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Competition and uncertainty in a paper's news desk*

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Abstract

We propose a model in which different types of journalists have superior information to a newspaper's editor. Journalists compete for having their report published, but when writing their reports, they are uncertain about the preferences of the editor. We analyze the effects of competition and uncertainty on the incentives of the journalists to write informative reports. We obtain that there is not a unique prediction as to the effects of competition, but the correct answer depends on how much uncertainty there is. Thus, if the editor is perceived to be honest, we show there is an equilibrium in which all the journalists write informative reports, provided that a certain level of competition is met. In contrast, if the editor is perceived to be biased, partial revelation of information exists, even in the absence of competition. Last, high levels of uncertainty inevitably results in uninformative reporting.

Keywords: Information transmission; media bias; competing journalists; uncertainty
JEL: D72; D82

1 Introduction

From the classical setting of Lazarsfeld et al. (1948) to the present, numerous studies have established the influence of the mass media on a wide range of social and economic spheres, from public policy and voter turnout to consumption and credit card penetration. Examples are Besley and Burgess (2002), Stromberg (2004), Gentzkow (2006), George and Waldfogel (2006), Baker and George (2010) or Enikolopov et al. (2011), among others.

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Despite this stark central role and the general consensus on the importance of a free press, there is abundant evidence of media bias. For example, Djankov et al. (2003) find that almost universally, the government controls the largest media firms, and that this control has consequences for economic and political variables. Groseclose and Milyo (2005) observe a strong liberal bias in the US major media outlets, and Ansolabehere et al. (2006) document a shift in newspaper's political orientation, from strongly favoring Republicans in the 1940s, to a more equalized support nowadays. The literature has as well been prolific on the question of why this media bias exists. The arguments proposed so far in the literature has been classified according to which side of the market for news they affect. Thus, explanations such as the aim to support the newspaper owner's world view (Anderson and McLaren (2012)), or the mere imposition or side-effects derived from advertisement (Ellman and Germano (2009)), have been grouped and christianized in the literature as "supply-side arguments". On the other hand, the "demand-side arguments" comprises arguments such as the pursuit of reputation (Gentzkow and Shapiro (2006)) or the existence of like-minded readers (Mullainathan and Shleifer (2005)).

This paper contributes to this literature by pointing to a new reason that could help to explain the media bias. Namely, the asymmetries of information between the journalists and the editor of a newspaper, and the natural competition between the journalists to have their work published. To this aim, we propose a simple model that focuses on the production of news in a paper's news desk and represents it as a game of advice, in which journalists have superior information to an editor. The model introduces two important and novel features: competition between journalists, and uncertainty about the editor's preferred piece of information.[1] Our objective is to analyze how these two features affects the incentives of the journalists to write informative reports. Therefore, the bias, in our context, refers to the information transmitted from the journalists to the editor and is defined relative to the truth.

More precisely, we consider an economy in which a rumor of a politician's wrongdoing is circulating. The rumor can be, for example, an allegation about some abuse of power, the use of slush money, or an illegal salary top-up. The economy comprises n journalists and an editor of a newspaper. The journalists receive perfectly informative signals on the veracity of the rumor, upon which they each write a report about it and sent it to the editor. The editor, who is uninformed, has to pick one report and publish it. The content of this report sets the position of the newspaper in this matter.

Additionally, we consider that journalists compete with each other for having their report published. This desire is common to all the journalists. However, some of the journalists do also care about the veracity of the information published in

[1]In different contexts, Mullainathan and Shleifer (2005), Gentzkow and Shapiro (2006), Andina-Díaz (2009) or Anderson and McLaren (2012) have also analyzed the effects of competition on the media bias.

the newspaper. Formally, our model considers journalists who can be either of two types: good or bad. Bad journalists only care about having their report published, whereas good journalists do also care about the information the newspaper prints out.

