Indifferent Public, Passionate Advocates, and Strategic Media

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Abstract

We present a dynamic reputation model of news reporting by a profit-maximizing media outlet whose credibility is uncertain to the public. In each period, the media outlet chooses its source of news: a costly independent investigation or, possibly, a free report prepared by an interest group. The revenue of the media outlet consists of the subscription fees for the public and the access fees for interest groups. We characterize the equilibrium structure of information transmission with and without disclosure of the source of the news to the public. In particular, we demonstrate that uncertainty about the source of the news may *increase* the probability of independent investigation by the media outlet. Nevertheless, the probability of correct decisions by the public and the profit of the media outlet *decreases* when the media outlet can be paid for reporting the news by the interest group without disclosing this to the public.

JEL Codes: D72, D82.

Key Words: media ethics, strategic information transmission, reputation.

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> The public is misled by individuals who present themselves to be independent, unbiased experts or reporters, but are actually shills promoting a prepackaged corporate agenda. ... Shoddy practices make it difficult for viewers to tell the difference between news and propaganda.
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> Statement of FCC Commissioner Adelstein, August 14, 2006

1 Introduction

There is a growing concern in the United States and worldwide about news organizations broadcasting information provided by third parties with special interests, unbeknownst to their listeners. In this paper, we investigate whether and how repeated interactions and reputational concerns affect incentives for news organizations to acquire and provide truthful information, with and without the requirement that they disclose the source of their information.

According to a survey of marketing executives, half of them admit to paying for broadcast or editorial placement of products, and half the remaining say they would consider doing so.[1] Two studies in 2006 by a media watchdog organization, Center for Media and Democracy, [13], [14], uncovered TV stations' widespread and undisclosed use of video news releases prepared by third parties. Empirical research has also documented evidence of news organizations making reports biased in favor of groups financially involved with them. For example, Reuter and Zitzewitz [34] find that recommendations of mutual funds are positively correlated with past advertising in personal finance publications.

We develop a dynamic reputation model of news reporting by a profit-maximizing newspaper whose credibility is uncertain to the public. In each period, the newspaper chooses its source of news: a costly independent investigation or, possibly, a free report prepared by an interest group. The newspaper derives its revenue from subscription fees for the public and access fees for interest groups. The public reads the news and chooses an action that affects its payoff and the interest group's payoff. Finally, the public learns which action would have been optimal and updates its belief about the credibility of the newspaper.

[1] The survey was conducted by the magazine PRweek and the PR company Manning Selvage & Lee in 2006, see [38].

In this paper, we follow the adverse-selection approach to reputation. To model credibility of the newspaper, we introduce the possibility of a truthful (non-profit-maximizing) type who always conducts an independent investigation and reports its findings truthfully. We allow the probability of this type to be arbitrarily small and characterize stationary Markov perfect equilibria for every discount factor.

We focus on environments where the public's stake in the issue is not strong enough for it to be willing to fully finance the cost of investigation. We show that even though the strategic newspaper never investigates and reports truthful information if disclosure of the source of its news is required, it does do so when such disclosure is not required.

Nevertheless, the quality of decisions by the public decreases under non-dsclosure. In equilibrium, the public behaves cautiously and ignores the newspaper's reports until its credibility becomes sufficiently high. Unfortunately, once the newspaper achieves credibility it publishes propaganda of the special interest group. Thus, in equilibrium the public ignores the informative reports in the early stages of the game and, if the profit-maximizing newspaper succeeds in building its reputation, follows the uninformative reports prepared by the interest group. Furthermore, the profit of the newspaper does not increase under non-dsiclosure either. Hence, although non-disclosure creates the market for the strategic newspaper by providing incentives to acquire and report truthful information, this market is wasteful.

Our results give support to the demands by media watchdogs and policy makers for stricter disclosure policies, as both the profits of the nespaper and the quality of the decisions by the public improve under disclosure of the source of the news. This conclusion, however, is based on a number of strong assumptions, the most important of which are: the structure of preferences and information, the absence of competition among media outlets, and the specific solution concept we employ to obtain explicit characterization of the equilibrium. Although we comment on these and other features of the model throughout the paper, the robustness of our results should be explored in future research.[2]

To the best of our knowledge, our paper is the first to explicitly model the reputation of media organizations in a repeated-games framework. We also make a technical contribution by providing a procedure that yields an *explicit* characterization of the (stationary Markov perfect) equilibrium for *any* discount factor, which allows

[2]For example, in Section 9, we consider a version of the model in which the newspaper has high initial reputation and the stakes of the interest group vary over time and could be zero. In this environment, the quality of decision by the public could be higher under no disclosure.

for better understanding of the parties' behavior and provides sharp comparative statics results.

In this paper, we focus on media markets. Nevertheless, the issues considered here are pertinent to other environments in which the public or a decision maker relies on the information provided by an intermediary, which can be captured by special interests. These settings could include (i) an investor, a financial analyst, and the issuer of an asset, (ii) regulator, a research center, and a regulated company, (iii) government, a government agency, and a lobby, etc.

The rest of the paper is organized as follows. Section 2 discusses related literature. In Section 3, we present the model. We characterize the equilibrium in the model with disclosure in Section 4 and in the model without disclosure in Section 5. The results are discussed in Section 6. In Section 8, we present a version of our model where the truthful type is replaced with a strategic type with low cost of investigation. In Section 9, we consider a version of the model in which the stakes of the interest group vary over time. In Section 10, we discuss some other possible modifications of the model. In Section 11, we conclude.

2 Related Literature

Our model can be viewed as an extension of Sobel's [36] model of reputational cheap-talk between an expert and a decision maker, where we allow the bias of the expert (the newspaper) to arise endogenously and vary over time. We also make endogenous information that is available to the expert. We compare our papers in more detail in Section 10.1.[3]

A growing literature explores multiple models in which media outlets have incentives to distort their news reports. Besley and Prat [7], for example, assume that media outlets can be paid by a politician interested in suppressing bad news. In their model, the information is verifiable, although there is uncertainty about whether the media outlets have any information. Moreover, there are no reputation concerns.

[3]There is a number of other papers exploring effects of reputation on cheap-talk communication. Bénabou and Laroque [6], for example, further develop Sobel's model by allowing the expert to have imperfect information. The reputation concerns about the expert's preferences are also studied by Morris [26] and Frisell and Lagerlöf [15]. Ottaviani and Sorensen [29] [30] [31] assume that the expert is concerned about appearing well-informed. Finally, Olszewski [28] considers the case where the expert would like to appear honest. In papers by Kim [21], Park [32], and Stocken [37], there is complete information about the type of the sender and reputation is interpreted as choosing an equilibrium action. Their main focus is the amount of information transmission between the parties.

Anderson and McLaren [3] analyze incentives for competing media outlets to merge and, in particular, the effects of mergers on the information reported to the public. Mullainathan and Shleifer [27] assume that readers have a preference for news that confirms their prior beliefs and, in equilibrium, media outlets choose to slant their news accordingly. Finally, Gentzkow and Shapiro [20] present a reputation model in which there is uncertainty about the quality of the information possessed by a media outlet. They show that reputation concerns might drive the media outlet to distort news in favor of readers' prior beliefs. Our paper complements this literature by providing an *explicit* model of reputation dynamics of a media outlet under the possibility of capture and analyzing the impact of different disclosure policies on the quality of information supplied by the media outlet and decisions made by the public.

Finally, the newspaper in our model can be interpreted as a platform in a two-sided market, which brings together the special interest group and the public, and hence is indirectly connected with the recent work on media as a two-sided market.[4]

3 Model

There are three players: a newspaper (she), a reader (he), and an interest group (it). There are infinitely many periods. The newspaper is a long-lived player with a discount factor $\delta \in (0,1)$. The reader and the interest group are short-lived players; they maximize their current period payoff.

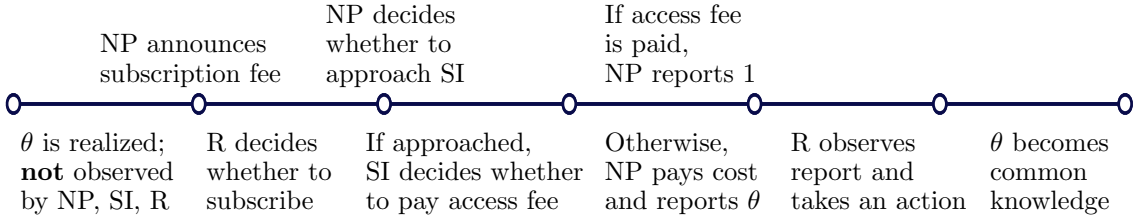

Figure 1: Timing of the stage game. Notation: NP – the newspaper, R – the reader, SI – the special interest group. If the reader does not subscribe, he does not receive any report from the newspaper and takes optimal action given his prior.

[4]Some of the recent contributions in this literature are Anderson and Coate [1], Choi [8], Crampes, Haritchabalet, and Jullien [9], Cunningham and Alexander [11], Ferrando, Gabszewicz, Laussel, and Sonnac [12], Gabszewicz, Laussel, and Sonnac [16], [17], [18], Gal-Or and Dukes [19], Peitz and Valletti [33]. In addition, an overview of the two-sided approach to media markets is provided by Anderson and Gabszewicz [2]. Finally, for a survey of the economics of advertisement including prior literature see Bagwell [5]. For a general analysis of two-sided markets see, for example, Armstrong [4] and Rochet and Tirole [35] and their references.

The timing of the game played in each period is as follows (see Figure 1). First, at the beginning of each period, the state of nature, θ, is realized. The state is a random variable taking a value of either 0 or 1 and is independent across periods. Let q be the probability of $\theta = 1$. We assume that

$$q < 1/2.$$

The state is not immediately observable to the newspaper, the reader, or the interest group.

