rational citizens interpret the same news λ differently: naive citizens take news at face value and interpret λ literally, while rational citizens are wary of capture and interpret them as $\lambda_\gamma(\lambda)$.[65] The following proposition summarizes the main features of communication equilibria with naive citizens.

Proposition 19. *In the linear-contest model, fix levels of capture r and l, with $r + l < 1$, and let $V_i(\lambda) \equiv \int_0^1 v_i(\mu^*(\lambda; p))\, dF_p(p)$ be the expected utility of the $i-$ if citizens interpret the message as λ. There exists a unique equilibrium interpretation of the news by rational citizens $\lambda_\gamma(\lambda)$, with unique $\overline{\lambda}$ and $\underline{\lambda}$, satisfying*

1. *$\lambda_\gamma(\lambda)$ is given by*

$$\lambda_\gamma(\lambda) = \begin{cases} V_L^{-1}(V_L(\underline{\lambda}) + \frac{1-\gamma}{\gamma}(V_L(\underline{\lambda}) - V_L(\lambda))) & \text{if } \lambda \leq \underline{\lambda}, \\ \lambda & \text{if } \underline{\lambda} < \lambda < \overline{\lambda}, \\ V_R^{-1}(V_R(\overline{\lambda}) + \frac{1-\gamma}{\gamma}(V_R(\overline{\lambda}) - V_R(\lambda))) & \text{if } \lambda \geq \overline{\lambda}. \end{cases} \tag{74}$$

2. *The associated $\overline{\lambda}$ and $\underline{\lambda}$ satisfy*

$$\int_{\overline{\lambda}}^{\infty} \left(\frac{\lambda - \lambda_\gamma(\lambda)}{\lambda_\gamma(\lambda) - 1} \right) dF_{H,-1}(\lambda) = \frac{r}{1-l-r}, \tag{75}$$

$$\int_{0}^{\underline{\lambda}} \left(\frac{\lambda_\gamma(\lambda) - \lambda}{1 - \lambda_\gamma(\lambda)} \right) dF_{H,-1}(\lambda) = \frac{l}{1-l-r} \tag{76}$$

3. *$\overline{\lambda}$ decreases in l, r, and γ while $\underline{\lambda}$ is increasing in l, r, and γ. Fixing $\overline{\lambda}$ and $\underline{\lambda}$, then $\lambda_\gamma(\lambda)$ decreases (increases) in l,r, and γ for $\lambda \geq \overline{\lambda}$ ($\lambda \leq \underline{\lambda}$).*

[65] To put it in terms of previous results, Proposition 1 in the main text indicates that when all citizens are rational (i.e., $\gamma = 1$), $\lambda_\gamma(\lambda) = \overline{\lambda}$ for $\lambda \geq \overline{\lambda}$ while $\lambda_\gamma(\lambda) = \underline{\lambda}$ for $\lambda \leq \underline{\lambda}$.

Proof. Suppose that the sophisticated citizens' assessments of the reporting strategies of R and L's strategies, expressed in terms of the accepted meaning, are $\tau_R(\lambda)$ and $\tau_L(\lambda)$. Then, the perceived likelihood ratio by sophisticated citizens, $\lambda_\gamma(\lambda) \equiv \frac{\Pr[\lambda|\theta=1]}{\Pr[\lambda|\theta=0]}$, is

$$\lambda_\gamma(\lambda) = \frac{(1-l-r)p_1(\lambda) + r\tau_R(\lambda) + l\tau_L(\lambda)}{(1-l-r)p_{-1}(\lambda) + r\tau_R(\lambda) + l\tau_L(\lambda)}, \tag{77}$$

while i's expected utility from a message that is interpreted as λ is $V_i(\lambda)$. Then, the expected utility of i when sending a message with literal meaning λ is

$$\tilde{V}_i(\lambda) \equiv (1-\gamma)\, V_i(\lambda) + \gamma V_i(\lambda_\gamma(\lambda)).$$

If IPs select $\tau_R(\lambda)$ and $\tau_L(\lambda)$, i's optimality, $i \in \{L, R\}$, requires that if $\lambda, \lambda' \in supp\, \tau_i$, then $\tilde{V}_i(\lambda) = \tilde{V}_i(\lambda')$. We now show that if the distribution $F_H(\lambda)$ is continuous, then (i) $supp \tau_i$ is an interval of the form $supp \tau_R = [\overline{\lambda}, \lambda_{max}]$ and $supp \tau_L = [\lambda_{min}, \underline{\lambda}]$, (ii) $\lambda_\gamma(\overline{\lambda}) = \overline{\lambda}$ and $\lambda_\gamma(\underline{\lambda}) = \underline{\lambda}$, and (iii) λ_γ must satisfy (74) given $\overline{\lambda}$ and $\underline{\lambda}$ for any level of capture.

First, suppose that $F_H(\lambda)$ is a continuous distribution with convex support $supp\, F_H$ and let $\overline{\lambda} \equiv \max\{\lambda : \lambda_\gamma(\lambda) = \lambda, \lambda \in supp\ F_H\}$ be the highest news that sophisticated citizens interpret at face value. Since $\lambda_\gamma(\lambda) \neq \lambda$ implies that $\lambda \in supp\, \tau_R \cup \tau_L$, we must have $\min\{\lambda : \lambda \in supp\ \tau_R\} \leq \overline{\lambda}$. We show that $\min\{\lambda : \lambda \in supp\ \tau_R\} = \overline{\lambda}$. Suppose by contradiction that $\min\{\lambda : \lambda \in supp\ \tau_R\} < \overline{\lambda}$. Then the R obtains utility $\tilde{V}_i(\overline{\lambda}) = V_i(\overline{\lambda})$ from $\overline{\lambda}$, while any $\lambda' \in (\min\{\lambda : \lambda \in supp\ \tau_R\}, \overline{\lambda})$ gives strictly less utility as $\tilde{V}_i(\lambda') \leq V_i(\lambda') < V_i(\overline{\lambda})$. Thus, the R can improve by sending instead $\overline{\lambda}$, thus reaching a contradiction. A similar argument applied to the L implies that $supp\, \tau_L = [\lambda_{min}, \underline{\lambda}]$ and $\lambda_\gamma(\underline{\lambda}) = \underline{\lambda}$. Finally, we obtain (74) by solving for $\lambda_\gamma(\lambda)$ in

