

Indifferent Public, Passionate Advocates, and Strategic Media

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Very preliminary. Comments are welcome.

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Abstract

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 public and the access fees for interest groups. We characterize the equilibrium structure of information transmission with and without interest groups. In particular, we demonstrate that the amount of information transmission and the public welfare may be enhanced by the presence of interest groups. In equilibrium, interest groups are willing to subsidize investigative reporting because it improves the credibility of the media outlet and hence the effect of the reports prepared by the groups.

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The public is misled by individuals who present themselves to be independent, unbiased experts or reporters, but are actually skills promoting a prepackaged corporate agenda. ... Shoddy practices make it difficult for viewers to tell the difference between news and propaganda.

Statement of FCC Commissioner Adelstein, August 14, 2006

1 Introduction

On August 14, 2006 the Federal Communications Commission (FCC) issued 42 inquiries to 77 news broadcasting companies to determine whether the source of news was properly disclosed during broadcasts.¹ The investigation is triggered by a complaint of a watchdog organization, Center for Media and Democracy, whose study suggests the widespread and undisclosed use of video news releases (VNRs) prepared by third parties.² The watchdog organization believes that undisclosed VNRs undermine the public trust in the integrity of news programming and urges stricter disclosure rules.³ By contrast, a statement filed with FCC by the Radio-Television News Directors Association that represents the news industry argues that determining when and how to identify sources is the responsibility of journalists and should be removed from government oversight.⁴

In this paper we discuss the effects of stricter disclosure on (i) the incentives for independent information acquisition by media outlets, (ii) the profits of media outlets and welfare of viewers, and (iii) credibility of media outlets and the amount and structure of information transmission to the viewers. In order to do this, we present a dynamic model of reporting by a profit-maximizing media outlet. In our model, the media outlet can be of two types: strategic and truthful. In each period, the strategic media outlet can choose its news from one of two sources: a costly independent investigation or, possibly, a free report prepared by an interest group. By contrast, the truthful media outlet does not have access to an interest group and can obtain news only by conducting a costly investigation. The revenue of the media

¹See FCC press release on August 14, 2006.

²See FCC press release on August 14, 2006, the report “Fake TV News: Widespread and Undisclosed” by Center for Media and Democracy released on April 6, 2006, and the follow-up report “Still Not the News” released on November 14, 2006.

³See the letter from Free Press to FCC signed by Campaign Director of free Press and Executive Director of Center for Media and Democracy on April 6, 2006, p. 2.

⁴See the letter from Wiley Rein and Fielding LLP to FCC on October 5, 2006, p. 16.

outlet consists of the subscription fees for the public and, for the strategic type, the payment from the interest group. The readers are uncertain about whether the media outlet has access to an interest group. In each period in our model, the readers observe the news reported by the media outlet and choose an action that affects their payoffs and the payoff of the interest group. After that, they learn the realization of the state of the world and update their beliefs about the credibility of the media outlet.

We characterize the equilibrium structure of information transmission with and without interest groups. In particular, we demonstrate that the amount of information transmission and the public welfare may be enhanced by the presence of interest groups. In equilibrium, interest groups are willing to subsidize investigative reporting because it improves the credibility of the media outlet and hence the effect of the reports prepared by the groups. The fear of losing reputation ensures that the media outlet choose investigative journalism over propaganda some of the time.

There are several recent models in which media outlets find it optimal to distort their reports in equilibrium. In Besley and Prat [1], for example, media outlets can be captured by a politician interested in hiding bad news. In their model, the media outlet does not have concerns about its reputation. Furthermore, unlike in our model, the information is verifiable. Mullainathan and Shleifer [4] assume the readers have a preference for news that confirms their prior beliefs and media outlets choose to slant their news accordingly. Gentzkow and Shapiro [2] present a reputation model in which there is uncertainty about the quality of the information possessed by the media outlet. In order to increase its reputation, a media might distort the news in the direction of the reports that are more likely according to the prior beliefs of the readers.

Our formal model is related to the model of political correctness in Morris [3]. In his setting, there is an informed advisor who can be perceived as biased and thus has an incentive to distort his recommendations to maintain reputation of being impartial. In our model, the media outlet similarly has an incentive to maintain reputation of being truthful and hence impartial. Nevertheless, the probability that the media outlet becomes biased and reports in favor of the interest group is determined endogenously and depends on its current reputation and the costs of independent information acquisition. The models of cheap talk information transmission with reputational concerns have also been studied by Ottaviani and Sorensen [6] and [7], who allow uncertainty about the expert's competence, and Olszewski [5], who assumes, similarly to our model, that the expert would like to be perceived honest.

The rest of the paper is organized as follows. Section 2 presents the model.

Section 3 looks at a two-period example to derive intuition. Section 4 develops an infinite-horizon model and provides some useful preliminary results. Section 5 characterizes the equilibrium of the infinite-horizon model and presents the main result. Section 6 concludes.