After the state is realized, the newspaper announces a subscription fee, ϕ, upon which the reader decides whether to pay the fee and subscribe to the newspaper. If the reader subscribes, the newspaper provides a report to the reader. She can obtain the report from two sources.[5] First, it can obtain a report through journalistic investigation at cost c, which yields the true state with certainty. Alternatively, it can charge the interest group an access fee, α, and choose the report prepared by the interest group.[6] After the reader observes the report, he takes an action $y \in \{0, 1\}$. We will consider two versions of the game, with and without mandatory disclosure of the source of the report to the reader.

If the reader does not subscribe to the newspaper, then he bases his action only on his prior beliefs. At the end of each period, all players observe the true state, and the current-period payoffs are realized. We also assume that beliefs about the credibility of the newspaper are perfectly passed on to future generations of short-lived players.

The action taken by the reader affects both his own and the interest group's payoff. The interest group prefers high actions and its utility function $\tilde{U}$ can be expressed as

$$\tilde{U}(y) \quad = \quad \lambda y - \alpha,$$

where $\lambda \geq 0$ measures the interest group's stake on the issue and α is the access fee paid to the newspaper. Observe that it is natural for the interest group to report

[5] In our model, the newspaper cannot shut down and cannot make up reports; she has to investigate and report the truth if the reader has subscribed and the interest group does not provide a report. In Section 10.4, we consider a two-period version of the model in which shutdown and cheap-talk messages are possible. Also, we discuss an alternative view of investigation in Section 10.3.

[6] Our assumption that the newspaper can accept money from interest groups to give them favorable reports should be viewed as a modelling shortcut. In reality, though monetary payments might not be observed, a newspaper can implicitly benefit from advertising commitments, access to interviews, etc.

high state whenever it is approached by the newspaper; we will assume that this is always the case.[7]

The reader prefers the action that matches the state of the nature and his utility function U can be expressed as

$$U(y,\theta) = \begin{cases} 1-\phi, & y=\theta; \\ -\phi, & \text{otherwise,} \end{cases}$$

where ϕ is the subscription fee paid to the newspaper.

The newspaper is not affected by the reader's action and maximizes her revenue net of the costs of investigation.

We follow the adverse-selection approach to reputation. To model the newspaper's credibility, we introduce the possibility of a truthful type which always chooses investigation. We further assume that this type will set the same fees as the strategic type.[8] It is commonly known that the newspaper is of the truthful type with probability $p_1 \in (0,1)$. We call p_1 the prior reputation of the newspaper. The reputation of the newspaper in period t is the probability with which the reader believes it to be of the truthful type, denoted by p_t.

We see these assumptions as a modeling shortcut that helps us avoid issues not central to our analysis. In Section 8, we replace the truthful type by a strategic (payoff) type who has a lower cost of investigation. We show that for some cost parameters there exist equilibria observationally equivalent to the equilibria in the model with the truthful type.

In our model, the possibility of a truthful type does not increase the payoff of the newspaper. At the same time, it affects the behavior of the parties. In particular, whenever the fees that can be collected by the newspaper are smaller than the cost of investigation, information acquisition is impossible in the model without uncertainty about the type of the newspaper.[9] This is not so if there is a possibility of the truthful type.

Our solution concept is stationary Markov perfect equilibrium, in which the Markov state is the reader's belief about the type of the newspaper. In this equi-

[7]This is without loss of generality in the sense that the interest group never strictly prefers the report 0 to 1. In addition, realistically, though not explicit in our model, the interest group's report is not costless to generate. It would not have spent resources to generate a report that would never enhance its interest.

[8]Alternatively, one can assume that there is a set of types with every possible pricing strategy, all of which are committed to investigation. Then, in each equilibrium the non-truthful type mimics one of these commitment types.

[9]This result is shown in Section 10.5.

librium, the past play may influence the future play only through the newspaper's reputation; the players' actions must be independent of the other aspects of the history. The equilibrium is stationary because the actions do not depend on the length of history either.[10] Finally, we focus on equilibria in which the newspaper sets the subscription and access fees equal to the maximum willingness to pay of the parties. We will demonstrate that equilibria that satisfy these conditions exist.

4 Disclosure

We start with analysis of the benchmark model in which the source of the report is disclosed to the reader. Our main interest is in the equilibria in which the newspaper investigates with the highest probability.

Imagine that in equilibrium the strategic newspaper investigates with probability 1. Hence, the reader will be able to always take the correct action and achieve a payoff of 1 if he subscribes to the newspaper. On the other hand, the reader will obtain a payoff of $1-q$ if he does not subscribe and takes action according to his prior beliefs. In equilibrium, the newspaper will charge the subscription fee equal to the difference of these payoffs, q. Then, her expected payoff equals

$$v \;=\; -c+q+\delta v = \frac{-c+q}{1-\delta}.$$

If the newspaper deviates and does not investigate, she will save the cost c, but has to take the report from the interest group. Furthermore, because of disclosure this deviation will be observed by the reader. The strongest punishment for this deviation is the continuation equilibrium in which the reader ignores the reports of the newspaper and the newspaper never investigates and obtains the payoff of 0. Hence, the newspaper will find it optimal to investigate with probability 1 if and only if $c \leq \delta v$ or, equivalently, if the discounted value of the subscription fee is greater than the cost of investigation, $c \leq \delta q$.

Lemma 1. *There exists an equilibrium in which the newspaper always chooses investigation on the equilibrium path if and only if* $c \leq \delta q$.

If $c \geq \delta q$, the cost of investigation is greater than the maximal benefit from investigation making it optimal for the newspaper to always choose propaganda.

[10] See Section 5.5.2 of Mailath and Samuelson [24] for a definition of stationary Markov perfect equilibrium. Although the game we study does not belong to the class of games considered therein, their definition extends straightforwardly to our setting.

Lemma 2. *There exists an equilibrium in which the newspaper always chooses propaganda if and only if $c \geq \delta q$. Furthermore, there is no equilibrium in which the newspaper chooses investigation with non-zero probability if $c > \delta q$.*

Proof. The proof of existence is straightforward. Let us prove uniqueness. Denote by v_t the continuation payoff of the newspaper in period t. Consider a newspaper with zero reputation, on or off the equilibrium path, in period t. Because the nodes of the game in which the newspaper has zero reputations are in fact root nodes of proper subgames, its reputation cannot increase in subsequent periods. Hence, $v_{t+1} \leq \max\left\{\frac{q-c}{1-\delta}, 0\right\}$. Observe that, by the assumption on the cost, $-c + \delta v_{t+1} < 0$, implying that investigation is not optimal in the current period. This proves that $v_t = 0$ if the newspaper is believed to be strategic.

Now consider a newspaper with positive reputation. Imagine that it chooses investigation in the current period t. If it never chooses propaganda in the future, then $v_{t+1} \leq \frac{q-c}{1-\delta}$. If it chooses propaganda in period $t+k+1$ and investigation in the prior periods, then $v_{t+k+2} = 0$ and $v_{t+1} \leq \frac{1-\delta^k}{1-\delta}(q-c) + \delta^k q$. In either case, we have $-c + \delta v_{t+1} < 0$. □

5 No disclosure

We now turn to the model in which the source of the report is not disclosed to the reader. Similar to the model with disclosure, if the cost of investigation is sufficiently low, there is an equilibrium in which the newspaper always chooses investigation. Let

$$c_* \quad = \quad \frac{\delta(1-q)q}{1-\delta q} - \frac{\lambda(1-q)(1-\delta)}{1-\delta q}.$$

Lemma 3. *There exists an equilibrium in which the newspaper always chooses investigation on the equilibrium path if and only if $c \leq c_*$.*

Proof. The proof is straightforward and is therefore skipped. □

Observe that c_* is increasing in δ. Hence, similar to the model with disclosure, perpetual investigation becomes sustainable for a larger set of costs as the newspaper becomes more patient. At the same time, $c_* < \delta q$, implying that perpetual investigation is feasible for a smaller set of costs under no disclosure than under disclosure.

This is because without disclosure a deviation of the newspaper to propaganda remains undetected whenever $\theta = 1$, making it more difficult to provide incentives for the newspaper to choose investigation.

On the other hand, if the cost of investigation is sufficiently high, there is a unique equilibrium with propaganda. Let

$$c^* = \frac{\delta(1-q)q}{1-\delta q} + \frac{\delta\lambda(1-q)^2}{1-\delta q}.$$

Lemma 4. *There exists an equilibrium in which the newspaper always chooses propaganda if and only if $c \geq c^*$. This equilibrium is unique if $c > c^*$.*

Proof. The proof of existence is straightforward. The proof of uniqueness is analogous to the proof in Lemma 2 and is skipped. □

Consider now an environment in which the cost of investigation is medium,

$$c_* < c < c^*.$$

Observe that c_* is decreasing in λ, and c^* is increasing in λ and therefore the range of costs that satisfies this condition is also increasing in λ.

In this environment, there is no equilibrium in which the newspaper chooses investigation with probability 1. Nevertheless, as Proposition 1 below demonstrates, there exists an equilibrium in which the newspaper chooses investigation sometimes. Furthermore, the equilibrium is essentially unique. In this equilibrium, the strategic newspaper randomizes between costly investigation and propaganda whenever its reputation is low and non-zero. Costly investigation increases the future reputation of the newspaper and, as a result, the expected future revenue from the fees collected from the reader and the interest group. In equilibrium, the current cost of investigation is equal to the additional revenues expected in the future, which makes randomization an equilibrium action. After the newspaper reaches high reputation, it stops acquiring information and publishes reports received from the interest group.