$$\begin{aligned} (1-\gamma)\, V_L(\lambda) + \gamma V_L(\lambda_\gamma(\lambda)) &= V_L(\underline{\lambda}) \quad \text{if } \lambda \leq \underline{\lambda}, \\ (1-\gamma)\, V_R(\lambda) + \gamma V_R(\lambda_\gamma(\lambda)) &= V_R(\overline{\lambda}) \quad \text{if } \lambda \geq \overline{\lambda}. \end{aligned}$$

Note that the equilibrium interpretation (74) depends on $\overline{\lambda}$ and $\underline{\lambda}$. These are pinned down in equilibrium by the condition that each IPs probability of sending each potential lie aggregate to one. Solving for $\tau_R(\lambda)$ and $\tau_L(\lambda)$ in (77)

$$\begin{aligned} \frac{r}{1-l-r}\tau_R(\lambda) &= \frac{\lambda - \lambda_\gamma(\lambda)}{\lambda_\gamma(\lambda) - 1} p_{-1}(\lambda), \\ \frac{l}{1-l-r}\tau_L(\lambda) &= \frac{\lambda_\gamma(\lambda) - \lambda}{1 - \lambda_\gamma(\lambda)} p_{-1}(\lambda), \end{aligned}$$

and integrating these expressions over the respective supports we obtain (75) and (76).

To complete the proof, we write (74) as $\lambda_\gamma(\lambda;\overline{\lambda},\underline{\lambda})$ to make explicit the dependence on $(\overline{\lambda},\underline{\lambda})$ and define

$$\overline{w}(\overline{\lambda}) \equiv \int_{\overline{\lambda}}^{\infty} \frac{\lambda - \lambda_\gamma(\lambda;\overline{\lambda},\underline{\lambda})}{\lambda_\gamma(\lambda;\overline{\lambda},\underline{\lambda}) - 1} dF_{H,-1}(\lambda), \tag{78}$$

$$\underline{w}(\underline{\lambda}) \equiv \int_{0}^{\underline{\lambda}} \frac{\lambda_\gamma(\lambda;\overline{\lambda},\underline{\lambda}) - \lambda}{1 - \lambda_\gamma(\lambda;\overline{\lambda},\underline{\lambda})} dF_{H,-1}(\lambda). \tag{79}$$

First, we show that $\lambda_\gamma(\lambda;\overline{\lambda},\underline{\lambda})$ is monotonic in $(\overline{\lambda},\underline{\lambda})$. Indeed, as V_R is strictly increasing (and V_L strictly decreasing), then $V_R(\overline{\lambda}) + \frac{1-\gamma}{\gamma}(V_R(\overline{\lambda}) - V_R(\lambda))$ increases in $\overline{\lambda}$ and decreases in γ for any $\lambda > \underline{\lambda}$; similarly, $V_L(\underline{\lambda}) + \frac{1-\gamma}{\gamma}(V_L(\underline{\lambda}) - V_L(\lambda))$ decreases in $\underline{\lambda}$ and increases in γ for any $\lambda < \underline{\lambda}$. Looking at (74) we conclude that, for a fixed value of λ, $\lambda_\gamma(\lambda;\overline{\lambda},\underline{\lambda})$ is non-increasing in $\overline{\lambda}$ and non-decreasing in $\underline{\lambda}$.

Second, we will make use of the fact that $\frac{\lambda-x}{x-1}$ is decreasing in x for $1 < x < \lambda$, while $\frac{x-\lambda}{1-x}$ is decreasing in x for $\lambda < x < 1$. This fact and the monotonicity of $\lambda_\gamma(\lambda;\overline{\lambda},\underline{\lambda})$ in $(\overline{\lambda},\underline{\lambda})$ imply that $\overline{w}(\overline{\lambda})$ in (78) is an strictly decreasing function of $\overline{\lambda}$ with $\overline{w}(\lambda_{max}) = 0$ while $\underline{w}(\underline{\lambda})$ in (79) is an strictly increasing function of $\underline{\lambda}$ with $\underline{w}(\lambda_{min}) = 0$. Furthermore, conditions (75) and (76) translate to $\overline{w}(\overline{\lambda}) = r/(1-r-l)$ and $\underline{w}(\underline{\lambda}) = l/(1-r-l)$. We can then establish uniqueness: As the left hand side of (75) is an strictly decreasing function of $\overline{\lambda}$ and the left hand side of (76) is strictly increasing function of $\underline{\lambda}$, a unique solution to (75-76) is guaranteed for every r and l.