Each journalist, knowing her type, has to decide what information to write down in their report to the editor. An important feature of our model is that journalists take this decision being uncertain about the preferences of the editor. They know, however, that the editor can be either honest or biased. We assume that a biased editor has a preference for publishing that the politician's malpractice is true, whereas an honest editor is concerned about what is printed out and does not want to misreport the facts. Our interest here is to illustrate a situation in which a front-page news stating that the rumor is true will boot the newspaper's readership, and the journalists, aware of it, are then uncertain as to whether the editor is really interested in publishing the truth, or he may instead have a preference for publishing a report that will redound to higher profits.[2]

We analyze how competition and uncertainty affect the incentives of the journalists to write informative reports, which sets the media bias. We obtain that there is not a unique prediction as to the effects of competition, but the correct answer depends on how much uncertainty there is. Thus, if the journalists consider that the editor is quite likely to be an honest type, there is an equilibrium in which all the journalist write informative reports, provided that a certain level of competition ($n \geq 3$) is attained. On the contrary, if the editor is perceived to be biased, no equilibrium as the one described above exists. However, in this case, we obtain that there is an equilibrium in which the journalists specialize and tailor their reports according to the type of editor they want to please. More precisely, in this equilibrium, good journalists look for the support of the honest editor, and so write informative reports; and bad journalists aim to cater to the biased editor, and so persistently state that the alleged malpractice is true. Interestingly, we obtain that this is an equilibrium even in the case of a single journalist, and that competition, in this case, does nothing but inhibits the information flow. Last, we obtain that for high levels of uncertainty, no equilibrium embedding information transmission exists, which means media bias is bound to arise in this case.

As for the effects of the uncertainty on the incentives of the journalists to write informative reports, contrary to expected, we obtain that a bit of uncertainty may actually pay. This is the case when $n = 2$, in which case, under certainty, no informative writing occurred; whereas introducing uncertainty makes it partially possible (from the good journalists). Hence, the uncertainty, far from precluding the information transmission, may help to reduce the media bias in this particular case.

Our paper is also related to the literature on information transmission. The works of Austen-Smith (1993), Krishna and Morgan (2001) and Ottaviani and Sorensen (2006), consider models with multiple experts. Their focus, however, is on how to

[2]Alternative explanations to the editor's bias are ideological motives or a partisan support.

elicit the experts' superior information, in a set-up in which experts have a preference that differs from that of the decision maker. In contrast, the present model considers journalists that do not want to pull the editor in a certain direction, but compete for his approval. This is in line with Cummins and Nyman (2005), who analyze the effects of competition in a model in which experts receive independent signals about the state of the world. In contrast to them, our journalists receive the same perfect signal, which departs our framework from one of herding. With respect to the uncertainty, the literature usually formalizes the uncertainty about the decision maker by means of a signal that he receives and that no other player knows (see Watson (1996) or Olszewski (2004)). Closest to the present paper, Andina-Díaz (2012) considers a decision maker with private information about his preferences. Her focus is, however, on how to elicit the expert's information in a two period game, where competition between experts is absent.

The rest of the paper is organized as follows. In Section 2 we propose the model. Section 3 presents the main results of the paper, where we analyze the effects of competition on the incentives of the journalists to write informative reports. In Section 4 we consider that the preferences of the editor are known, which serves us to analyze the effects of the uncertainty on the journalists' incentives to be informative. Finally, Section 5 concludes.

2 The model

Consider a situation in which there is a rumor about, let us say, a politician's wrongdoing. The rumor can be either true (T) or false (F). These two possibilities are refereed as the two stages of the world, $w \in \{\mathrm{T}, \mathrm{F}\}$, where the prior probability on the malpractice being true is $\theta \in (0,1)$.