We now explain how we construct the equilibrium. Let p denote the newspaper's reputation, $r(p)$ the probability with which the reader believes this newspaper chooses costly investigation, and $v(p)$ the newspaper's expected payoff. Furthermore, denote by $v^1(p)$ and $v^0(p)$ the continuation payoff of the newspaper in the next period if it

provides a correct report in high and low state respectively. Finally, note that the payoff of a newspaper with reputation 0 is 0.[11]

Now, consider the incentives of the newspaper deciding between propaganda and investigative journalism. If the newspaper chooses propaganda, then it receives the access fee from the interest group for the current period, $\alpha(p, r)$. Therefore, the benefit from propaganda, net of the sunk subscription fee, is the sum of the access fee and the discounted continuation payoff after the correct report if the state is high,

$$\mathcal{P}(p, r) \quad = \quad \alpha(p, r) + \delta q v^1(p).$$

On the other hand, if the newspaper chooses investigative journalism, it gets no access fee and incurs the cost of investigation, c. Therefore, the benefit from investigation is

$$\mathcal{I}(p, r) \quad = \quad -c + \delta q v^1(p) + \delta(1 - q)v^0(p).$$

Hence, the net benefit of investigation *relative* to propaganda is the discounted value of reputation after state 0 minus the investigation cost and the access fee,

$$\mathcal{L}(p, r) \quad = \quad -c - \alpha(p, r) + \delta(1 - q)v^0(p).$$

Next, we demonstrate that if the newspaper's reputation is sufficiently high, $p > p^*$, the net benefit of investigation is negative and the newspaper will always choose propaganda. This is done in two steps. First, we can bound from above the value of payoff v^0. In the meantime, for the newspaper with a high reputation, the value of the access fee is very high, $\alpha(p, r) = \lambda(1 - q)$, which makes investigation unattractive. This is ensured by the assumption $c > c_*$.

If the newspaper's reputation is low, $p < p^*$, she must mix and hence be indifferent between investigation and propaganda, $\mathcal{L}(p, r) = 0$. Again, this can be shown in two steps. First, it cannot be that the newspaper always chooses propaganda. This is ensured by the assumption $c < c^*$ and the value of reputation 1, which can be calculated from our conclusion that the newspaper with a reputation higher than p^* always chooses propaganda. Next, it cannot be that the newspaper always chooses investigative journalism: if this were the case, her reputation would not change over time and her payoffs from investigative journalism and propaganda would be the same as those of the newspaper with reputation 1; yet, the newspaper with reputation 1 never chooses investigation in equilibrium.

[11] Whenever a newspaper's report fails to match the state of the nature, it is revealed to be the strategic type. Therefore, "zero reputation" nodes are in fact root nodes of subgames. Hence, subgame perfection and stationarity dictate that a newspaper with reputation 0 choose propaganda and collect zero fees.

We construct the rest of the equilibrium recursively. We know the behavior of the newspaper with high reputation and hence the continuation payoff v^0 for all $p \in (p^*, 1]$. This allows us to find pairs of p and r satisfying $\mathcal{L}(p, r) = 0$ for some interval $p \in ((p^*)^2, p^*]$. Next, we calculate the continuation payoffs for the newspaper with reputation in this interval. This allows us to find pairs of p and r satisfying $\mathcal{L}(p, r) = 0$ and continuation payoffs for another interval, and so on.

We now describe the value of reputation in equilibrium. Let

$$w = \frac{\delta(1-q)}{1-\delta q}.$$

and assume that $p \in ((p^*)^{n+1}, (p^*)^n)$ for some $n \in \{0, 1, \dots\}$.[12] Then, the payoff of the newspaper equals

$$v(p) = \max\left\{-\frac{c}{1-\delta q}\frac{1-w^n}{1-w} + w^n \frac{\left(\frac{p}{(p^*)^n} + \lambda - 1\right)(1-q) + q}{1-\delta q}, 0\right\}. \quad (1)$$

The value of $v(p)$ is depicted in Figure 2.

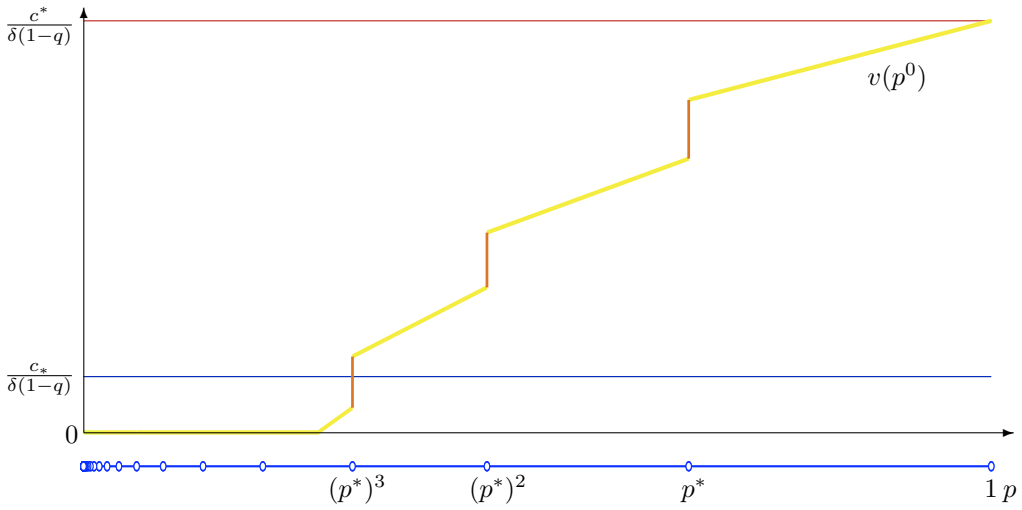

Figure 2: The horizontal axis represents the reputation. The vertical axis represents the payoff of the newspaper. The parameters are: $q = \frac{1}{4}$, $c = \frac{7}{20}$, $\delta = 0.95$, $\lambda = 1.4$.

In order to state the probability of investigation in the equilibrium, let $\overline{n}$ be the largest integer for which $v(p) > 0$ and $p \in ((p^*)^{\overline{n}+1}, (p^*)^{\overline{n}})$. Moreover, if $v((p^*)^{\overline{n}+1}) >$

[12] If $p = (p^*)^n$, $n \in \{1, \dots\}$, the payoff depends on the probability with which the reader follows the newspaper's reports if its reputation is $p = p^*$. There could be multiple equilibria which differ in this probability; we describe the set of probabilities for which the equilibrium exists in the body of the proof of Proposition 1.

0 set $\tilde{p} = (p^*)^{\overline{n}+1}$. If $v((p^*)^{\overline{n}+1}) = 0$, there must exist a maximum value $p \in [(p^*)^{\overline{n}+1}, (p^*)^{\overline{n}})$ for which $v(p) = 0$, in which case set $\tilde{p} = p$.[13] In equilibrium, the newspaper chooses investigation with probability

$$r(p) = \begin{cases} 0, & \text{if } p \geq p^*; \\ \frac{p^*-p}{1-p}, & \text{if } \tilde{p} \leq p < p^*; \\ \frac{p}{1-p}\frac{p^*-\tilde{p}}{\tilde{p}}, & \text{if } p < \tilde{p}. \end{cases} \tag{2}$$

Proposition 1. *Let $c_* < c < c^*$. There exists an equilibrium. Furthermore, in any equilibrium, (1) and (2) are satisfied. In addition, there exists an equilibrium in which (1) and (2) are satisfied if $c = c^*$.*

Proof. See the appendix. □

6 Disclosure versus no disclosure

Probability of correct decision. If the cost of investigation is intermediate, $\delta q < c < c^*$, the strategic newspaper chooses propaganda under disclosure, but may engage in costly investigation under no disclosure.[14] Nevertheless, the reader cannot benefit from the information acquired by the strategic newspaper under nondisclosure.

The intuition behind this result is as follows. Consider the game without disclosure. First, since the cost of investigation is relatively high, the newspaper with high reputation, $p > p^*$, finds it strictly preferable to choose propaganda over investigation. Yet, in equilibrium the reader follows its reports. Second, the reports of the newspaper with low reputation have no value for the reader even though the newspaper investigates with positive probability. To see this, observe that the value of future reputation cannot be worth more for a low-reputation media outlet than for a high-reputation media outlet. Thus, in order for a low-reputation media outlet to be willing to choose investigation, it must be that the opportunity cost of investigation is lower for a low-reputation media outlet. Consequently, its influence over the public, which is positively related to the interest group's access fee, must be lower than that of a high-reputation newspaper who never investigates. The only way to

[13] The newspaper's payoff is 0 if its reputation is less than or equal to $\tilde{p}$ and positive otherwise. The value of $\overline{n}$ is the number of successes in low state which are required for the newspaper with reputation $p \leq \tilde{p}$ to convince the reader to pay positive subscription fees and follow its reports.

[14] We have that $\delta q < c^*$ if λ or δ are sufficiently large.

achieve this in equilibrium is by choosing investigation with probability that makes the reader indifferent about whether to follow the newspaper's report.

We can also compare the effect of disclosure for other parameter constellations, which gives the following result.

Corollary 1.1. *If $c > c_*$, the ex-ante expected probability of correct decision by the reader is higher under disclosure than under no disclosure. Otherwise, the ex-ante expected probability of correct decision is the same under both types of policies.*

Payoff of the newspaper. If the cost of investigation is small, $c < c_*$, the newspaper chooses investigation with certainty and obtains the same positive payoff under any disclosure regime.

Let now $c \geq c_*$. Consider the game without disclosure. If $c \geq c^*$, the newspaper always chooses propaganda in equilibrium and its subscription and access fees are 0, resulting in zero profits. If $c < c^*$, the newspaper will attempt to build its reputation in equilibrium. The only possibility to do so is to randomize between independent investigation and pushing the interest group's agenda. If the newspaper's initial reputation is low, choice of propaganda results in zero profits: the newspaper has no influence on the public and, hence, cannot collect positive revenues from the reader or the interest group. At the same time, in order to randomize the newspaper must be indifferent between propaganda and investigation. Therefore, the expected benefit from costly investigation, even if it results in more credibility and larger revenues in the future, must be 0.