Finally, increasing r or l raises the right hand side of (75) and (76) leading to a lower $\overline{\lambda}$ and higher $\underline{\lambda}$. Likewise, increasing γ lowers both $\overline{w}(\overline{\lambda})$ and $\underline{w}(\underline{\lambda})$, leading to a lower equilibrium $\overline{\lambda}$ and higher $\underline{\lambda}$. □

The presence of naive citizens among the public does not qualitatively change our insights regarding message polarization and audience skepticism: the R selects messages with a literal meaning above some $\overline{\lambda}$ while L chooses messages below $\underline{\lambda}$; this results in an increased frequency of extreme messages which, in turn, are not trusted by sophisticated citizens. However, IPs' strategies must now balance the effect of messages on each type of citizen: as naive citizens take messages at face value, selecting messages with more favorable literal meanings must be offset by a less favorable interpretation by sophisticated citizens. This effect is captured in (74) as $\lambda_\gamma(\lambda)$ is decreasing for both $\lambda > \overline{\lambda}$ and for $\lambda < \underline{\lambda}$– see Figure 4. It follows from (74) that more extreme messages are in this model more heavily discounted by rational citizens and lead

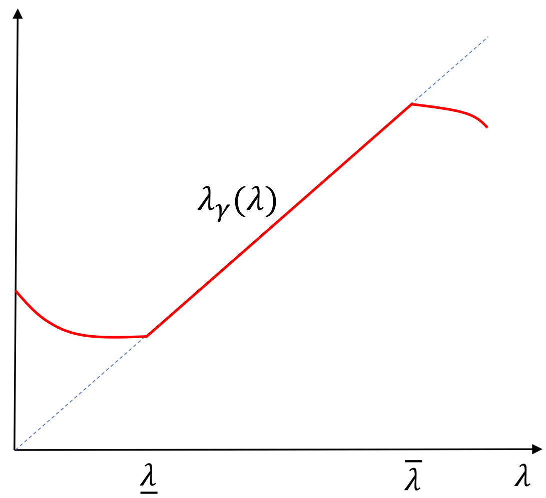

Figure 4: Equilibrium Interpretation by Sophisticated citizens in the presence of Naive citizens.

to a non-monotonic interpretation: messages whose literal reading would be more favorable are interpreted by sophisticated citizens as having less favorable implications regarding the state of the world.[66]

Another key difference between Proposition 1 and 19 is that, in the presence of naive citizens, communication equilibria can vary with the distribution of priors in the audience. The reason is that each IP's indifference among all potential lies relies on balancing its returns from naive and sophisticated citizens, but an IP's utility from each message interpreted at face value does depend on citizens' priors. This also implies that the highest and lowest trusted news, as given by Part 2 of the Proposition, now vary with the public's distribution of priors.

Finally, increased citizen sophistication (higher γ) makes them trust a smaller set of news – this is in part 3 of Proposition 19. This is intuitive as each IP gains less from pandering to naive citizens. The increased need to convince sophisticated citizens means IPs must reduce the likelihood of sending the most extreme messages and therefore put more weight in more centrist messages.

A key feature of Proposition 19, as shown in part 3, is that increasing the capture level of, say, L, not only reduces $\overline{\lambda}$ and increases $\underline{\lambda}$, but it also affects in a monotonic way the interpretation of the messages by sophisticated citizens: increasing l worsens

[66]Chen (2011) provides conditions on the constant bias in the Crawford-Sobel leading example for the existence of communication equilibria in which messages with accepted meaning are interpreted in a non-monotonic way by sophisticated receivers. In our setup, where IPs conflict of interest is extreme, this is a feature of every communication equilibria.

the interpretation of the messages R sends – by reducing $\lambda_\gamma(\lambda)$ for $\lambda \geq \overline{\lambda}$– but makes the lies of L more favorable to R – by increasing $\lambda_\gamma(\lambda)$ for $\lambda \leq \underline{\lambda}$. Both effects unambiguously reduce R's marginal gain from capture. Therefore, in this extended model capturing efforts are also strategic substitutes.

Proposition 20. *Suppose that there is a single information source and the probability that R (L) captures the coverage is r(l). Then, for any fraction $\gamma > 0$ of sophisticated citizens, capture efforts are strategic substitutes.*

Proof. Suppose that citizens anticipate a level of capture $\left(\tilde{r}, \tilde{l}\right)$. R's expected utility when investing r in covertly capturing the source if citizens correctly anticipate R's capture effort is $W_R(r, l; \tilde{r}, \tilde{l})\Big|_{l=\tilde{l}} - C_R(r)$ with

$$W_R(r, l; \tilde{r}, \tilde{l})\Big|_{l=\tilde{l}} = r\tilde{V}_R(\overline{\lambda}) + \tilde{l}\mathbb{E}_{\tau_L}\left[\tilde{V}_R(\lambda); p_R\right] + (1 - r - l)\mathbb{E}_H\left[\tilde{V}_R(\lambda); p_R\right].$$

with

$$\mathbb{E}_H\left[\tilde{V}_R(\lambda); p_R\right] = \overline{F}_H(\overline{\lambda}; p_R)V_R(\overline{\lambda}) + \int_{\lambda_{min}}^{\overline{\lambda}} \left((1-\gamma) V_R(\lambda) + \gamma V_R(\lambda_\gamma(\lambda))\right) dF_H(\lambda; p_R).$$

Therefore, R 's marginal gain from covertly increasing media capture is $B_R(\tilde{r}, \tilde{l}) - C'_R(r) \equiv \frac{\partial W_R(r,l;\tilde{r},\tilde{l})}{\partial r}\Big|_{l=\tilde{l}} - C'_R(r)$ where

$$\begin{aligned} B_R(\tilde{r}, \tilde{l}) &= V_R(\overline{\lambda}) - \mathbb{E}_H\left[V_R(\lambda); p_R\right] \\ &= \int_{\lambda_{min}}^{\overline{\lambda}} \left(V_R(\overline{\lambda}) - V_R(\lambda)\right) dF_H(\lambda; p_R) \qquad (80) \\ &\quad - (1-\gamma)\int_{\lambda_{min}}^{\underline{\lambda}} \left(V_R(\lambda_\gamma(\lambda)) - V_R(\lambda)\right) dF_H(\lambda; p_R). \qquad (81) \end{aligned}$$

By increasing capture efforts, R obtains $V_R(\overline{\lambda})$ instead of the utility derived from an honest coverage $\mathbb{E}_H\left[V_R(\lambda); p_R\right]$.Thus, the R gains $V_R(\overline{\lambda}) - V_R(\lambda)$ whenever $\lambda \leq \overline{\lambda}$ and all citizens (including sophisticated ones) interpret the message at face value –this is (80)– except when $\lambda \leq \underline{\lambda}$ and sophisticated citizens discount the news –this is (81).