There are $n \geq 2$ journalist and an editor of a newspaper.[3] The journalists receive perfectly informative signals on whether the politician's wrongdoing is true or false, upon which they each send a report $r \in \{t, f\}$ to the editor, who updates beliefs on the state of the world and publishes a report $a \in \{T, F\}$ that sets the position of the newspaper on this matter.[4]

We assume that the space in the newspaper is limited, so only one report can be published. The journalists compete for this space. Specifically, for a journalist $i \in \{1, ..., n\}$, her utility $U_i(r_i, a)$, is 0 if her report is the one published, and -1 otherwise. In the case $k \leq n$ journalists write the same report and the editor is to

[3]For compactness and analytical convenience, the analysis in the text refers to the case $n \geq 2$. The results when there is a single journalist are relegated to footnotes.

[4]In the paper we consider that the available set of actions for the editor is always $\{T, F\}$, independently on whether there are reports that support each of the actions. The idea behind this assumption is that if an editor considers that, let us say, the politician's wrongdoing is false and all the reports say true, he still has the possibility of writing himself the report and setting therefore the newspaper's position that he considers to be appropriate. In equilibrium, however, the editor never writes the report himself, except for the biased editor in Proposition 1. This point becomes clear in the proofs.

choose among these reports, we assume that the editor picks one of these reports at random.

We assume, however, that the editor is uncertain as for the ultimate objective of the journalists. Specifically, with probability $\alpha \in (0,1)$ a journalist is good, in which case she cares about her report being published as well as about the newspaper publishing an informative piece of news. This fact is represented by an extra term, $\lambda U_i(a,w)$, where $U_i(a,w)$ takes the value 0 if (T,T) or (F,F); and -1, if (T,F) or (F,T), with $\lambda > 0$ being a measures of how strong are the outcome concerns of the journalist. With probability $1-\alpha$ a journalist is bad (exclusively self interested), in which case she only cares about having her report published in the newspaper. The type of a journalist is her private information and types are drawn independently.

Additionally to the journalists, we consider that the editor can be either of two types: honest or biased. An honest editor wants to publish an informative report. His utility, $U_E(a,w)$, is either 0, if (T,T) or (F,F); and -1, if (T,F) or (F,T), In contrast, a biased editor always wants to publish a report saying that the politician's corrupt practice is true. Then, $\forall w \in \{\mathrm{T},\mathrm{F}\}$, his utility is 0 if (T,w), and -1 if (F,w). The prior that the editor is honest is $\beta \in (0,1)$.

In a context in which the journalists compete for the space in the newspaper, our interest is twofold: (i) We want to analyze how the competitive pressure between the journalists affects their incentives to write informative reports and (ii), which is the impact of the uncertainty about the preferences of the editor on the incentives of the journalists to be informative. Whereas the two analysis focuses on different questions, competition and uncertainty, respectively, both have a common objective: That of understanding what drives the accuracy of news we receive from the media and how media bias is affected by these two variables.

Hence, we focus on equilibria in which the journalists reveal their information to the editor. The one exception is that we also analyze the existence of equilibria in which some of the journalists cater to the preferences of the biased editor and choose to report on the politician's wrongdoing as being true, independently of the veracity of the alleged practice. In any case, we only consider symmetric equilibria, i.e., equilibria in which all the journalists of a type send the same report. We focus on pure strategies and our equilibrium concept is the perfect Bayesian equilibrium.

3 The competitive pressure

Let $\Lambda(r_1, r_2, ..., r_n)$ be the equilibrium posterior probability assigned to the state of the world being T, upon observing the vector of reports $(r_1, r_2, ..., r_n)$. Additionally, let x (resp. y) denote the out-of-equilibrium-path belief assigned to the state of the world being T, upon observing all reports saying t (resp. f), but one.

Our first result shows that if there are only two journalists that compete for the space in the newspaper, there is no equilibrium in which the two journalist write informative reports. It also says that the informativeness of the process is restored when competition increases. In fact, three journalists turns to be sufficient to break the previous negative outcome and restore the information flow.

Proposition 1. *There is an informative equilibrium in which all the journalists write informative reports if and only if* $n \geq 3$ *and* $\beta \geq \frac{n}{n+1}$.