2 Model

There are three players in the game: a newspaper, a reader, and an interest group. In each period, the reader takes an action that affects both its own and the interest group's payoff. We denote it by y . The reader's utility function and the interest group's, U and \tilde{U} respectively, can be expressed as

$$\begin{aligned} U(M, y^*, y) &= M - L(|y - y^*|), \\ \tilde{U}(M, y^*, y) &= M - \lambda L(|y - y^*|), \end{aligned}$$

where M denotes monetary income, y^* denotes the agent's optimal action, L is a strictly increasing function measuring the agent's loss from a suboptimal action, and λ measures the interest group's stake on the issue (relative to the reader). For the reader, the optimal action is equal to the "true" state of the world, θ . For the interest group, the optimal action is equal to its "agenda," $\hat{\theta}$. Both are random variables taking a value of either 0 or 1. Let q be the probability of $\theta = 1$ and \hat{q} that of $\hat{\theta} = 1$. We assume they are independent of each other, which implies the reader's interest is orthogonal to that of the interest group. In addition, we assume both θ and $\hat{\theta}$ are independent across periods. The state and the agenda are realized at the beginning of each period. The newspaper reports news and the reader makes his decision based on the newspaper's report if he subscribes to it.

There are two types of newspapers: strategic and truthful. The former chooses strategies that maximize its expected payoff, while the latter always investigates and reports the true state. It is commonly known that the newspaper is of the truthful type with probability $p_0 \in (0, 1)$. A strategic newspaper has two sources for its news. The first source is through investigation at cost c , which yields the true state with certainty. The other source is from the interest group.

The timing of the game is as follows. At the beginning of each period, the state and the interest group's agenda are realized. However, the state is not immediately observable to the newspaper, the reader, or the interest group, and the interest group's agenda is its private information. The newspaper announces a subscription fee, ϕ .⁵

⁵We assume the truthful newspaper will charge the same subscription fee as the strategic news-

The reader decides whether to subscribe to the newspaper. If the reader does not subscribe, then the rest of the period proceeds without any role for the newspaper or the interest group. If the reader does subscribe, a strategic newspaper will be faced with two options: (i) propaganda – charging the interest group an access fee, α , and choosing the group’s favorite report;⁶ (ii) investigative journalism – incurring cost c to conduct an investigation and reporting the true state.⁷ Let the newspaper’s report be denoted by m . The reader makes a decision based on his prior and if he has subscribed to the newspaper, the newspaper’s report. Let y_m denote the action taken by the reader after receiving report m . At the end of each period, all three parties observe the true state, and the payoffs of reader and the interest group are realized. The reader updates his belief about the type of the newspaper. The reputation of the newspaper is the probability with which it is believed to be truthful.

The equilibrium concept we use is sequential equilibrium. In addition, we restrict our attention to equilibria in behavior strategies that depend only on the information available in the current period: the newspaper’s reputation and the newspaper’s report.

3 Benchmark: a Two-Period Example

In this section, we look at a two-period version of our model to derive intuition about our results. We assume the agents’ preferences to be quadratic, that is,

$$L(x) = x^2, \quad x \geq 0.$$

In addition, we make the simplifying assumption that $q = \frac{1}{2}$, that is, the state θ is 0 or 1 with equal probability. Throughout this section, we assume $c > \frac{1}{4}$, so that the subscription fee is not enough to cover the investigation cost.⁸

paper. In effect, the truthful newspaper has no conscious strategic choices to make. Therefore, when we discuss the newspaper’s strategies, we refer exclusively to those of the strategic type.

⁶Our 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 are not usually observed, a newspaper can implicitly benefit from advertising commitments, access to interviews, etc.

⁷If the newspaper conducts an investigation, it always at least weakly prefers reporting the true state to any alternative as doing so has a potentially reputation-enhancing effect and no negative effect.

⁸The maximum willingness to pay by the reader is his utility difference between complete information and no information, which is $\frac{1}{4}$.

We will look at two cases: (i) $\hat{q} = \frac{1}{2}$; (ii) $\hat{q} = 1$. In the first case, the interest group's agenda, $\hat{\theta}$, is either 0 or 1 with equal probability. In the second case, the interest group has a consistent bias, in that it wants the action 1 taken at all times.

3.1 Interest Group with a Random Agenda

Before proceeding, it is important to note that the reader makes his subscription decision *before* the newspaper's report. In addition, the newspaper cannot commit to its strategies in advance. Since investigative journalism is costly and propaganda is not, the only reason for the newspaper to choose the former is to maintain its reputation. Thus, in the second period, the strategic newspaper will always choose propaganda over investigative journalism.

We solve the game backward. Suppose the newspaper's reputation is p_1 at the beginning of the second period. We have argued that a strategic newspaper always chooses propaganda in the second period. Thus, when the reader receives the report m , he infers that it reflects θ with probability p_1 and $\hat{\theta}$ with probability $1 - p_1$. Due to his quadratic preferences, his optimal action is equal to the conditional expectation of θ :

$$\begin{aligned} y_0 &= \frac{p_1 \cdot 1/2 \cdot 0 + (1 - p_1) \cdot 1/2 \cdot 1/2}{p_1 \cdot 1/2 + (1 - p_1) \cdot 1/2} = \frac{1 - p_1}{2}, \\ y_1 &= \frac{p_1 \cdot 1/2 \cdot 1 + (1 - p_1) \cdot 1/2 \cdot 1/2}{p_1 \cdot 1/2 + (1 - p_1) \cdot 1/2} = \frac{1 + p_1}{2}. \end{aligned}$$