By contrast, under disclosure the newspaper will obtain positive profits if $c < \delta q$. Therefore, if the initial reputation of the newspaper is low, its profit under no disclosure is always lower than or equal to its profit under disclosure. Moreover, as c_* is decreasing in the stake of the interest group, a higher value of λ implies a larger set of the costs for which the newspaper is worse off under no disclosure. The above discussion leads to the following conclusion:

Corollary 1.2. *The profit of the newspaper with a sufficiently low reputation is greater under disclosure if $c_* < c < \delta q$ and is equal to the profit under no disclosure otherwise. Furthermore, the profit of the newspaper under no disclosure is non-increasing, and sometimes decreasing, in the stake of the interest group.*

7 Competition

In this section, we discuss the effect of competition among newspapers on our results and, in particular, on the probability of investigation in equilibrium and the quality of decisions made by the public. Our main conclusions are: (1) competition may increase the probability of investigation in the model without disclosure but has no effect on the probability of investigation under disclosure, and (2) competition does not affect the result that the quality of the decisions made by the reader are higher under disclosure.

First, we assume that there are two newspapers.[15] In addition, we drop the assumption about the existence of a non-strategic type and assume instead that both types of the newspaper(s) are strategic, but have different costs of information acquisition, 0 with probability $p_0^{(i)}$ and c otherwise, where $i = 1, 2$ is the index of the newspaper.[16] The costs are distributed independently across newspapers and are common knowledge among the newspapers and the interest group but are unknown to the readers.[17] All newspapers are long-lived and maximize their expected discounted profits. The preferences of the reader are the same as in the original model.

The timing of the stage game is the same as in the original model. The newspapers' decisions about subscription fees, access fees, choice between investigation and propaganda, and reports are made simultaneously and independently. The outcome of one newspaper's investigation, if any, is not observed by the other newspapers. Similarly, the decision of one of the newspaper's about whether to approach the interest group, the amount of access fee asked, and the group's decision about whether to provide a report to this newspaper is not observed by the other newspapers. The rest of the actions are observed by all parties, without any delay. As before, the state and, therefore, the reputation of the newspapers, becomes common knowledge at the end of each period.

The rest of the model, including the payoffs of the reader and the interest group,

[15] It is unnecessary to introduce more than two newspapers because we model the competition in the subscription and the access fees as Bertrand competition. All of the results presented in this section are not affected by introducing additional newspapers.

[16] As we argue in Section 8, a non-strategic truthful type in the original model can be viewed as a modeling shortcut for a strategic type with low cost of investigation. In addition, in the model with multiple newspapers the assumption that both types are strategic has an advantage: it makes clear how competing newspapers set their subscription and access fees.

[17] Although the assumption that the newspapers do not know each other costs might be more reasonable in some environment, it will raise the issues of signaling and learning about costs through subscription fees, access fees, and the decisions of the interest group about whether to accept the access fees. Our model is already rather involved; we make the assumption that costs are commonly known among firms to simplify analysis.

is unchanged. In particular, the source of the report of each newspaper is revealed to the reader in the model with disclosure and is not revealed in the model without disclosure.

The solution concept is stationary Markov perfect equilibrium, in which the Markov (2-dimensional) state is the reader's beliefs about the types of the newspapers. Moreover, we restrict attention to equilibria in which newspapers with 0 costs always choose investigation on the equilibrium path. To ensure that these equilibria exist we assume that $c_* > 0$. Finally, we only consider equilibria in which all newspapers that choose propaganda receive equal access fees.

7.1 Investigation with certainty

A consequence of the assumption that both types of the newspapers are strategic is that we can always construct an equilibrium in which one of the newspapers is ignored: if after any history the reader expects newspaper i to choose propaganda, then choosing propaganda is the best response for newspaper i.

As a result, it is not very surprising that equilibria of the monopoly model can be, in a sense, replicated as asymmetric equilibria in the model with competition in which all newspapers except one are ignored by the reader. This observation, nevertheless, is important because it implies that whenever investigation with certainty is feasible in the monopoly model it is also feasible under competition. We now provide details of this argument.

Fix an equilibrium in the monopoly model, with or without disclosure of the source of the report to the reader, in which the newspaper investigates with probability 1. We construct an analogous equilibrium in the model with competition as follows:

Choice of investigation. Newspaper 1 chooses investigation as long as the reader subscribes to her reports and she has chosen investigation in preceding periods. If newspaper 1 ever chooses propaganda, it chooses propaganda in all subsequent periods. All other newspapers always choose propaganda.

Subscription fees. The subscription fees are q for newspaper 1 and 0 for the other newspapers.

Reader. The reader never subscribes to newspaper 2. He subscribes to newspaper 1 in the first period unless her fees are higher than q. In all subsequent periods, the reader subscribes to newspaper 1 as long as he does not observe a deviation from investigation and her fees are not higher than q.

It is easy to see that the strategies of newspaper 2 and the reader are best

response. Furthermore, if newspaper 1 has high cost, her incentives to choose investigation are exactly the same as in the monopoly case. If, on the other hand, newspaper 1 has low cost, her incentives to choose investigation are even stronger. This gives us the following result.

Proposition 2. *If investigation with certainty is feasible when the newspaper is a monopoly, it is also feasible under competition.*

Remark. The above equilibrium is inefficient because sometimes newspaper that chooses investigation, $i = 1$, might have costs higher than her competitors. Nevertheless, it is straightforward to construct a similar equilibrium in which the information is acquired by a newspaper with the lowest cost.

7.2 No investigation

We now consider the situation in which there can be no investigation with positive probability by the strategic newspaper in the monopoly model. In the version of the model with disclosure of the source of the report to the reader, no investigation is the only equilibrium when the discounted value of a fully informative report for the reader is smaller than the cost of investigation, $c > \delta q$. In this case, there is simply not enough surplus on the table to create incentives to investigate even for one newspaper. Hence, there is also no investigation under competition. A similar result holds under no disclosure of the source of the report, although the argument is a little bit more involved.

Proposition 3. *If investigation with positive probability is not feasible in the monopoly model it is also not feasible under competition.*

Proof. Consider the model with disclosure. In order to see that there is no equilibrium with investigation if $c > \delta q$, observe that in this case the continuation payoff of the newspaper with any reputation is bounded from above by $\tilde{v} = \max\left\{q, \frac{-c+q}{1-\delta}\right\} = q$. Hence, the payoff from choosing investigation is bounded from above by $\tilde{v}' = -c+\delta q < 0$.

Now consider the model without disclosure. If a newspaper chooses investigation with non-zero probability in any period, it is necessary that

$$\delta q v^1 + \delta(1-q)v' \leq -c + \delta q v^1 + \delta(1-q)v^0,$$

where v^1, v^0, and v' are respectively the newspaper's continuation payoffs after a correct report in state 1, a correct report in state 0, and an incorrect report (in state 0), or, equivalently,

$$c \leq \delta(1-q)(v^0 - v'). \tag{3}$$

Moreover, observe that the continuation payoff of the newspaper is bounded from below by 0 and from above by

$$\tilde{v} = \max\{q + \lambda(1-q) + \delta q\tilde{v}, -c + q + \delta\tilde{v}\} = \max\left\{\frac{q+\lambda(1-q)}{1-\delta q}, \frac{-c+q}{1-\delta}\right\}.$$

Let $c > c^*$, in which case there is no investigation with positive probability in the monopoly model. Then, $\tilde{v} = \frac{q+\lambda(1-q)}{1-\delta q}$ from $c > c^* \geq c_*$, implying that the right hand side of (3) is less than or equal to c^*. Hence, if $c > c^*$, investigation with positive probability is impossible both under monopoly and under competition. □

7.3 Some investigation

The previous sections leave open the question what is the effect of competition in the model without disclosure if $c_* < c < c^*$. Proposition 1 establishes that for these costs the model without disclosure has an (essentially) unique equilibrium in which the strategic newspaper investigates with non-zero probability but never investigates with certainty. As our first result in this section, we show that competition may improve incentives of the newspapers in the model without disclosure and make investigation with certainty possible.

There are two ingredients in this result. First, in equilibrium that we construct, both newspapers investigate with certainty and the reader subscribes to both of them. As a result, if a newspaper deviates to propaganda, it is unable to collect positive access fees because the interest group expects the other newspaper to report the truth. In this sense, competition has a positive effect in that it decreases incentives for a newspaper to report propaganda.

At the same time, competition may have another, negative, effect on the incentives to provide valuable information to the reader - it makes it more difficult for the newspapers to collect subscription fees. In particular, if the reader expects both newspapers to investigate with certainty, the marginal value of a second report for the reader is 0.

Nevertheless, in our equilibrium the subscription fees of each newspaper are positive and equal to $q/2$. This is achieved as follows. If the reader subscribes

only to one of the newspapers, this newspaper chooses propaganda in the current period (regardless of her costs). Furthermore, starting from the next period, the parties play the continuation equilibrium in which both newspapers always choose propaganda. Hence, unless the reader subscribes to both newspapers, he receives no useful information and therefore he is willing to subscribe to both newspapers and pay $q/2$ for each subscription.

The equilibrium we have just sketched exists if the investigation costs are not too high. Let

$$\tilde{c} = \frac{1}{2}\frac{\delta q(1-q)}{1-\delta q}.$$

We have the following result.

Remark 5. If $c_* < c \leq \tilde{c}$, investigation with certainty is feasible in the model without disclosure under competition but not under monopoly.