Proof. Let us conjecture an equilibrium in which, for all $w \in \{\mathrm{T}, \mathrm{F}\}$, $r(w) = w$ for both types of journalists. By Bayes' rule, $\Lambda(t, t, ..., t) = 1$ and $\Lambda(f, f, ..., f) = 0$. Let Λ("all reports say t but one") $= x \in [0, 1]$ and Λ("all reports say f but one") $= y \in [0, 1]$. According to these posteriors, the honest editor optimally chooses $a(t, t, ..., t) = T$ and $a(f, f, ..., f) = F$. Additionally, he publishes a("all reports say t but one") $= T$ if and only if $x \geq \frac{1}{2}$ and a("all reports say f but one") $= F$ if and only if $y \leq \frac{1}{2}$.

(1) Consider $y > \frac{1}{2}$ (with $x \in [0, 1]$). If $w = \mathrm{F}$ and $r(\mathrm{F}) = f$, the payoff to a bad journalist is $\beta(\frac{1-n}{n}) + (1-\beta)(-1)$; whereas her payoff if she deviates to $r(\mathrm{F}) = t$ is 0. Hence, there is no equilibrium of the type conjectured.

(2) Consider $y \leq \frac{1}{2}$ and $x < \frac{1}{2}$. Let us focus on the bad journalist. If $w = \mathrm{T}$ and $r(\mathrm{T}) = t$, her payoff is $\frac{1-n}{n}$; whereas if she deviates to $r(\mathrm{T}) = f$, it is $(1-\beta)(-1)$. Hence, $r(\mathrm{T}) = t$ if and only if $\beta \leq \frac{1}{n}$. Now, if $w = \mathrm{F}$ and $r(\mathrm{F}) = f$, her payoff is $\beta(\frac{1-n}{n}) + (1-\beta)(-1)$; whereas if she deviates to $r(\mathrm{F}) = t$, it is $\beta(-1)$. Hence, $r(\mathrm{F}) = f$ if and only if $\beta \geq \frac{n}{n+1}$. As $\frac{n}{n+1} \leq \frac{1}{n}$ if and only if $n = 1$ and neither x nor y are defined in this case, there is no equilibrium of the type conjectured.

(3) Consider now $y \leq \frac{1}{2}$ and $x \geq \frac{1}{2}$. If $w = \mathrm{T}$ and $r(\mathrm{T}) = t$, the payoff to a bad journalist is $\frac{1-n}{n}$; whereas if she deviates to $r(\mathrm{T}) = f$, it is -1. Analogously for a good journalist. Now, if $w = \mathrm{F}$ and $r(\mathrm{F}) = f$, the payoff to a bad journalist is $\beta(\frac{1-n}{n}) + (1-\beta)(-1)$; whereas if she deviates to $r(\mathrm{F}) = t$, it is $\beta(-1)$. Similarly, if $r(\mathrm{F}) = f$, the payoff to a good journalist is $\beta(\frac{1-n}{n}) + (1-\beta)(-1-\lambda)$; whereas if she deviates to $r(\mathrm{F}) = t$, it is $\beta(-1) + (1-\beta)(-\lambda)$. Hence, for all $w \in \{\mathrm{T}, \mathrm{F}\}$, $r(w) = w$ for both types of journalists if and only if $\beta \geq \frac{n}{n+1}$.