We now show that $\partial B_R(\tilde{r}, \tilde{l})/\partial\tilde{l} \leq 0$ so the R's incentives to capture decrease with the anticipated level of capture of L. First, part 3 of Proposition 19 shows that $\overline{\lambda}$ decreases with l, so (80) decreases with $\tilde{l}$. Moreover, part 3 of Proposition 19 also shows that increasing l, (a) increases $\lambda_\gamma(\lambda)$ for $\lambda \leq \underline{\lambda}$, and (b) increases $\underline{\lambda}$. Both effects raise the value of the integral in (81), thus decreasing (81). Therefore, increasing $\widetilde{l}$ lowers $B_R(\tilde{r}, \tilde{l})$. A similar analysis applied to capture by L shows that $\partial B_L(\tilde{r}, \tilde{l})/\partial \widetilde{r} \leq 0$. $\square$

This section therefore establishes that our main results, while driven by rational skepticism, are not knife-edge. Even in the presence of a large share of citizens who believe the lies they are fed, strategic and competitive IPs must still consider how sophisticated citizens update, which leads to their efforts being strategic substitutes.

19 Multiple IPs

We now consider the effect of multiple IPs on equilibrium capture in our binary-state setup. Suppose that there are multiple interested parties, indexed by $\mathscr{I}$, partitioned into two disjointed classes: $\mathscr{R}$ and $\mathscr{L}$. IPs utility depends on citizens' beliefs: if IP i is in class $\mathscr{R}$ then its expected utility $v_i(\mu)$ is strictly increasing, while it is strictly decreasing for any IP j in class $\mathscr{L}$, where in both cases $|v'|$ is bounded away from zero. That is, we can sort IPs into "like-minded" (aligned) classes where all IPs want to move citizens' beliefs in the same direction, albeit with possibly different intensities as captured by v_i. Nevertheless, both classes are "opposed" as IPs across classes favor a different direction in citizens' updating.

The presence of multiple aligned and opposed IPs raises new questions regarding competitive capture of news sources. Next we explore the case of capture of a single news source. We show that: (i) communication equilibria also feature message clustering by like-minded IPs; (ii) under the same conditions as in the model with two IPs, competitive capture is a game in strategic substitutes given citizens updated beliefs, regardless of whether IPs are like-minded or opposed; and (iii) capture has a public good component among like-minded IPs so that collusive agreements would exacerbate capture and reduce equilibrium informativeness –this is in spite of the negative externality that a perceived increased in capture has on other like-minded IPs.

19.1 Setup

Let s_i be the capture effort of IP i and $s = (s_1, ..., s_N)$ be the profile of IPs' capture efforts. Suppose that $\pi_i(s)$ is the likelihood that the $i-$IP captures the information source given capture efforts s. We assume that increasing capture efforts by an IP only increases its own chances of controlling the channel, i.e., $\partial \pi_i(s)/\partial s_j > 0$ if and only if $i = j$. Thus, increased pressure by the $i-$IP reduces the likelihood of capture by any other IP and also the likelihood of honest reporting.

19.2 Communication equilibria with Multiple IPs

How would the presence of like-minded IPs affect each IP's equilibrium reporting upon capture? The following Proposition shows that, for given capture efforts, communication equilibria are essentially equivalent to the case with two opposing IPs if we aggregate the likelihoods of capture for all IPs in the same class.

Proposition 21. *Consider a single news source and fix a profile of capture efforts s with $\pi_H(s) > 0$. Then, there are unique $\overline{\lambda}$, $\underline{\lambda}$, $\overline{m}^*$, and $\underline{m}^*$, with $\overline{\lambda} = \lambda_H(\overline{m}^*)$ and $\underline{\lambda} = \lambda_H(\underline{m}^*)$, so that for every communication equilibrium, with $\tau_i^*(m)$ IP is' equilibrium (mixed) strategy, we have*

1. $\cup_{i\in\mathscr{R}} support(\tau_i^*) = \{m : \lambda_H(m) \geq \overline{\lambda}\}$ and $\cup_{i\in\mathscr{L}} support(\tau_i^*) = \{m : \lambda_H(m) \leq \underline{\lambda}\}$.

2. *The equilibrium likelihood ratio of message m, $\lambda^*(m) \equiv \frac{\Pr[m|\theta=1]}{\Pr[m|\theta=-1]}$, satisfies*

$$\lambda^*(m) = \begin{cases} \underline{\lambda} & \text{if } m \leq \underline{m}^* \\ \lambda_H(m) & \text{if } \underline{m}^* < m < \overline{m}^*. \\ \overline{\lambda} & \text{if } m \geq \overline{m}^* \end{cases}$$

3. *The maximum and minimum likelihood ratios $\overline{\lambda} = \max\limits_{m\in\mathscr{M}} \lambda^*(m)$ and $\underline{\lambda} = \min\limits_{m\in\mathscr{M}} \lambda^*(m)$ satisfy*

$$\int_{\overline{\lambda}}^{\infty} \left(\lambda - \overline{\lambda}\right) dF_{H,-1}(\lambda) = \frac{\sum_{i\in\mathscr{R}} \pi_i(s)}{\pi_H(s)} \left(\overline{\lambda} - 1\right), \tag{82}$$

$$\int_{0}^{\underline{\lambda}} \left(\underline{\lambda} - \lambda\right) dF_{H,-1}(\lambda) = \frac{\sum_{i\in\mathscr{L}} \pi_i(s)}{\pi_H(s)} \left(1 - \underline{\lambda}\right). \tag{83}$$