By symmetry, for either values of $\hat{\theta}$, the willingness to pay by the interest group is the same and equal to the utility difference between getting its favorite equilibrium action for sure (e.g., y_1 when $\hat{\theta} = 1$) and getting it only half of the time. Therefore, the newspaper earns an access fee

$$\alpha(p_1) = \frac{1}{2} [-\lambda(y_1 - 1)^2] - \frac{1}{2} [-\lambda(y_0 - 1)^2] = \frac{1}{2} \lambda p_1. \quad (1)$$

On the other hand, the reader's willingness to pay for the newspaper subscription is equal to the utility difference between taking the ex ante optimal action, $\frac{1}{2}$, and taking actions that are optimal conditional on the newspaper's report. Therefore, by symmetry, the newspaper earns a subscription fee of

$$\phi(p_1) = - \left[p_1(y_1 - 1)^2 + (1 - p_1) \left(\frac{1}{2}(y_1 - 0)^2 + \frac{1}{2}(y_1 - 1)^2 \right) \right] - \left[-\frac{1}{4} \right] = \frac{1}{4} p_1^2.$$

In the first stage, let the newspaper choose investigative journalism with probability q . It is straightforward to verify that

$$\begin{aligned} y_0 &= \frac{1 - p_0 - (1 - p_0)q}{2}, \\ y_1 &= \frac{1 + p_0 + (1 - p_0)q}{2}. \end{aligned}$$

As a result, at the beginning of the period, the newspaper can earn a subscription fee of

$$\phi = \frac{1}{4} [p_0 + (1 - p_0)q]^2.$$

We now turn to the newspaper's choice between investigative journalism and propaganda. If the newspaper chooses propaganda, it earns an access fee of

$$\alpha = \frac{1}{2} \lambda [p_0 + (1 - p_0)q].$$

After the state becomes common knowledge, the reader updates his belief about the newspaper's type, which in turn becomes common knowledge. We call the scenario in which the newspaper's report is consistent with the true state (as it would be if the newspaper were of the truthful type) a *success*, and the alternative case a *failure*. In the case of a failure, the newspaper's reputation drops to zero as an investigation perfectly reveals the true state. In the case of a success, the newspaper's reputation becomes

$$p_1^s = \frac{p_0}{p_0 + (1 - p_0)(q + (1 - q)/2)} = \frac{2p_0}{2 - (1 - p_0)(1 - q)} \in [p_0, \frac{2p_0}{1 + p_0}].$$

Note that it is decreasing in q . If the newspaper chooses investigative journalism, then its reputation will become p_1^s with probability one. If the newspaper chooses propaganda, however, then its reputation will become either p_1^s or 0 each with probability one half. Thus, if $q \in (0, 1)$ in equilibrium, the following must hold:

$$\frac{1}{2} \lambda [p_0 + (1 - p_0)q] + \delta \cdot \frac{1}{2} [\phi(p_1^s) + \alpha(p_1^s)] = -c + \delta [\phi(p_1^s) + \alpha(p_1^s)],$$

or

$$\frac{1}{2} \lambda [p_0 + (1 - p_0)q] = -c + \delta \cdot \frac{1}{2} [\phi(p_1^s) + \alpha(p_1^s)]. \quad (2)$$

The left hand side of the above equation represents the payoff from choosing propaganda – the access fee received from the interest group in the current period. The right hand side represents the net benefit from choosing investigative journalism –

the gain in subscription and access fees in the future due to enhanced reputation minus the cost of investigation. Note that the “temptation” for choosing propaganda is increasing in q , since the willingness to pay by the interest group is higher when the newspaper’s report is more influential to the reader. The net benefit for choosing investigative journalism is decreasing in q , since the newspaper’s post-success reputation (of being of the honest type) next period will drop as q increases. If $q = 1$ in equilibrium, or the newspaper always chooses investigative journalism, we need the LHS to be not more than the RHS. If $q = 0$ in equilibrium, or the newspaper always chooses propaganda, we need the LHS to be not less than the RHS. Thus, in order for there to exist an equilibrium in which the strategic newspaper chooses investigative journalism with a positive probability (possibly one), it is necessary and sufficient that the LHS is strictly lower than the RHS when $q = 0$, which can be written

$$\frac{1}{2}\lambda p_0 < -c + \delta \cdot \frac{1}{2} \left[\frac{1}{4} \left(\frac{2p_0}{1+p_0} \right)^2 + \frac{1}{2} \lambda \frac{2p_0}{1+p_0} \right],$$

or

$$\frac{1}{2}\lambda p_0 < -c + \delta \cdot \frac{1}{2} \left[\left(\frac{p_0}{1+p_0} \right)^2 + \lambda \frac{p_0}{1+p_0} \right].$$

Rearrangement gives us

$$c < \delta \cdot \frac{1}{2} \left(\frac{p_0}{1+p_0} \right)^2 + \frac{1}{2} \lambda p_0 \frac{\delta - (1+p_0)}{1+p_0}. \quad (3)$$

Fixing p_0 , this condition can only be satisfied when δ is larger than $1 + p_0$. Furthermore, either δ or λ has to be relatively large, which means that the future is important enough for the newspaper or the interest group has a high enough stake. To understand these conditions, first look at the benchmark case with $\delta = 1$. When $q = 0$, the post-success reputation of the newspaper, p_1^s , is in the interval $(p_0, 2p_0)$. By (1), the access fee in the second period is proportional to p_1^s . But the gain in access fee is weighted by $\frac{1}{2}$, the differential in success probability between investigative journalism and propaganda. Since $p_1^s < 2p_0$, the gain is less than the current access fee from propaganda. In addition, since $c > \frac{1}{4}$, the gain in the future subscription fee is not enough to cover the investigative cost. Therefore, when $\delta = 1$, the newspaper always chooses propaganda in the first period. However, if $\delta > 1 + p_0$, then the gain in the future access fee is more than the current fee from propaganda. Thus, we can either further increase δ , or increase the stake of the interest group, so that the net gain from investigative journalism dominates the temptation for choosing propaganda.