Proof. A newspaper's payoff along the equilibrium path is equal to

$$v = \frac{-c + q/2}{1-\delta}.$$

Investigation is a best response for a newspaper with high cost whenever

$$\delta q v \leq -c + \delta v,$$

which is equivalent to $c \leq \tilde{c}$. □

We have established that competition may improve incentives to acquire information under no disclosure but does not have such an effect under disclosure. Does it mean that under competition the quality of the decisions can be higher under no disclosure, unlike in the monopoly model? Although we do not have a formal result, we offer an argument suggesting that the answer to this question is negative.

First, note that no disclosure cannot lead to a better quality of decisions if $c \geq \delta q$. This is because if the investigation is impossible under disclosure it is also impossible under no disclosure.[18] In particular, since $\tilde{c} < \delta q$, we have that whenever $c < \tilde{c}$ there is an equilibrium in which there is investigation with certainty in both versions of the model, with and without disclosure.

Now let $c > \delta q$. In this case, there is no equilibria in which newspaper with high cost investigates under disclosure but there are equilibria with mixing between

[18] If there is investigation with certainty in each period, then the access fees are zero. Therefore, the continuation payoff of each newspaper is bounded from above by $\frac{-c+q}{1-\delta}$, which immediately implies that investigation is not a best response in the model without disclosure.

investigation and propaganda under no disclosure. Moreover, we know that under no disclosure equilibria in which only one newspaper is active in the market cannot improve the quality of decisions compared to the model with disclosure. We now show that this is also true for the equilibria in which both newspapers are active and share subscription and access fees equally.

The reason why in the monopoly model no disclosure does not improve the quality of the decisions is that the newspaper mixes in a manner that makes the reader indifferent about whether to follow the newspaper's reports or make a decision according to his prior beliefs. Hence, in order for an equilibrium under competition to improve the quality of decisions by the reader, it must be that the newspapers choose investigation frequently enough such that the reader strictly prefers to follow their reports. In this case, to make randomization feasible the newspaper must be indifferent about her actions,

$$\frac{1}{2}\lambda(1-q) \;=\; -c+\delta(1-q)v',$$

or, equivalently,

$$c \;=\; \delta(1-q)v'-\frac{1}{2}\lambda(1-q), \tag{4}$$

where v' is the continuation payoff after a truthful report in low state. The value of v' can be expressed as a discounted value of the subscription and access fees and is bounded from above by

$$\overline{v}=\frac{1}{2}\frac{\lambda(1-q)+q}{1-\delta q}.$$

Therefore, a necessary condition for (4) to hold is

$$c \;\leq\; \frac{1}{2}c_*.$$

Because $c>\delta q>c_*$, it is impossible.

8 High and low cost

Our results rely on the existence of a *non-strategic* type that always acquires information, regardless of the amount of subscription and access fees, and never attempts to separate itself from the other type. We view this type as a convenient modeling shortcut for a strategic type who either has a lower cost of investigation or experiences a positive utility from reporting truthfully to the reader. Let us consider a model in which there are two types of newspapers that have different costs of investigation, $\overline{c}$

and $\underline{c}$, where $0 < \underline{c} < c_* < \overline{c} < c^*$. Again, the reader is uncertain about the type of the newspaper. The rest of the model is identical to the one considered in the previous sections.

We now demonstrate that it is indeed an equilibrium for the low-cost type to always investigate and report truthfully and for the high-cost type to behave as prescribed in our previous sections.

For low values of reputation, in the original model the newspaper with high cost is indifferent between propaganda and costly investigation. Hence, in the new model, the newspaper with low cost strictly prefers investigation. It remains to check that for $p \geq p^*$, the low cost newspaper prefers to investigate, that is,

$$\underline{c} + \alpha(p, r) \leq \delta(1 - q)\underline{v}(1), \tag{5}$$

where

$$\underline{v}(1) \quad = \quad \frac{-\underline{c} + q}{1 - \delta}$$

is the value of reputation 1 for the newspaper with low cost.[19]

A sufficient condition for (5) to hold for any $p \geq p^*$ is that this inequality holds for the highest possible access fee, $\alpha = \lambda(1 - q)$, that is,

$$\underline{c} + \lambda(1 - q) \leq \delta(1 - q)\frac{-\underline{c} + q}{1 - \delta},$$

which is equivalent to $\underline{c} \leq c_*$.

The equilibrium in the model with the truthful type can now be replicated if we assign (out-of-equilibrium) beliefs to the reader that the newspaper has high cost whenever the subscription fee is different from the subscription fee prescribed in the original game.

9 Variable importance of actions

In our model, no disclosure decreases the quality of decisions made by the reader. This is so even when the incentives of the newspaper to acquire information are improved. In equilibrium, the strategic newspaper does not acquire information frequently enough to be useful for the reader. This feature of equilibrium might, however, change if the stake of the interest group varies over periods. In such an environment,

[19] Note that the high-cost type never investigates when $p \geq p^*$ and hence the newspaper's reputation becomes 1 after investigation in low state.

the newspaper could find it optimal to acquire information with certainty when the stakes are low in order to preserve its reputation and obtain a higher payoff from propaganda when the stakes are high. Hence, variability of stakes creates a channel through which the reader can benefit from the improved incentives of the newspaper. In this section, we present an example in which the ex-ante expected probability of correct decision by the reader is *greater* under no disclosure than under disclosure.

Let the stake of the special interest group, λ, be a realization of a random variable distributed identically and independently across periods, with support $\{0, \overline{\lambda}\}$. Let β denote the probability that $\lambda = 0$. The value of λ is realized in the beginning of each period and is observed by each player. The rest of the model is unchanged. The solution concept is stationary Markov perfect equilibrium, in which the Markov state is the reader's belief about the type of the newspaper *and* the realization of stake, λ.

In the model with disclosure, the newspaper cannot obtain a positive access fee. Hence, the variability in the stakes of the special interest groups does not affect the incentives of the newspaper. As a result, Lemma 1 and Lemma 2 characterizing equilibria in the original model continue to hold.

We now turn to the model without disclosure. We assume that the prior reputation of the newspaper is greater than p^*. This assumption significantly simplifies analysis: for any $p > p^*$, the reader finds it optimal to follow the reports of the newspaper regardless of its behavior.

Define

$$\begin{aligned} \tilde{c}_* &= \frac{\delta(1-q)q}{1-\delta q} - \frac{\overline{\lambda}(1-q)(1-\delta)}{1-\delta q} \\ \tilde{c}^* &= \beta\frac{\delta(1-q)q}{1-\delta q} + (1-\beta)\frac{\delta\overline{\lambda}(1-q)^2}{1-\delta q}. \end{aligned}$$

Remark 6. Let $\tilde{c}_* \leq c \leq \tilde{c}^*$. Then, there exists an equilibrium in which the newspaper with reputation $p > p^*$ investigates with probability 1 if $\lambda = 0$ and probability 0 if $\lambda = \overline{\lambda}$.

Proof. Observe that in any continuation game in which the newspaper has reputation 0 choosing propaganda and collecting zero fees is a unique stationary equilibrium.

Now, consider a newspaper with reputation $p > p^*$. In equilibrium, she collects the access fee of 0 if $\lambda = 0$ and $\overline{\lambda}(1-q)$ if $\lambda = \overline{\lambda}$. Furthermore, her subscription fees are q if $\lambda = 0$ and $2q - 1 + p(1-q)$ if $\lambda = \overline{\lambda}$. As a result, the payoff of the newspaper

with reputation $p > p^*$ along the equilibrium path can be expressed as

$$\begin{aligned} v(p) &= \beta(q - c + \delta v(p)) + (1-\beta)(2q - 1 + p(1-q) + \overline{\lambda}(1-q) + \delta q v(p)) \\ &= \frac{\beta(q-c) + (1-\beta)(2q - 1 + p(1-q) + \overline{\lambda}(1-q))}{1 - \delta + \delta(1-\beta)(1-q)}. \end{aligned}$$

The condition $c \leq \tilde{c}^*$ ensures that the net benefit of investigation is non-negative if $\lambda = 0$,

$$\mathcal{L}(p, 1) = -c + \delta(1-q)v(p) \geq 0. \quad (p > p^*)$$

At the same time, the condition $c \geq \tilde{c}_*$ ensures that the net benefit of investigation is non-positive if $\lambda = \overline{\lambda}$,

$$\mathcal{L}(p, 0) = -c - \overline{\lambda}(1-q) + \delta(1-q)v(1) \leq 0.$$

□

Observe that $\delta q < \tilde{c}^*$ whenever

$$\overline{\lambda} > \frac{q(1 - \delta q - \beta(1-q))}{(1-\beta)(1-q)^2}. \quad (6)$$

In this case, there exists a range of costs, $(\delta q, \tilde{c}^*]$, for which investigation is impossible under disclosure but occurs with certainty under no disclosure if $\lambda = 0$.

Let us now assume that (6) holds and compare the probability of correct decision under disclosure and under no disclosure. The expected probability of correct decision in each period under disclosure is equal to

$$\kappa_{\text{disclosure}} = p_0 + (1 - p_0)(1 - q).$$

Under no disclosure, the probability of correct decision depends on the history of realizations of θ and λ. The strategic newspaper maintains its reputation as long as there has not been a period in which $\theta = 0$ and $\lambda = \overline{\lambda}$; the corresponding probability of correct decision is equal to

$$\kappa_{\text{no disclosure}} = p_0 + (1 - p_0)(\beta + (1-\beta)q).$$

After the period in which $\theta = 0$ and $\lambda = 1$, the type of the newspaper is revealed to the reader and the probability of the correct decision coincides with the one under disclosure. We conclude that whenever $\kappa_{\text{no disclosure}} > \kappa_{\text{disclosure}}$ or, equivalently,

$$\beta > p^*$$

the ex-ante expected probability of correct decision is greater under no disclosure.