Proof. Let $\tilde{\tau}_i(m)$ be citizens assessment of the probability that IP i sends m if it captures the source. Then, the perceived likelihood ratio $\lambda(m) \equiv \frac{\Pr[m|\theta=1]}{\Pr[m|\theta=0]}$ by a citizen is

$$\lambda(m) = \frac{\pi_H(s)p_1(m) + \sum_{i\in\mathscr{I}} \pi_i(s)\tilde{\tau}_i(m)}{\pi_H(s)p_{-1}(m) + \sum_{i\in\mathscr{I}} \pi_i(s)\tilde{\tau}_i(m)}, \tag{84}$$

and IP i's indirect utility from message m is

$$V_i(m) \equiv \int_0^1 v_i\left(\mu(m;p)\right) dF_p(p) = \int_0^1 v_i\left(\frac{p\lambda(m)}{1-p+p\lambda(m)}\right) dF_p(p) \tag{85}$$

Let τ_i be IP i's actual reporting strategy. Then, IP optimality requires by a similar argument as in the case of two IPs –see Proposition 1 in the main text– that if $m, m' \in supp\, \tau_i$ then $\lambda(m) = \lambda(m')$. Furthermore, if $i, j \in \mathscr{R}$ ($i, j \in \mathscr{L}$), then for any $m \in supp\, \tau_i$ and $m' \in supp\, \tau_j$ we have $\lambda(m) = \lambda(m')$. Otherwise, if, say, $\lambda(m) > \lambda(m')$ then (85) implies that $V_j(m) > V_j(m')$ –given that $|v_j'| > 0$– and we reach a contradiction as then $m' \notin supp\, \tau_j$.

Consider any $i \in \mathscr{R}$ and let $\tau_i^*(m)$ be its equilibrium strategy, and $\lambda^*(m) = \overline{\lambda}$ be the equilibrium perceived likelihood ratio for any message $m \in \cup_{i\in\mathscr{R}} support(\tau_i^*)$. We now show that $\cup_{i\in\mathscr{R}} support(\tau_i^*) = \{m : \lambda_H(m) \geq \overline{\lambda}\}$. Indeed, we must have $\{m : \lambda_H(m) \geq \overline{\lambda}\} \subset \cup_{i\in\mathscr{R}} support(\tau_i^*)$ as any m with $\lambda_H(m) > \overline{\lambda}$ would yield a strictly higher payoff to every IP in $\mathscr{R}$ if m is not sent by any IP in $\mathscr{R}$. Furthermore, any m with $\lambda_H(m) < \overline{\lambda}$ must have $\lambda^*(m) < \overline{\lambda}$ so m is not sent by any IP in $\mathscr{R}$. Finally, (84) implies that for any $m \in \cup_{i\in\mathscr{R}} support(\tau_i^*)$

$$\frac{\sum_{i\in\mathscr{R}} \pi_i(s)\tau_i(m)}{\pi_H(s)} \left(\overline{\lambda} - 1\right) = \left(\lambda_H(m) - \overline{\lambda}\right) p_{-1}(m).$$

Integrating over $\{m : \lambda_H(m) \geq \overline{\lambda}\}$ we obtain (82). A similar analysis on the supports and messages of IPs in $\mathscr{L}$ yields (83). $\square$

Proposition 21 shows that the presence of multiple IPs does not alter the communication patterns after capture for fixed levels of capture efforts. As like-minded IPs want to distort citizens' beliefs in the same direction, citizens regard them as interchangeable when interpreting the equilibrium message and their inference only depends on the aggregate probability of capture of each class of IPs. Proposition 21 is also consistent with like-minded IPs systematically sending different messages –for instance, an IP promoting green energy and an environmental IP may send different messages, albeit all their messages are interpreted in the same way by the audience. The key is that, given the similar interests of like-minded IPs, citizens expect them to distort messages in a similar way.

19.3 Incentives to Capture

While the presence of multiple IPs does not qualitatively change the nature of communication equilibria, it does affect the incentives to capture and, hence, the equilibrium informativeness of a captured information source. We first establish the effect of (anticipated) changes in capture effort on the ensuing communication equilibrium.

Lemma 10. *Consider the equilibrium in Proposition 21 as a function of the anticipated profile s, and suppose that for all $j \in \mathscr{R}$ and $k \in \mathscr{L}$,*

$$\frac{\partial}{\partial s_j}\left(\frac{\sum_{i\in\mathscr{L}}\pi_i(s)}{\pi_H(s)}\right) \geq 0 \text{ and } \frac{\partial}{\partial s_k}\left(\frac{\sum_{i\in\mathscr{R}}\pi_i(s)}{\pi_H(s)}\right) \geq 0. \tag{86}$$

Then, for all $i \in \mathscr{I}$, $\overline{\lambda}$ decreases and $\underline{\lambda}$ increases in s_i. That is, an increased in anticipated capture by any IP leads to a Blackwell-less informative equilibrium message.

Proof. If $j \in \mathscr{R}$ then $\frac{\partial}{\partial s_j}\left(\frac{\sum_{i\in\mathscr{R}}\pi_i(s)}{\pi_H(s)}\right) \geq 0$, as the numerator increases and the denominator decreases with s_j. Similarly, if $k \in \mathscr{R}$ then $\frac{\partial}{\partial s_k}\left(\frac{\sum_{i\in\mathscr{L}}\pi_i(s)}{\pi_H(s)}\right) \geq 0$. Combined with the conditions on the marginal likelihood ratio of capture (86), these imply that the right hand sides of (82) and (83) increase with s_j regardless of whether $j \in \mathscr{R}$ or $j \in \mathscr{L}$. Equilibrium then requires that $\overline{\lambda}$ must decrease (as well as $\overline{m}^*$) with s_j, while $\underline{\lambda}$ must increase (as well as $\underline{m}^*$) with s_j. The proof is complete by adapting Lemma 2 –which shows that that more captured sources are Blackwell-less informative when Assumption II holds– to this setting. □

What is the nature of competition to influence citizens? From lemma 10, increasing capture effort by any IP, be it like-minded or opposed, reduces the informativeness of the channel. This implies that, regardless of the preferences of other IPs, news-source capture is a game of strategic substitutes.