Our model captures a seemingly paradoxical phenomenon. Under the assumption $c > \frac{1}{4}$ and without the interest group, the market for news breaks down in that the

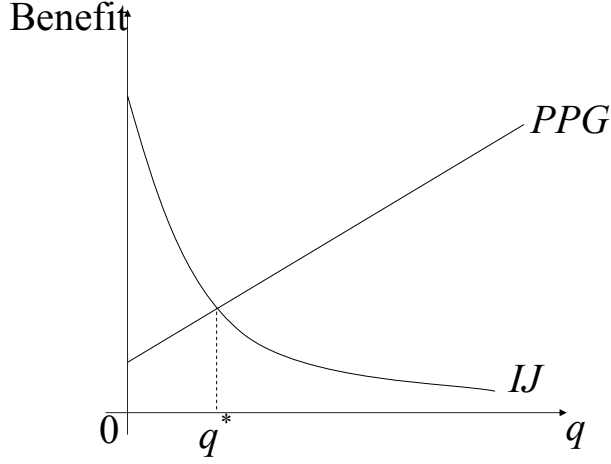


Figure 1: Newspaper’s choice between propaganda (PPG) and investigative journalism (IJ).

reader does not subscribe to the newspaper and receives no information at all, as the reader does not have a strong enough interest in “truth” to make him willing to finance the investigation cost. However, *with* the presence of the interest group, whose sole interest is to use the newspaper to distort information transmitted to the reader and hence his decision, the reader *can* now receive useful information from the newspaper. The interest group complements the reader in providing the financial incentive for the newspaper to conduct investigative journalism. The interest group is willing to pay more to the newspaper in the future if the newspaper maintains its reputation of honest journalism. This prevents the newspaper from choosing propaganda in the present. As long as δ is above a threshold $(1 + p_0)$, or the future is important enough, then as long as λ is large enough, or the interest group feels passionate enough about the issue, in equilibrium the newspaper chooses investigative journalism with positive probability.

Let us focus on the case $q \in (0, 1)$. In addition to (3), we also need that when $q = 1$, LHS of (2) is greater than RHS of (2), which gives $c > \frac{1}{8}\delta p_0^2 + \frac{1}{2}\lambda(\frac{\delta}{2}p_0 - 1)$. The equilibrium probability of investigative journalism, q^* , is determined by (2), as demonstrated by Figure 1. The following proposition summarizes the comparative statics of q^* .

Proposition 1. *In equilibrium, q^* , the frequency at which the newspaper chooses investigative journalism in the first period, satisfies the following:*

1. *it increases with δ , the importance of the next period’s payoff for the newspaper;*

2. *it decreases with c , the cost of investigative journalism;*
3. *it increases with λ , the stake of the interest group, as long as $c \geq \delta \cdot \frac{1}{2} \left(\frac{p_0}{1+p_0} \right)^2$.*

Here, we provide an intuitive proof of the above proposition. First, observe that an increase in δ drives up the net benefit of investigative journalism and an increase in c drives it down, without changing the benefit of propaganda. Therefore, Figure 1 shows that the equilibrium probability of investigative journalism, q^* , goes up as δ increases and down as c increases. The argument for the comparative statics with respect to λ is more involved. The condition on c implies that the gain in the future subscription fee cannot offset the investigation cost given $q = 0$ (it cannot either at any $q > 0$ since the future subscription fee is decreasing in q). Thus, at q^* , the gain in the future access fee must be higher than the current access fee in order to offset the investigation cost. Note also the future access fee is decreasing in q and the current access fee is increasing in q . Suppose now λ increases to λ' . Thus, for all $q \leq q^*$, there is an increase in the difference between the gain in the future access fee and the current access fee, which means that the new equilibrium probability of investigative journalism, q' , must be higher than q^* so as to decrease the difference in access fees and the future subscription fee in order to maintain the equilibrium.

3.2 Interest Group with a Consistent Bias

Let us consider a case in which the interest group has a favorite action regardless of what is best for the reader. In the context of our model, let the interest group's agenda, $\hat{\theta}$, be always equal to 1. We retain all the other features of our model, including notations. The game can be solved similarly. Note, however, states and actions are no longer symmetric.