10 Discussion

We have developed a model in which a media outlet serves either as an honest investigator and messenger or a propagandist. In this section, we discuss the relationship of our research to the literature, and investigate possible modifications to our model.

10.1 Comparison to Sobel [36]

Adopting a purely cheap-talk model à la Crawford and Sobel [10], Sobel [36] studies reputation concerns of a potentially biased sender in a repeated setting. In Sobel's model, the sender could be a friend of the receiver, who wants the same action taken as the receiver, or an enemy of the receiver, who wants the opposite action taken. The model also allows the the importance of the issue to vary from period to period.

Sobel focuses on honest equilibria, which are observationally equivalent to equilibria of a model where the friend of the receiver is an honest type. Sobel shows that in honest equilibria, the enemy of the sender sometimes chooses to report truthfully if the issue is not very important, so as to maintain his reputation, in order to influence the receiver's decision in the future. A feature of Sobel's model is that the receiver is better off from finding out the bias of the sender, because by so doing, he can both obtain full information from his friend and avoid manipulation by his enemy. In a repeated setting, the potential welfare gain for the receiver is even more pronounced.[20]

In contrast, in our model the newspaper is either honest or opportunistic. The latter is not intrinsically biased, but is driven by its profit motive. Therefore, our model can be viewed as a model of communication with uncertainty about bias, where bias is endogenously generated and may vary across periods. Our model is not a purely cheap-talk one (more on this in Section 10.4.2), in that the newspaper has to conduct a costly investigation in order to make a report on its own. Furthermore, both subscription fees and access fees are forthcoming only if the newspaper maintains its influence on the reader. It may well be that obtaining revenue from interest groups is more important, whereby maintaining its reputation is just an instrument to achieve that goal.

In a related paper, Li [23] presents a model with an expert with reputation incentives and an uninformed decision maker. The decision maker is uncertain about

[20]However, this result is not robust to variations of the distribution of the sender's bias. For a demonstration in the static setting that the receiver may benefit from *not* learning the sender's type, see Morgan and Stocken [25] and Li and Madarasz [22].

whether the expert has a bias. The expert has two motives: to influence the decision maker's action and to maintain his reputation of being unbiased. Li compares direct communication and communication through a strategic, possibly biased, intermediary. She identifies the following tradeoff: direct communication allows for more effective influence whereas mediated communication is better at maintaining reputation. As a result, the expert prefers mediated communication if his prior reputation is sufficiently high or if his reputation concerns are relatively low. In her paper, the value of future reputation takes a reduced form, as opposed to our paper, where it is derived as the result of equilibrium play in a repeated game.

10.2 Role of assumptions on preferences

In our model, the reader's payoff function is linear and the only actions allowed are 0 and 1.[21] Though these assumptions simplify the mathematical expressions, they also cause a discontinuity in the reader's best response (it is an upper hemicontinuous correspondence, though). There exist a threshold of reputation and a threshold of probability of investigation at which the newspaper's report goes from being ignored to being followed. As a result, the access fee the interest group is willing to pay jumps from zero to a positive constant. Fortunately, the reader can mix between the two actions at the right probability when he is indifferent, which ensures the existence of equilibria (a consequence of the Kakutani fixed point theorem). This in some sense eliminates the effect of such discontinuity. In addition, the reputation-updating rule is independent of the reader's preferences. However, if we allow actions other than 0 and 1, the discontinuity mentioned above does cause a key difference between linear and other preferences. For example, if the reader's payoff function is quadratic, then the value of the newspaper's report for the reader is continuous in its reputation and probability of investigation. Furthermore, the access fee is strictly increasing in the newspaper's reputation (as opposed to the step function in the linear case). However, the intuitive argument we made would still apply, namely, a low-reputation newspaper cannot investigate too frequently as its value of reputation cannot exceed that of a high-reputation newspaper.

We also assume that the interest group always prefers the action 1 taken regardless of the true state of the nature. We may also allow the interest group's preferred action to be random, for example, an iid random variable drawn from a Bernoulli

[21] Given there are only two allowed actions, any loss function that is a function of the distance between the action and the state can be represented as a linear function, since we have only two possible values of distance: 0 or 1.

distribution whose realization is only known to the interest group itself. In this case, the willingness to pay by the interest group varies with its preferred action. When choosing propaganda, the newspaper sets the access fee to maximize her revenue, anticipating if she sets it too high, it will be rejected by one of the two types of interest groups. However, the tradeoff faced by the newspaper is the same, namely, that between maintaining reputation through costly investigation and taking an access fee from the interest group in the current period. For intermediate cost values, a high-reputation newspaper always chooses propaganda, while a low-reputation newspaper mixes between investigation and propaganda.

10.3 Order of revelation of the state and alternative interpretation of investigation

In our model, none of the parties know the state of the nature at the beginning of each period. Alternatively, we may allow the interest group to be well-informed about the state. By our assumption, in case of rejection by the interest group, the newspaper has to conduct an investigation and make a truthful report. Thus, the interest group is only willing to pay a positive access fee in state 0. The newspaper simply charges the maximum access fee the interest group is willing to pay in state 0, λ, if its report is followed by the reader. Thus, the newspaper always has to investigate in state 1 even if it chooses "propaganda," which makes the comparison between investigation and propaganda more favorable to the former than our initial model does. The qualitative results, however, are not affected. Namely, the results that high-reputation newspapers cash out and low-reputation newspapers build reputation by investigation and that low-reputation newspapers' investigation is wasteful.

Another assumption we make is that the newspaper has to report truthfully once it conducts an investigation. Alternatively, we could interpret investigation as the act of gathering relevant evidence. Once the newspaper has done so, it has the option of reporting either message, which can be interpreted as slanting news to support either action. Thus, the newspaper's threat of investigation is likely to be more severe towards the interest group. However, the newspaper's threat to report 0 in state 1 is not credible, as that would completely destroy her reputation. Therefore, allowing the possibility of slanting does not affect our qualitative results.

10.4 Shut-down and cheap-talk

Here, we consider a version of our model in which the strategic newspaper can choose to shut down after obtaining the subscription fee from the reader and a version in which the strategic newspaper can make up any report at zero cost (cheap-talk) even without investigation.

10.4.1 Shut-down

Now, we consider a version of our model in which the strategic newspaper can "shut down" and report nothing after the reader has subscribed. Furthermore, there is no cost to shutting down. On the other hand, we assume that the truthful newspaper never shuts down. Note that shutting down gives the newspaper no access fee in the current period, and deprives the newspaper of any reputation in the next period. Thus, the newspaper's expected payoff from choosing shut-down is zero.

The newspaper's threat of shutdown has an effect on the interest group's willingness to pay as access fee only if the newspaper's report affects the reader's behavior. That is, either the newspaper finds it optimal to investigate or its reputation is high enough (more than p^*). In the first case, since propaganda bring in a strictly positive payoff, the newspaper must also earn a strictly positive payoff from investigation, which makes the threat of shut-down not credible. In the second case, again, investigation brings in a strictly positive payoff, as the payoff from investigation is weakly increasing in reputation.

From the above discussion, in any equilibrium where the newspaper's report ever affects the reader's behavior, shut-down would not be a credible threat. Hence, the possibility of shut-down does not affect the set of equilibria.

10.4.2 Cheap-talk

Let us now consider a version of the model in which the reports of the newspaper are cheap-talk: we assume that the newspaper can always send, at zero cost, any of the two reports, regardless of whether it obtains any report from investigation or special interest group and regardless of what this report might be. The equilibrium in our initial model breaks down.

Observe that cheap-talk with message "1" is (weakly) dominated by propaganda with message "1," as the newspaper receives a non-negative access fee in the latter option using the threat of sending the cheap-talk message "0." Since they affect the other players' payoffs in the same way, it is without loss of generality that we

eliminate cheap-talk message 1 from the newspaper's strategy set. Cheap-talk with message 0 can be used as a threat for a higher access fee, compared to the case where cheap-talk is not allowed. Hence, the newspaper's payoffs from choosing investigation, propaganda, and cheap-talk (with message "0") are respectively

$$-c + \delta q v^1(p) + \delta(1-q)v^0(p), \quad \alpha + \delta q v_1(p), \text{ and } \delta(1-q)v_0(p).$$

Cheap-talk gives a higher payoff than investigation if and only if

$$c \geq \delta q v^1(p).$$

If the above inequality holds for high reputations ($p > p^*$), it is an equilibrium for the newspaper to always choose propaganda and earn a high access fee from the interest group using cheap-talk as a threat; but that implies for low reputations ($p < p^*$), the newspaper does not investigate at all as cheap-talk is strictly better since $v^1(p)$ is strictly increasing in p.

Therefore, in order for there to be any investigation at all in equilibrium, we need $c \leq \delta q v^1(p)$ for $p > p^*$, that is, cheap-talk cannot be used as a credible threat for high reputations ($p > p^*$). Hence, for high reputations, the continuation payoff remains the same as that in our original setting. Now, investigation is preferred to cheap-talk if and only if $c \leq \delta q v^1(p)$. Thus, if there is investigation at all, it must be by a newspaper with an intermediate value of reputation. A newspaper with a very low reputation does not investigate at all. This breaks down the equilibrium of our initial model.

To summarize, if we allow cheap-talk in our model, investigation is only chosen by the newspaper with intermediate reputations.

10.5 Absence of Honest Type

There are two two crucial features in our model: uncertainty about the source of the report and the possibility of a truthful newspaper. Throughout the paper, we have compared the results in our model with the benchmark case in which the source of the report is known. In particular, there are circumstances under which investigation is impossible if the source of the news is always disclosed and is possible otherwise.