Proposition 22. *Let $B_i(s;\tilde{s})$ be IP i's marginal gain from capture when citizens assessment of IPs capture efforts is $\tilde{s}$. Suppose that the conditions in Lemma 10 are satisfied. Then, if for all $k,i,j \in \mathscr{I}$, with $i \neq j$,*

$$\frac{\partial^2 \pi_k}{\partial s_i \partial s_j} = 0, \tag{87}$$

then, for any $i \neq j$ we have

$$\frac{\partial B_i(s;\tilde{s})}{\partial \tilde{s}_j} \leq 0.$$

Proof. Let $V_i(\lambda) \equiv \int_0^1 v_i(\mu(\lambda,p))F_p(p)$. Given a capture effort profile s, citizens' assessment of IPs' capture strategies $\tilde{s}$, with an assessment of reporting strategies $\tilde{\tau}$ that is consistent with $\tilde{s}$ –see Proposition 21– IP-$i's$ expected utility is

$$Z_i(s;\tilde{s}) \equiv \sum_{j\in\mathscr{R}}\pi_j(s)V_i(\overline{\lambda}) + \sum_{j\in\mathscr{L}}\pi_j(s)V_i(\underline{\lambda}) + \pi_H(s)\mathbb{E}_H\left[V_i(\lambda);p_i\right] - C_i(s_i), \tag{88}$$

given that capture is followed by a sequentially rational reporting strategy as described in Proposition 21. If $B_i(s;\tilde{s})$ is IP i's marginal gain from capture, then

$$\begin{aligned}
B_i(s;\tilde{s}) &= \sum_{j\in\mathscr{R}} \frac{\partial \pi_j(s)}{\partial s_i} V_i(\overline{\lambda}) + \sum_{j\in\mathscr{L}} \frac{\partial \pi_j(s)}{\partial s_i} V_i(\underline{\lambda}) + \frac{\partial \pi_H(s)}{\partial s_i}\mathbb{E}_H\left[V_i(\lambda); i\right] \\
&= \left(\sum_{j\in\mathscr{R}} \frac{\partial \pi_j(s)}{\partial s_i}\right)\left(V_i(\overline{\lambda}) - \mathbb{E}_H\left[V_i(\lambda); i\right]\right) + \left(\sum_{j\in\mathscr{L}} \frac{\partial \pi_j(s)}{\partial s_i}\right)\left(V_i(\underline{\lambda}) - \mathbb{E}_H\left[V_i(\lambda); i\right]\right) \\
&= \left(\sum_{j\in\mathscr{R}} \frac{\partial \pi_j(s)}{\partial s_i}\right)\int_{\underline{\lambda}}^{\overline{\lambda}} V_i'(\lambda) F_H(\lambda; p_i) d\lambda - \left(\sum_{j\in\mathscr{L}} \frac{\partial \pi_j(s)}{\partial s_i}\right)\int_{\underline{\lambda}}^{\overline{\lambda}} V_i'(\lambda) \overline{F}_H(\lambda; p_i) d\lambda,
\end{aligned}$$

so that IP$-i$'s marginal expected utility from covertly increasing capture is $\frac{\partial Z_i(s;\tilde{s})}{\partial s_i} = B^i(s;\tilde{s}) - C_i'(s_i)$. Suppose that IP$-j$, $j \neq i$, marginally raises its capture effort and it is correctly anticipated by citizens. Then, the effect on $B_i(s;\tilde{s})$ is

$$\begin{aligned}
\frac{\partial B_i(s;\tilde{s})}{\partial s_j} + \left.\frac{\partial B_i(s;\tilde{s})}{\partial \tilde{s}_j}\right|_{s_j=\tilde{s}_j} &= \sum_{j\in\mathscr{R}} \frac{\partial^2 \pi_j(s)}{\partial s_i \partial s_j}\int_{\underline{\lambda}}^{\overline{\lambda}} V_i'(\lambda) F_H(\lambda; p_i) d\lambda - \sum_{j\in\mathscr{L}} \frac{\partial^2 \pi_j(s)}{\partial s_i \partial s_j}\int_{\underline{\lambda}}^{\overline{\lambda}} V_i'(\lambda) \overline{F}_H(\lambda; p_i) d\lambda \\
&+ \left(\sum_{j\in\mathscr{R}} \frac{\partial \pi_j(s)}{\partial s_i}\right)\left(V_i'(\overline{\lambda}) F_H(\overline{\lambda}; p_i)\frac{\partial \overline{\lambda}}{\partial \tilde{s}_j} - V_i'(\underline{\lambda}) F_H(\underline{\lambda}; p_i)\frac{\partial \underline{\lambda}}{\partial \tilde{s}_j}\right) \\
&- \left(\sum_{j\in\mathscr{L}} \frac{\partial \pi_j(s)}{\partial s_i}\right)\left(V_i'(\overline{\lambda}) \overline{F}_H(\overline{\lambda}; p_i)\frac{\partial \overline{\lambda}}{\partial \tilde{s}_j} - V_i'(\underline{\lambda}) \overline{F}_H(\underline{\lambda}; p_i)\frac{\partial \underline{\lambda}}{\partial \tilde{s}_j}\right) \\
&= \left(\sum_{j\in\mathscr{R}} \frac{\partial \pi_j(s)}{\partial s_i}\right)\left(V_i'(\overline{\lambda}) F_H(\overline{\lambda}; p_i)\frac{\partial \overline{\lambda}}{\partial \tilde{s}_j} - V_i'(\underline{\lambda}) F_H(\underline{\lambda}; p_i)\frac{\partial \underline{\lambda}}{\partial \tilde{s}_j}\right) \\
&- \left(\sum_{j\in\mathscr{L}} \frac{\partial \pi_j(s)}{\partial s_i}\right)\left(V_i'(\overline{\lambda}) \overline{F}_H(\overline{\lambda}; p_i)\frac{\partial \overline{\lambda}}{\partial \tilde{s}_j} - V_i'(\underline{\lambda}) \overline{F}_H(\underline{\lambda}; p_i)\frac{\partial \underline{\lambda}}{\partial \tilde{s}_j}\right)
\end{aligned}$$