Assume the newspaper's reputation at the beginning of the second stage to be p_1 . Again, in the second period, a strategic newspaper always chooses propaganda over investigative journalism as the former is strictly preferable. Recall that y_i is the action taken by the reader when receiving the report 1. Thus,

$$\begin{aligned} y_0 &= 0; \\ y_1 &= \frac{p_1 \cdot \frac{1}{2} \cdot 1 + (1 - p_1) \cdot \frac{1}{2}}{p_1 \cdot \frac{1}{2} + (1 - p_1)} = \frac{1}{2 - p_1}. \end{aligned}$$

Note the action y_1 is between $\frac{1}{2}$ and 1. If the interest group does not buy access, then the newspaper has to conduct an investigation and reports 1 and 0 each with probability $\frac{1}{2}$. If the interest group does buy access, then it ensures the newspaper

publishes its favorite report, 1, with probability one. The newspaper charges an access fee equal to the newspaper's willingness to pay. Hence, the access fee is

$$\alpha(p_1) = \frac{1}{2}\lambda[-(y_1 - 1)^2 - (-(y_0 - 1)^2)] = \frac{1}{2}\lambda[1 - (1 - y_1(p_1))^2],$$

where $y_1(p_1)$ is the y_1 the reader takes in the second period given the newspaper's reputation p_1 , with a slight abuse of notation. The access fee $\alpha(p_1)$ is increasing in p_1 as $y_1(p_1)$ is.

The reader's willingness to pay for the subscription to the newspaper is his utility difference between making decisions based on the newspaper's report and doing so solely based on the prior. The newspaper charges a subscription fee equal to the reader's willingness to pay at the beginning of the second period:

$$\begin{aligned}\phi(p_1) &= - \left[(1 - p_1) \left[\frac{1}{2}(y_1 - 0)^2 + \frac{1}{2}(y_1 - 1)^2 \right] + p_1 \cdot \frac{1}{2}(y_1 - 1)^2 \right] - \left(-\frac{1}{4}\right) \\ &= \frac{1}{4} - \frac{1}{2}(1 - y_1(p_1))^2 - \frac{1}{2}(1 - p_1)[y_1(p_1)]^2.\end{aligned}$$

We do not rule out negative subscription fee here. However, as long as λ is large enough, the newspaper will find it profitable to operate rather than shut down. In addition, by the envelope theorem,

$$\frac{d\phi(p_1)}{dp_1} = \frac{1}{2}[y_1(p_1)]^2 > 0.$$

We now proceed to the first period of the game. Again, let q be the probability with which the newspaper investigates in the first period. The reader's actions are

$$\begin{aligned}y_0 &= 0; \\ y_1 &= \frac{p_0 \cdot \frac{1}{2} \cdot 1 + (1 - p_0) \cdot \frac{1}{2}}{p_0 \cdot \frac{1}{2} + (1 - p_0)(\frac{1}{2} + \frac{1}{2}(1 - q))} = \frac{1}{2 - p_0 - (1 - p_0)q}.\end{aligned}$$

The newspaper can charge an access fee equal to

$$\alpha(q) = \frac{1}{2}[1 - (y_1(q) - 1)^2].$$

Again, we have abused notation a little in using $y_1(q)$ to denote the action y_1 the reader takes in the first period, given that the newspaper investigates q of the time.

After the first period, the true state is realized and observed by all the players. The reader then updates his belief about the newspaper's type. Let p_1^f , $p_1^{s_0}$, and $p_1^{s_1}$ be respectively the newspaper's reputation after a failure, a success in state 0, and a

success in state 1. We claim

$$\begin{aligned} p_1^f &= 0, \\ p_1^{s1} &= p_0, \\ p_1^{s0} &= \frac{p_0}{p_0 + (1 - p_0)q}. \end{aligned}$$

If the newspaper's report fails to match the true state, then its reputation becomes zero. If the true state is 1, and the newspaper's reputation does not change. This is because the newspaper will always report 1 when the true state is 1 as a result of either investigation or propaganda. Thus, a success in state 1 does not reveal information about the type of the newspaper. On the other hand, a success in state 0 will increase the newspaper's reputation. Also, p_1^{s0} is increasing in p_0 and decreasing in q .

If the newspaper chooses propaganda, then it receives the access fee for the current period and its reputation will become p_0 or 0 each with probability half. On the other hand, if the newspaper chooses investigative journalism, then it has to incur the investigation cost c and its reputation will become p_0 or p_1^{s0} each with probability half. In order for $q \in (0, 1)$ to hold, the newspaper's payoff from propaganda must be the same as that from investigative journalism, which gives us a condition similar to (2):

$$\frac{1}{2}\lambda [1 - (y_1(q) - 1)^2] = \delta \cdot \frac{1}{2} [\phi(p_1^{s0}) + \alpha(p_1^{s0})] - c. \quad (4)$$

As in (2), the left hand side above corresponds to the benefit of propaganda, which increases with q as $y_1(q)$ is. The right hand side corresponds to the benefit of investigative journalism, which decreases with q , as the access and subscription fees are increasing in p_1 and p_1^{s0} decreases with q . Therefore, Figure 1 again illustrates the equilibrium condition.

Again, in order for an equilibrium with $q > 0$ to exist, it is necessary and sufficient that at $q = 0$, the benefit to investigative journalism exceeds that to propaganda, which can be formally written as

$$\frac{1}{2}\lambda \frac{3 - 2p_0}{(2 - p_0)^2} < \delta \cdot \frac{1}{2} \left[\frac{1}{4} + \frac{1}{2}\lambda \right] - c. \quad (5)$$

As we assumed in the previous section, $c > \frac{1}{4}$. The above condition can only be satisfied if $\delta > \frac{2(3-2p_0)}{(2-p_0)^2}$. Then, the condition can be met with either a large δ or λ . Also, the equilibrium is unique.