A similar result holds with respect to the possibility of a truthful newspaper. The set of costs for which non-zero probability of investigation is possible is smaller in the model without the possibility of the truthful type. This is because in the absence of the truthful type, the newspaper does not have a means to build its reputation and become influential. Hence, although introducing uncertainty about

the credibility of the newspaper may not improve the payoff of the newspaper, it affects it behavior. This discussion is made formal by the following result, which uses sequential equilibrium as the solution concept.

Remark 7. When the newspaper is always strategic, investigation is possible in equilibrium if and only if $c \leq c_*$.

Proof. If the newspaper chooses investigation with non-zero probability in any period, it must be that

$$\lambda(1-q) + \delta q v^1 + \delta(1-q)v' \quad \leq \quad -c + \delta q v^1 + \delta(1-q)v^0,$$

where v^1, v^0, and v' are respectively the newspaper's continuation payoffs after a correct report in state 1, a correct report in state 0, and an incorrect report (in state 0), or, equivalently,

$$c \quad \leq \quad -\lambda(1-q) + \delta(1-q)(v_0 - v').$$

The result, then, follows from the observation that

$$0 \leq v^1, v^0, v' \leq \max\left\{\frac{q-c}{1-\delta}, \frac{q+\lambda(1-q)}{1-\delta q}\right\}.$$

□

10.6 Varying audience

Suppose the circulation of the newspaper depends on its reputation. Let $1+\sigma(p)$ be the circulation of a newspaper of reputation p, where σ is nondecreasing in p. The newspaper's subscription fee and access fee are proportional to her circulation. Since reputation has the extra benefit of increasing circulation, investigation becomes more attractive to the newspaper.

Now, a reputation-one newspaper finds it optimal to investigate if and only if

$$c \quad \leq \quad c_* \equiv \frac{\delta(1-q)q[1+\sigma(1)]}{1-\delta q} - \frac{\lambda(1-q)(1-\delta)[1+\sigma(1)]}{1-\delta q}.$$

On the other hand, a newspaper of reputation zero finds it optimal to investigate if and only if

$$c \quad \leq \quad c^* \equiv \frac{\delta(1-q)q[1+\sigma(1)]}{1-\delta q} + \frac{\delta\lambda(1-q)^2[1+\sigma(1)]}{1-\delta q}.$$

As we have done in the main model, let $c \in [c_*, c^*]$. It follows that it is never the case that a newspaper always investigates. A reputation-p newspaper always investigates if and only if

$$c \leq c_*(p) \equiv \frac{\delta(1-q)q[1+\sigma(p)]}{1-\delta q} - \frac{\lambda(1-q)(1-\delta)[1+\sigma(p)]}{1-\delta q}.$$

The above expression is either negative, or less than c_*. In either case, a reputation-p newspaper would not want to investigate as we assume $c > 0$ and $c > c_*$.

Recall that p^* is the reputation level above which a newspaper's report is followed even if the strategic newspaper never investigates. A newspaper of reputation $p > p^*$ always chooses propaganda if and only if

$$c \geq c^*(p) \equiv \frac{\delta(1-q)q[1+\sigma(1)]}{1-\delta q} + \lambda(1-q)\frac{\delta(1-q)[1+\sigma(1)] - (1-\delta q)[1+\sigma(p)]}{1-\delta q}.$$

This threshold turns out to be larger than $c_* = c_*(1) = c^*(1)$. As a result, we can no longer conclude that a newspaper with reputation higher than p^* always chooses propaganda, as we do in the main model. The reason is that by switching to investigation from propaganda, the newspaper also increases her circulation, which may imply next period's access fee dominates the current period's. It is possible, therefore, for a newspaper with reputation higher than p^* to choose investigation, though it is still the case that a newspaper with reputation close to one always chooses propaganda.

In the case of disclosure, a reputation-p newspaper investigates if and only if

$$c \leq \delta[1+\sigma(p)]q.$$

Note that, for a reputation-one newspaper, this threshold is lower than c^* for large enough λ. Let us consider the case $c > \delta[1+\sigma(1)]q$, in which the strategic newspaper never investigates under disclosure. We look at whether it would be possible for the reader to make more informed decisions under non-disclosure. Recall that r is the probability of investigation by the strategic newspaper. The probabilities of correct decisions by the reader for a newspaper of reputation p are respectively $1-(1-p)(1-q)(1-r)$ for nondisclosure and $1-(1-p)q$ for disclosure. The two are the same when $r = p^*$.

For an illustration, we focus on a newspaper with reputation p^*. In order for the newspaper to mix between investigation and propaganda, we have

$$c + [1+\sigma(p^*)]\lambda(1-q) = \delta(1-q)v(p^0),$$

where p^0 is the newspaper's updated reputation after reporting 0 truthfully. As before, the left hand side represents the newspaper's cost of investigation, while the right hand side her benefit of investigation. Suppose at reputation p^0, a newspaper always chooses propaganda. Then,

$$v(p^0) = \frac{[1+\sigma(p^0)][q-(1-q)(1-p^0)+\lambda(1-q)]}{1-\delta q}.$$

Let $r = p^*$. In addition, assume $\sigma(p^*) = 0$ and $\sigma(p^0) = 1$ at $r = p^*$. Furthermore, let $\sigma(p) = 1$ for all $p \geq p^0$. This implies the newspaper always does choose propaganda at reputation p^0. Then, for large enough λ and δ, the cost of investigation is lower than the benefit at $r = p^*$. Observe that $v(p^0)$ is decreasing in the newspaper's current probability of investigation. Then, in equilibrium, the newspaper's probability of investigation must be higher than p^*, thereby making the reader's decision to be more likely correct under nondisclosure.

10.7 Long-Lived Interest Groups

In certain settings, it is likely that the interest group has repeated interactions with the newspaper. In this case, the newspaper and the interest group may play equilibria that make use of information available only to them, but not the reader. We want to see whether it is possible for the newspaper to investigate frequently enough such that the probability of making a correct decision is increased from the case of short-lived interest groups.

Let us consider the following strategy profile: every period there is a draw of a Bernoulli random variable, which is only observable to the newspaper and the interest group. If the realization is 1, then the newspaper investigates; if it is 0, the newspaper approaches the interest group, asks for an access fee, and publishes its propaganda if the interest group pays the access fee. Let us assume the realization 1 happens with probability p^*. This ensures that the reader takes the correct action with exactly the same probability as under the complete-information case, where the strategic newspaper is completely ignored. We also introduce two phases: collusion phase and defection phase, differing only in the amount of access fee paid by the interest group each period if the newspaper is supposed to approach the interest group.

- *Collusion phase.* In this phase, the newspaper asks for an access fee equal to the full surplus $\lambda(1-q)$ and the interest group accepts any access fee lower than or equal to this amount.

- *Defection phase.* In this phase, the newspaper asks for an access fee equal to $\lambda(1-q)-x$ and the interest group accepts any access fee lower than or equal to this amount.

We consider the following strategy profile as a candidate for equilibrium. Note that the newspaper's probability of investigation in either phase is p^*. Simple calculation yields that the newspaper should charge a subscription fee of pq.

- The newspaper and the interest group start in the collusion phase.
- They start the defection phase if the newspaper deviates from her prescribed action.
- They start the collusion phase if the interest group deviates from its prescribed action.

Let $v^c(p)$ be the continuation payoff of the newspaper in the collusion phase, and $v^d(p)$ be its counterpart in the defection phase. For an illustration that why long-lived interest groups may induce more investigation than do short-lived interest groups, consider the case $p=1$. Since the newspaper's reputation will remain one as long as her report matches the state of the world, we can write

$$\begin{aligned} v^c(1) &= q+p^*[-c+\delta v^c(1)]+(1-p^*)[\lambda(1-q)+\delta q v^c(1)], \\ v^d(1) &= q+p^*[-c+\delta v^d(1)]+(1-p^*)[\lambda(1-q)-x+\delta q v^c(1)]. \end{aligned}$$

Solving them gives

$$\begin{aligned} v^c(1) &= \frac{(\lambda+1)q-p^{ast}c}{1-\delta(1-q)}, \\ v^d(1) &= \frac{(\lambda+1)q-p^{ast}c-(1-p^*)x}{1-\delta(1-q)}. \end{aligned}$$

The incentive conditions that have to be satisfied include no deviations by the newspaper in either phase and no deviation by the interest group in the defection phase. In the defection phase, the utility of the newspaper must be the same from investigation and propaganda, since the "punishment" for deviation is to continue the punishment phase. We obtain

$$c = c_* + \frac{1-\delta}{1-\delta q}x.$$

To deter deviation in the collusion phase, we need

$$c \leq c_* + \frac{\delta q(1-p^*)}{1-\delta q}x.$$

To ensure that both of the above conditions hold, we need

$$1 - \delta(1-q) \;\leq\; \delta(1-p^*),$$

or

$$\delta \;\geq\; \frac{1-q}{1-q+q^2},$$

which also guarantees that the interest group will not deviate in the defection phase and accept an offer that gives it less than x. Finally, we need to require that x be small enough such that $v^d(1) \geq 0$. Indeed, we can find strictly positive x to satisfy all the above conditions. Thus, the newspaper is willing to investigate with probability p^* even though she already has reputation one. Similarly, for other reputation levels, we can find conditions such that the newspaper is induced to investigate, though we also need to vary x according to the newspaper's reputation.

11 Conclusions

In this paper, we present a dynamic model of news reporting by a profit-maximizing media outlet whose credibility is uncertain to the public. In each period, the media outlet chooses its source of news: a costly independent investigation or, possibly, a free report prepared by an interest group. The revenue of the media outlet consists of the subscription fees for the public and the access fees for interest groups. We characterize the equilibrium structure of information transmission with and without disclosure of the source of the media report. In particular, we demonstrate that absence of disclosure may create incentives for the strategic media outlet to choose costly investigation in the hope of improving its reputation. Nevertheless, the public cannot benefit from more informative reports as they serve the goal of confusing the public and making the reports by the interest group more effective.