where the last equality uses (87).

Suppose that $i \in \mathscr{R}$. Then, $V_i'(\lambda) > 0$ and $\sum_{j\in\mathscr{R}} \frac{\partial \pi_j(s)}{\partial s_i} \geq 0 \geq \sum_{j\in\mathscr{L}} \frac{\partial \pi_j(s)}{\partial s_i}$. As lemma 10 implies that $\frac{\partial \overline{\lambda}}{\partial \tilde{s}_j} \leq 0$ and $\frac{\partial \underline{\lambda}}{\partial \tilde{s}_j} \geq 0$ we have that $\frac{\partial B^i(s;\tilde{s})}{\partial s_j} + \left.\frac{\partial B^i(s;\tilde{s})}{\partial \tilde{s}_j}\right|_{s_j=\tilde{s}_j} \leq 0$. Similarly, for the case that $i \in \mathscr{L}$ we have that $V_i'(\lambda) < 0$, $\sum_{j\in\mathscr{R}} \frac{\partial \pi_j(s)}{\partial s_i} \leq 0 \leq \sum_{j\in\mathscr{L}} \frac{\partial \pi_j(s)}{\partial s_i}$. These observations, coupled with Lemma 10, imply again that $\frac{\partial B^i(s;\tilde{s})}{\partial s_j} + \left.\frac{\partial B^i(s;\tilde{s})}{\partial \tilde{s}_j}\right|_{s_j=\tilde{s}_j} \leq 0$. $\square$

19.4 Effect of Like-Minded IP Coordination on Equilibrium Capture.

Does the presence of multiple like-minded IPs exacerbate capture? What would happen if like-minded IPs coordinated capture resources in an effort to maximize their joint payoff? We now investigate these questions by comparing equilibrium capture of a single information source under two regimes. First, we study equilibria in which multiple IPs separately compete to capture the source. We then compare those equilibrium outcomes to equilibria where a representative IP for each class selects a profile of capture efforts, one for each IP in the class, in order to maximize their joint payoff.[67]

We show that competition between colluding special interest groups increases equilibrium capture and reduces source informativeness. This is in spite of the negative congestion externality in communication described in Lemma 10. The reason is that this congestion externality only operates through citizens anticipation of the level of capture. For fixed citizens' assessment of IPs capture, IPs from each class face a public-good problem as they each benefit privately from capture by one of its members. Thus, the representative $R-$IP or $L-$IP will always have a higher incentive to capture the source given citizens' assessment. If equilibria can be Blackwell-ranked, then collusion unambiguously reduces source equilibrium informativeness.

Proposition 23. *In a linear contest model, $\pi_i(s) = s_i$, with strictly convex costs $C_i(s_i)$, consider a monopoly information source with two possible regimes: S and C. Under S(eparation), all IPs select capture efforts independently. Under C(ollusion), all like-minded IPs coordinate their capture efforts to maximize the sum of their utilities. Then, there is no equilibrium capture under C that results in a strictly (Blackwell) more informative message than under S.*

Proof. Recall that $Z_i(s;\tilde{s})$ in (88) is IP$-i$'s expected utility when covertly capturing the source if the profile of capture efforts is s, citizens anticipate a capture profile $\tilde{s}$, and capture is followed by a sequentially rational reporting strategy. Then, a representative IP for class $\mathscr{R}$ ($\mathscr{L}$) selects s_i with $i \in \mathscr{R}$ ($i \in \mathscr{L}$) to maximize $Z^R(s;\tilde{s})$ ($Z^L(s;\tilde{s})$) where

$$Z^R(s;\tilde{s}) \equiv \sum_{i\in\mathscr{R}} Z_i(s;\tilde{s}) \text{ and } Z^L(s;\tilde{s}) \equiv \sum_{i\in\mathscr{L}} Z_i(s;\tilde{s}).$$

[67] From Proposition 21, for any profile of anticipated capture efforts, the equilibrium reporting strategies of a representative $R-$ and $L-$ would be the same as independent IPs. Therefore, the only difference between collusive and independent interest groups is in their choice of capture efforts.