Given (5) holds, we may also establish a result similar to Proposition 1.

4 An Infinite-Horizon Model

In the example in the previous section, we have demonstrated the possibility that the presence of interest groups may enhance social welfare, in that the interest group who has a large stake in the issue enables the operation of the otherwise broken-down market for news, so as to have influence on the reader. We have shown that in order for this effect to take place, the second period must be important enough for the newspaper, which is reflected in the condition that δ must be significantly higher than one. Intuitively, the second period can be viewed as the reduction of the future periods in the newspaper's life span.

In this section, we now construct an infinite-horizon model to show that the intuition indeed carries through. Again, we make a functional form assumption on the agents' preferences:

$$L(x) = x, \quad , x \geq 0.$$

Let p_t be the reputation of the newspaper at the beginning of period t and r_t be the probability with which the strategic newspaper undertakes costly investigation in this period. If the newspaper chooses propaganda, it reports 1. Thus, when the reader receives report 1, he infers that it reflects θ with probability $p_t + (1 - p_t)r_t$ and has no valuable information with probability $(1 - p_t)(1 - r_t)$. As a result, conditional on report 1, the reader believes that the probability of θ being 1 is

$$q(p_t, r_t) = \frac{q}{1 - (1 - q)(p_t + (1 - p_t)r_t)}.$$

The value of $q(p_t, r_t)$ is increasing in the newspaper's reputation, p_t , and the probability of costly investigation by the strategic newspaper, r_t . In particular, if the newspaper is expected to always choose propaganda, the reader believes that both states are equally likely after report 1 by the newspaper whose reputation is

$$p^* = \frac{1 - 2q}{1 - q}.$$

Notice that this condition can be satisfied only if $q \leq 1/2$.

Furthermore, if $p_t > p^*$ then $q(p_t, r_t) > 1/2$ regardless of how frequently the newspaper chooses investigative journalism. On the other hand, if $p_t < p^*$, then the reader believes that both states are equally likely if the newspaper chooses to investigate with probability

$$r_t^*(p_t) = \left(\frac{1 - 2q}{1 - q} \frac{1}{p_t} - 1 \right) \frac{p_t}{1 - p_t}.$$

By contrast, if the reader receives report 0, he infers that it reflects θ with probability one. Let y_m denote the action taken by the reader after receiving report m . Because the reader's preferences are expressed by an absolute value loss function, his optimal action is equal to the more likely value of the state of the world:

$$y_0 = 0;$$

$$y_1(p_t, r_t) = \begin{cases} 0, & \text{if } q(p_t, r_t) < \frac{1}{2}; \\ \tilde{y}, & \text{if } q(p_t, r_t) = \frac{1}{2}; \\ 1, & \text{otherwise;} \end{cases}$$

where \tilde{y} is any number between zero and one.

The reader's willingness to pay for the subscription to the newspaper is his utility difference between making his decision based on the newspaper's report and doing so solely based on the prior. If $q(p_t, r_t) < 1/2$, the newspaper's report does not affect the reader's decision and hence his willingness to pay for subscribing to the newspaper is zero. Furthermore, if $q(p_t, r_t) = 1/2$, the reader is indifferent about which action to choose after report 1 and hence his willingness to pay for the reports is also zero.

On the other hand, if $q(p_t, r_t) > 1/2$, the newspaper's report is valuable to the reader. The value of subscription, however, depends on the reader's prior beliefs. If $q \leq 1/2$, the best action for the reader in the absence of the newspaper's report is 0, in which case his payoff is equal to $M - q$. If he subscribes to the newspaper, his expected payoff is $M - (1 - p_t)(1 - r_t)(1 - q)$. As a result, he is willing to pay for the subscription to the reports up to $2q - 1 + (p_t + (1 - p_t)r_t)(1 - q)$. On the other hand, if $q > 1/2$, the optimal action for the reader given his prior beliefs is 1, which gives him the expected payoff of $M - (1 - q)$. In this case, he is willing to pay to the newspaper up to $(p_t + (1 - p_t)r_t)(1 - q)$.

At the beginning of each period, the newspaper charges a subscription fee equal to the reader's willingness to pay:

$$\phi(p_t, r_t) = \begin{cases} 0, & \text{if } q(p_t, r_t) \leq \frac{1}{2}; \\ (p_t + (1 - p_t)r_t)(1 - q) + \min\{2q - 1, 0\}, & \text{otherwise.} \end{cases}$$

The subscription fee is increasing in the newspaper's reputation, p_t , and the probability of costly investigation by the strategic newspaper, r_t .