There are a number of ways in which our model can be extended. We assume the newspaper's investigation technology is perfect, and the reader learns the true state of the nature with certainty after each period. As a result, once a strategic newspaper's report fails to match the true state of the nature, it is fully exposed and deprived of any reputation. This is an assumption that greatly simplifies the analysis. Though in this paper we do not explore the relaxation of these assumptions, we believe allowing imperfect investigation by the newspaper and imperfect verification by the reader may generate interesting results that might otherwise not be possible. However, we believe the underlying tradeoff remains the same.

In our model, there is a single newspaper and only one interest group in each period. It is interesting to consider competition between newspapers and interest groups. We may use competition between interest groups to justify the newspaper being able to extract the entire surplus from the interest group. On the other hand, competition between newspapers for readers may force newspaper to charge very low subscription fees, thus increasing the weight of access fees in newspapers' choices.

A Proof of Proposition 1

Proof. Existence. Let

$$f(\tilde{z},n) \;=\; -\frac{c}{1-\delta q}\frac{1-w^n}{1-w}+w^n\frac{\tilde{z}\lambda(1-q)}{1-\delta q},\quad n\in\{0,1,\dots\}$$

If $\tilde{p}=(p^*)^{\overline{n}}$, then define z^* implicitly by

$$f(z^*,\overline{n})=\frac{c}{\delta(1-q)}.$$

Otherwise, let z^* be any value in $[z',1]$, where

$$z'=\frac{\delta(1-q)}{1-\delta q}+\frac{\delta q}{\lambda(1-\delta q)}-\frac{c}{\lambda(1-q)}.$$

The following set of strategies, together with corresponding Bayesian beliefs, is an equilibrium: The newspaper chooses investigation with probability given by (2). The reader always subscribes and follows low report. Furthermore, if $p>p^*$, he follows high report. If $p=(p^*)^n$ and $p\geq\tilde{p}$, the reader follows high report with probability z^*. If $p\in((p^*)^{n+1},(p^*)^n)$ and $p\geq\tilde{p}$, $n=\{1,\dots\}$, he follows high report with probability $\frac{c-\delta(1-q)v\left(\frac{p}{p^*}\right)}{\lambda(1-q)}$. If $p<\tilde{p}$, the reader ignores high report and chooses 0. The subscription fee is 0 if $p\leq p^*$ and equal to $q-(1-p)(1-q)$ otherwise. The access fee is $z\lambda(1-q)$, where z is the probability that the reader follows high report.

It is direct to show that if the newspaper follows its strategy, it obtains the payoff given by (1). Furthermore, the payoff of the newspaper with reputation $p=((p^*)^n)$, $n\in\{1,\dots\}$, is equal to

$$v(p) \;=\; \max\left\{f(z^*,n),0\right\}. \tag{7}$$

The optimality of the fees and the reader's behavior is straightforward. Moreover, it is optimal for the newspaper with reputation 0 to choose propaganda because its reputation cannot increase after investigation. Now, consider the newspaper with reputation $p>p^*$. If the newspaper chooses investigation, its reputation will be 1, implying $v^0=\overline{v}$. Furthermore, the reader always follows the reports and hence $\alpha(p,r)=\alpha(1,0)$ for any $r\in[0,1]$. This implies that $\mathcal{L}(p,r)<0$, making propaganda optimal.

Next, assume that the newspaper has reputation $p\in((p^*)^{n+1},(p^*)^n)$, $n=1,\dots,$ such that $p\geq\tilde{p}$. Note that its reputation after a truthful report in state 0 becomes

$$p^0(p,r_*(p))=\frac{p}{p^*}\in((p^*)^n,(p^*)^{n-1}).$$

Furthermore, the probability with which the reader follows high report, z, satisfies

$$c + z\lambda(1-q) \;=\; \delta(1-q)v\left(\frac{p}{p^*}\right),$$

or, equivalently, $\mathcal{L}(p,r) = 0$, implying that the newspaper is indifferent about its choice. The argument for $p = (p^*)^n$, $n = 1, \ldots,$ $p > \tilde{p}$, and for $p < \tilde{p}$ is analogous.

Uniqueness. We now prove the second part of the proposition. First, we calculate the subscription fees in any equilibrium. If $p_t \leq p^*$ and $r_t \leq r_*(p_t)$, the newspaper does not investigate frequently enough to make its reports valuable for the reader, in which case $\phi(p_t, r_t) = 0$. On the other hand, if $p_t \leq p^*$ and $r_t > r_*(p_t)$ or if $p_t > p^*$, the reader will find reports informative, in which the subscription fee is $\phi(p_t, r_t) = 2q - 1 + (p_t + (1-p_t)r_t)(1-q)$.

The access fees depend on how frequently the reader follows high report of the newspaper, $\alpha = \tilde{z}\lambda(1-q)$, where $\tilde{z}$ is the probability that the reader takes action 1 after report 1. In equilibrium, $\tilde{z}$ is equal to 0 if $p_t \leq p^*$ and $r_t < r_*(p_t)$, is any number between 0 and 1 if $p_t \leq p^*$ and $r_t = r_*(p_t)$, and is 1 otherwise.

Next, observe that in any continuation game in which the newspaper has reputation 0 choosing propaganda and collecting zero fees is a unique stationary equilibrium.

We now calculate the continuation payoff of the newspaper with reputation 1, $\overline{v}$. First, reputation 1 implies that the fees are $\phi(1,r) = q$ and $\alpha(1,r) = \lambda(1-q)$ for any value of r. If the newspaper chooses investigation, its reputation will remain 1 and, therefore, its expected payoff is equal to

$$v' = -c + q + \delta\overline{v}.$$

If, on the other hand, the newspaper chooses propaganda, it will lose its reputation whenever the state is 0, which happens with probability q. In this case, its expected payoff is

$$v'' = \lambda(1-q) + q + \delta(1-q)\overline{v}.$$

The value of reputation 1 is given by

$$\overline{v} \;=\; \max\{v', v''\} = \frac{\lambda(1-q)+q}{1-\delta q},$$

implying that the newspaper will choose propaganda and $\mathcal{L}(1,0) < 0$. The value of $\overline{v}$ provides the upper bound on the continuation payoff of the newspaper with any reputation.

Let us now consider a newspaper with reputation $p \in (p^*, 1)$. Because $v^0 \leq \overline{v}$ and $\alpha(p, r) = \alpha(1, 0)$ for any $r \in [0, 1]$, we have $\mathcal{L}(p, r) < 0$. Thus, the newspaper will choose propaganda. As a result, the payoff of the newspaper is given by

$$v(p) = \frac{(p + \lambda - 1)(1 - q) + q}{1 - \delta q}.$$

If $p = p^*$, then $\mathcal{L}(p, r) < 0$ for all $r \in (0, 1]$ and hence the newspaper with this reputation will never choose costly investigation. For $r = 0$ to be optimal, we need the reader to follow high reports with probability $z(p^*) \geq z'$, which gives $\mathcal{L}(p, 0) \leq 0$.

Thus, the value of reputation is given by (1) if $p > p^*$ and $f(z(p^*), 0)$ if $p = p^*$. This implies that in any equilibrium the following properties are satisfied, with $k = 0$:

(i) The value of reputation is given by (1) for $p \in ((p^*)^{n+1}, (p^*)^n)$ and equal to $\max\{f(z(p^*), n), 0\}$ for $p = (p^*)^{n+1}$ for all $n = 0, \ldots, k$;

(ii) The probability of investigation satisfies (2) for $p \in [(p^*)^{k+1}, 1]$.

The rest of the proof is by induction. We will show that if (i) and (ii) are satisfied in any equilibrium for $k = i$, then it is also satisfied in any equilibrium for $k = i + 1$. First, let $p < p^*$. Observe that if the reader expects the newspaper to always choose propaganda, $r = 0$, then a deviation to investigation will convince the reader that the newspaper is truthful, implying $v^0 = \overline{v}$. It follows then that $\mathcal{L}(p, 0) > 0$, as $c < c^*$ and $\alpha(p, 0) = 0$. Therefore, in equilibrium the newspaper does not always choose propaganda. On the other hand, for all $r > r_*(p)$, we have $\mathcal{L}(p, r) \leq \mathcal{L}(1, 0) < 0$. Hence, in equilibrium the newspaper cannot choose investigative journalism with probability greater than $r_*(p)$.

Now, consider the newspaper with $p \in ((p^*)^{i+2}, (p^*)^{i+1})$. Let $p \geq \tilde{p}$. Note that if the newspaper chooses investigation with probability $r < r_*(p)$, its reputation after a truthful report in state 0 becomes

$$p^0(p, r) > \frac{p}{p^*} \in ((p^*)^n, (p^*)^{n-1}).$$

Furthermore,

$$c \;\leq\; \delta(1 - q)v\left(\frac{p}{p^*}\right) < \delta(1 - q)v\left(p^0(p, r)\right).$$

Therefore, the newspaper would prefer to investigate with probability $1 > r_*(p)$. This shows that $r_*(p)$ is the unique value for which $\mathcal{L}(p, r) = 0$ is possible.

Let now $p < \tilde{p}$. Observe that in this case, $\mathcal{L}(p, r_*(p)) < 0$ and therefore $r(p) < r_*(p)$. The probability of investigation is determined by $\mathcal{L}(p, r(p)) = 0$, which is equivalent to

$$-c \;=\; \delta(1-q)v(p^0(p,r)). \tag{8}$$

The value $v(p^0(p,r))$ is decreasing in r on $(0, r_*(p)]$. Therefore, (8) has at most one solution. By construction of $\tilde{p}$, $r = r(p)$ is a solution. The argument for $p = (p^*)^n$, $n = 1, \ldots,$ is analogous. □

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