Let $\tilde{\Psi}_i(s_{-i};\tilde{s})$ be $-i$'s best-response correspondence given citizens' assessment $\tilde{s}$ and the profile of capture efforts s

$$\tilde{\Psi}_i(s_{-i};\tilde{s}) \equiv \{s_i : Z_i(s_i, s_{-i};\tilde{s}) \geq Z_i(s_i', s_{-i};\tilde{s}), s_i' \in X_i\},$$

and $\tilde{\Psi}^S(s;\tilde{s}) \equiv (\tilde{\Psi}_i(s_{-i};\tilde{s}))_{i\in\mathscr{I}}$. Letting $s_R \equiv (s_i)_{i\in\mathscr{R}}$ and $s_L \equiv (s_i)_{i\in\mathscr{L}}$, consider now the collusive regime and define the best response correspondence $\tilde{\Psi}^C(s;\tilde{s})$ where,

$$\tilde{\Psi}^C(s;\tilde{s}) \equiv \{\tilde{\Psi}_R(s_L;\tilde{s}), \tilde{\Psi}_L(s_R;\tilde{s})\}.$$

with

$$\tilde{\Psi}_R(s_L;\tilde{s}) \equiv \{s_R : \sum_{i\in\mathscr{R}} Z_i(s_R, s_L, \tilde{s}) \geq \sum_{i\in\mathscr{R}} Z_i(s_R', s_L, \tilde{s}), s_R' \in \Pi_{i\in\mathscr{R}} X_i\}$$
$$\tilde{\Psi}_L(s_R;\tilde{s}) \equiv \{s_L : \sum_{i\in\mathscr{L}} Z_i(s_R, s_L, \tilde{s}) \geq \sum_{i\in\mathscr{L}} Z_i(s_R, s_L', \tilde{s}), s_L' \in \Pi_{i\in\mathscr{L}} X_i\}$$

Finally, let $\Psi^S(s) \equiv \tilde{\Psi}^S(s;s)$ and $\Psi^C(s) \equiv \tilde{\Psi}^C(s;s)$ be the citizen-consistent best-response correspondences when citizens are correctly anticipating other IPs effort levels. Note that s^* is a pure-strategy-in-capture-efforts equilibrium for regime $k \in \{S, C\}$ if and only if $s^* \in \Psi^k(s^*)$, that is, s^* is a fixed point of the restriction of $\tilde{\Psi}^k$ to the set $\{(s;\tilde{s}) : s = \tilde{s}\}$. Existence of pure-strategy-in-capture-efforts is established under standard arguments exploiting the continuity of $\Psi^i(s)$, $i = S, C$.

We now show that both Ψ^S and Ψ^C are actually single-valued (i.e., they are functions), decreasing in s, but Ψ^C is higher than Ψ^S. First, the assumption of strict convexity of costs and the linear contest functions implies that $Z_i(s_i, s_{-i};\tilde{s})$ is strictly concave in s_i and independent of s_{-i}, so that $Z^R(s;\tilde{s})$ ($Z^L(s;\tilde{s})$) is strictly concave in s_R (s_L). Second, as $\overline{\lambda}$ decreases, and $\underline{\lambda}$ increases, with $\tilde{s}_i, i \in \mathscr{I}$, then $Z_i(s;\tilde{s})$ decreases in $\tilde{s}$. Thus, the best responses $\tilde{\Psi}^k(s;s)$ $k \in \{S, C\}$ decrease in $(s, \tilde{s})$, and so do their restrictions to the set $\{s = \tilde{s}\}$. Third, for any $(s;\tilde{s}) \in \Pi_{i\in\mathscr{I}} X_i \times \Pi_{i\in\mathscr{I}} X_i$, $\tilde{\Psi^I}(s;\tilde{s}) \leq \tilde{\Psi^C}(s;\tilde{s})$. Indeed, under the assumption $\pi_i(s) = s_i$ we have that for $i \in \mathscr{R}$, $-i$'s marginal return from capture given $(s, \tilde{s})$ is

$$\frac{\partial Z_i(s,\tilde{s})}{\partial s_i} = \int_{\underline{\lambda}}^{\overline{\lambda}} V_i'(\lambda) F_H(\lambda; p_i) d\lambda - C_i'(s_i), \tag{89}$$

where the first term only depends on $\tilde{s}$ through $\overline{\lambda}$ and $\underline{\lambda}$. The representative R−IP would instead evaluate a higher marginal return of

$$\sum_{j\in\mathscr{R}}\frac{\partial Z_j(s,\tilde{s})}{\partial s_i}=\int_{\underline{\lambda}}^{\overline{\lambda}}\left(\sum_{j\in\mathscr{R}}V_j'(\lambda)F_H(\lambda;p_j)\right)d\lambda-C_i'(s_i). \tag{90}$$

Thus, the representative $R-$IP best response facing the same citizens' assessment (i.e., the same $\overline{\lambda}$ and $\underline{\lambda}$) would be higher than that of the independent IPs.

Let s^S and s^C be capture equilibria under regime S and C. Equilibrium s^C leads to a strictly Blackwell more-informative source than under s^S if and only if

$$\sum_{i\in\mathscr{K}}s_i^C\leq\sum_{i\in\mathscr{K}}s_i^S,\ \mathscr{K}\in\{\mathscr{R},\mathscr{L}\}, \tag{91}$$

with at least one of these inequalities strict–see Proposition 21. We now show that no pair of equilibria can satisfy (91). To see this, note that (91) with (89) and (90) imply that $\tilde{\Psi}^C(s^C;s^C)\geq\tilde{\Psi}^C(s^S;s^S)$. But then, using the fact Ψ^C is higher than Ψ^S, we have

$$s^C=\tilde{\Psi}^C(s^C;s^C)\geq\tilde{\Psi}^C(s^S;s^S)\geq\tilde{\Psi}^S(s^S;s^S)=s^S,$$

which implies that $\sum_{i\in\mathscr{K}}s_i^C\geq\sum_{i\in\mathscr{K}}s_i^S,\ \mathscr{K}\in\{\mathscr{R},\mathscr{L}\}$, thus reaching a contradiction. □

Like-minded IPs face a public-good problem: if one gains control of the source, it will select the message favored by all other IP in the same class. As citizens interpret messages according to the anticipated level of capture, a collusive regime would always respond with a higher level of capture to any citizen assessment of capture. There may be cases in which the resulting equilibria may not be Blackwell-ranked. Alas, if they are, the source is more informative when independent, uncoordinated IPs compete for capture.