For the interest group the newspaper is valuable if and only if the newspaper's report of 1 affects the reader's decision, $y_1(p_t, r_t) > 0$. In this case, if the interest group does not buy access, then the newspaper has to conduct an investigation and

reports 1 with probability q and 0 with probability $1 - q$. If the interest group does buy access, then it ensures that the newspaper publishes its favorite report, 1. The newspaper charges an access fee equal to the interest group's willingness to pay. Hence, the access fee is

$$\alpha(p_t, r_t) = y_1(p_t, r_t)\lambda(1 - q).$$

Finally, at the end of each period, the state becomes common knowledge. After this, the reader updates his belief about the newspaper, which in turn becomes common knowledge. We call the scenario in which the newspaper's report is consistent with the true state (as it would be if the newspaper were of the truthful type) a *success*, and the alternative case a *failure*. Let p_{t+1}^f , $p_{t+1}^{s_0}$, and $p_{t+1}^{s_1}$ be respectively the newspaper's reputation after a failure, a success in state 0, and a success in state 1. We have

$$\begin{aligned} p_{t+1}^f(p_t, r_t) &= 0, \\ p_{t+1}^{s_1}(p_t, r_t) &= p_t, \\ p_{t+1}^{s_0}(p_t, r_t) &= \frac{p_t}{p_t + (1 - p_t)r_t}. \end{aligned}$$

If the newspaper's report fails to match the true state, then its reputation becomes zero. If the true state is 1 and the report matches the state, the newspaper's reputation does not change. This is because the newspaper will always report 1 when the true state is 1 as a result of either investigation or propaganda. Thus, a success in state 1 does not reveal information about the type of the newspaper. In addition, if the newspaper investigates with probability one, $r_t = 1$, then a success in state 0 also does not reveal any information about the type of the newspaper. On the other hand, if the strategic newspaper engages in propaganda at least sometimes, $r_t < 1$, a success in state 0 is informative and will increase the newspaper's reputation. This increase in reputation $p_{t+1}^{s_0}$ will be larger for lower values of r_t .

We now turn to the newspaper's choice between investigative journalism and propaganda. Let $V(p)$ be the expected payoff of the newspaper whose reputation is p . In this paper, we will concentrate on equilibria in which $V(p)$ is nondecreasing.

If the newspaper chooses propaganda, then it receives the access fee for the current period and its reputation will become 0 with probability $1 - q$ and will not change with probability q . Therefore, the benefit from propaganda is

$$\mathcal{P}(p_t, r_t) = \alpha(p_t, r_t) + \phi(p_t, r_t) + \delta q V(p_t).$$

On the other hand, if the newspaper chooses investigative journalism and incurs the cost of investigation c , its reputation will increase to $p_{t+1}^{s_0}$ with probability $1 - q$ and will not change with probability q . The benefit from investigation is

$$\mathcal{I}(p_t, r_t) = -c + \phi(p_t, r_t) + \delta q V(p_t) + \delta(1 - q)V(p_{t+1}^{s_0}).$$

The net benefit from investigation is

$$\mathcal{L}(p_t, r_t) = -c - \alpha(p_t, r_t) + \delta(1 - q)V(p_{t+1}^{s_0}).$$

It is non-increasing in r_t . Hence, $r_t = 1$ if and only if $\mathcal{L}(p_t, 1) \geq 0$, $r_t = 0$ if and only if $\mathcal{L}(p_t, 0) \leq 0$, and $r_t \in (0, 1)$ if and only if $\mathcal{L}(p_t, 1) < 0$ and $\mathcal{L}(p_t, 0) > 0$. Furthermore, and if $r_t \in (0, 1)$ then $\mathcal{L}(p_t, r_t) = 0$; the newspaper is indifferent between investigative journalism and propaganda if:

$$\alpha(p_t, r_t) = \delta(1 - q)V(p_{t+1}^{s_0}) - c.$$

5 Equilibrium

In order to characterize the equilibrium, we start with the newspaper whose reputation is one. Let r^* be the probability of investigation in equilibrium. The expected payoff of the newspaper equals

$$v(r^*) = \begin{cases} \frac{\lambda(1-q) + \min\{q, 1-q\}}{1-\delta q}, & r^* < 1; \\ \frac{-c + \min\{q, 1-q\}}{1-\delta}, & r^* = 1. \end{cases}$$

In any period, the net benefit of investigation is

$$\mathcal{L}(1, r^*) = -c - \lambda(1 - q) + \delta(1 - q) \cdot v(r^*).$$

Let

$$c^* = \frac{\delta(1 - q) \min\{q, 1 - q\}}{1 - \delta q}.$$

In equilibrium, the newspaper chooses investigative journalism with probability one if $\mathcal{L}(1, 1) \geq 0$, which is equivalent to

$$c \leq c^* - \frac{\lambda(1 - q)(1 - \delta)}{(1 - \delta q)}. \quad (6)$$

Observe that if $r_t = 1$, then $\mathcal{L}(p_t, 1) = \mathcal{L}(1, 1)$ for all p_t . Hence, if (6) is satisfied the newspapers with any reputation will find optimal to choose investigative journalism with probability one given that this is expected by the reader. Hence, we obtain the following result.

Lemma 1. *There exists an equilibrium in which the newspaper chooses investigative journalism with probability one if and only if (6) holds.*

Let us now assume that (6) is not satisfied:

$$c > c^* - \frac{\lambda(1-q)(1-\delta)}{(1-\delta q)}. \quad (7)$$

It is straightforward to verify that a newspaper with reputation $p \geq p^*$ chooses propaganda with probability one, $\mathcal{L}(p, 0) \leq 0$, and its expected payoff is equal to

$$V(p) = \frac{\lambda(1-q) + p(1-q) + \min\{2q-1, 0\}}{1-\delta q}. \quad (8)$$

Furthermore, $\mathcal{L}(p, 0) \leq 0$ for all $p > 0$ if

$$-c + \delta(1-q) \cdot V(1) \leq 0.$$

which can be rewritten as

$$c \geq c^* + \frac{\delta\lambda(1-q)^2}{1-\delta q}. \quad (9)$$

This implies the following result.

Lemma 2. *There exists an equilibrium in which the newspaper always chooses propaganda if and only if (9) holds.*

We now turn to the case in which (7) holds and (9) does not:

$$c^* - \frac{\lambda(1-q)(1-\delta)}{(1-\delta q)} < c < c^* + \frac{\delta\lambda(1-q)^2}{1-\delta q}. \quad (10)$$

Consider a newspaper with reputation $p_t < p^*$. (This is possible only if $q < 1/2$.) Let r_t be the probability with which it chooses investigative reporting and $y_1(p_t, r_t)$ be the action chosen after the newspaper reports 1. Observe that $y_1(p_t, 0) = 0$ and $y_1(p_t, 1) = 1$. The net benefit from investigative journalism for the newspaper is

$$\mathcal{L}(p_t, r_t) = -c - y_1(p_t, r_t)\lambda(1-q) + \delta(1-q) \cdot V(p_{t+1}^{s_0}(p_t, r_t)).$$

Notice that for any $r_t > r^*(p_t)$, we have

$$\begin{aligned} \mathcal{L}(p_t, r_t) &= -c - \lambda(1-q) + \delta(1-q) \cdot V(p_{t+1}^{s_0}) \\ &\leq -c - \lambda(1-q) + \delta(1-q) \cdot v \stackrel{(7)}{<} 0. \end{aligned}$$

At the same time,

$$\mathcal{L}(p_t, 0) = -c + \delta(1-q) \cdot V(1) \stackrel{(10)}{>} 0.$$

Therefore, there is an equilibrium if and only if r_t belongs to $(0, r^*(p_t)]$ and that $r_t(p_t)$ and $y_1(p_t, r_t(p_t))$ solve

$$-c - y_1(p_t, r_t)\lambda(1 - q) + \delta(1 - q) \cdot V(p_{t+1}^{s_0}(p_t, r_t)) = 0. \quad (11)$$

The solution of (11) exists and can be found recursively as follows. Let $p^0 = p^*$ and

$$p^i = p^{i-1} \cdot \frac{1 - 2q}{1 - q}.$$

The value of p^i converges to zero as i converges to infinity. Observe that for all $p \geq p^0$ the value of $V(p)$ is continuous and given by (8). Furthermore, $r(p) = 0$ and $y_1(p, r(p)) = 1$. Now, assume that for all $p \geq p^i$ the value of $V(p)$ is known and continuous. Let us construct the values of $r(p)$ and $y_1(p, r(p))$ for $p^{i+1} \leq p < p^i$. Observe that

$$p_{t+1}^{s_0}(p, r^*(p)) = p \cdot \frac{1 - q}{1 - 2q} \geq p^i.$$

Hence, for any $r_t \in (0, r^*(p_t)]$, $p_{t+1}^{s_0}(p, r_t) \geq p^i$. Therefore, for any $r_t \in (0, r^*(p_t)]$ the equation (11) is well-defined and by continuity of $V(p)$ on $[p^i, 1]$ it has a solution $r(p)$ and $y_1(p, r(p))$ on $[p^{i+1}, p^i]$. In turn, this determines the value of $V(p)$ on $[p^{i+1}, p^i]$. We skip the proof that it is continuous on this interval and that $\lim_{p \rightarrow p^i} V(p) = V(p^i)$.

Lemma 3. *If (10) holds, there exists an equilibrium in which the newspaper chooses investigative journalism with positive probability if its reputation is less than p^* .*

6 Discussion

Let us compare the situations in which the newspaper is allowed to accept reports from the interest group ($\lambda > 0$) and in which it is not feasible ($\lambda = 0$). It follows from (6) that the presence of interest group can destroy the equilibrium in which the newspaper chooses investigative journalism. In particular, this is the only possibility if state 1 is more likely given prior beliefs of the reader. In this case, increasing λ always leads to switch to the equilibrium in which propaganda is chosen with probability one. (In this case, $q \geq 1/2$ and hence $p^* < 0$, implying that there is no equilibrium in which the newspaper randomizes between propaganda and investigative journalism.)

On the other hand, the presence of the interest group can lead to an increase in investigative journalism if state 1 is relatively unlikely given the prior beliefs of the

reader. This is the case when (10) holds. If $\lambda = 0$, investigative journalism cannot be sustained whenever (7):

$$c^* < c.$$

Nevertheless, with $\lambda > 0$ investigative journalism can be sustained if the prior reputation is very small and (10) is satisfied:

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

Observe that in this equilibrium the newspaper with (arbitrarily) small prior reputation will engage in investigative journalism. By contrast, the newspaper with large prior reputation will choose propaganda. Furthermore, investigation induced by the concern about reputation creates zero value for the reader – either the newspaper’s report has no effect on the reader’s decision or the reader is indifferent about whether to follow the newspaper’s recommendation.

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