Last, note that $n = 2$, $x = y$, which means that out-of-the-equilibrium-path, the honest editor either publishes T or F. From (1) and (2) we know that there is no equilibrium in those cases. This completes the proof. □

From Proposition 1, we observe that for all the journalists to be sincere and so, for media bias (as the one we focus on) not to exist, we need at least three journalists that send advice to the editor.[5] Otherwise, a journalist can always take advantage of the confusion the editor has when receiving conflicting reports and gain from a deviation. This is not the case if $n \geq 3$, as in this case a strict

[5]Note that in the case of $n = 1$, there is neither an equilibrium in which the journalist is sincere. To show it, it is sufficient to note that the bad journalist is never informative, which is straightforward, as his desire to please the editor induces him to cater to his action. Formally, let us conjecture an equilibrium in which, for all $r \in \{t, f\}$, $a(r) = F$ for the honest receiver. If $r(\cdot) = t$, the payoff to a bad journalist is $\beta(-1)$; whereas if $r(\cdot) = f$, her payoff is $(1-\beta)(-1)$. Hence, if $\beta \neq \frac{1}{2}$, the bad journalist is not truthful. Let us now conjecture an equilibrium in which, for all $r \in \{t, f\}$, either $a(r) = T$, $a(r) = r$ or $a(r) \neq r$ for the honest receiver. The bad journalist always pools at T, i.e., she is never informative.

majority is well defined. This is precisely the condition that off-equilibrium beliefs must satisfy: $x \geq \frac{1}{2}$ and $y \leq \frac{1}{2}$. Under these beliefs, the editor publishes the report sent by the majority, which is the most natural response in a context in which all the journalists have access to the same signal. As a result, no journalist is pivotal given truthful revelation by the others, which allows private information to be transmitted in equilibrium.

Condition $n \geq 3$ is however not sufficient to guarantee the existence of an equilibrium in which all the journalists write informative reports, as $\beta \geq \frac{n}{n+1}$ is additionally required.[6] Note that $\beta \geq \frac{3}{4}$ constitutes a lower bound to β, and that as n increases, the lower bound increases too. In other words, the range of parameter values of β for which this inequality holds shrinks in n.[7] Hence, for an equilibrium as the one described in Proposition 1 to hold, not only a certain degree of competition between the journalists must exist, but they additionally must assign the editor a high probability of being honest.

What then if the editor is perceived by the journalists as being biased? The result above yields a clear-cut prediction: no equilibrium in which all the journalist write informative reports exists. This does not mean, however, that no information can be transmitted in this case, as the possibility of a partially-informative equilibrium, in which only one type of journalist is sincere, has not been contemplated yet. This is done next. In particular, we posit the most natural scenario in our set-up: That one in which good journalists cater to the preferences of the honest editor by writing informative reports, and bad journalists try to please the biased editor by always claiming that the politician's wrongdoing is true. Interestingly, we obtain that this is an equilibrium in our set-up, and that for this equilibrium to hold, the journalists must assign the editor a high probability of being biased. Just the opposite belief! Additionally, we obtain that apart from this particular configuration, there is no other partially-informative equilibrium, implying that, in an equilibrium of this type, bad journalists never pool at f neither reveal their signal. For expositional purposes, the analysis of these other partially-informative equilibria is relegated to Appendix A.

Next result exclusively refers to the most natural posited scenario.[8]

Proposition 2. *There is a partially-informative equilibrium in which good journalists write informative reports and bad journalists always state that the alleged*

[6] Should this condition not hold, both types of journalists would find it profitable to cater to the biased editor, by always reporting that the alleged wrongdoing is true. Note that this includes the good journalist. The reason being that, since $n \geq 3$, the implemented policy does never depend on a single journalist's advice and reporting t always guarantees the deviating journalist the approval of the biased editor.

[7] The reason is that, the tougher the competition, the lower the equilibrium payoff associated to the event of the editor being honest, whereas off-equilibrium-path payoffs do not vary.

[8] In the proof of this result, as well as in the other partially-informative equilibria, note that we take into account that journalists face two sources of uncertainty: Not only they do not know the type of the editor, but the type of each of the other journalists is also unknown to them.

wrongdoing is true if and only if $\theta \geq \frac{(1-\alpha)^n}{1+(1-\alpha)^n}$ *and* $\frac{\alpha(1-\alpha^n)}{1-\alpha^{n+1}+(1-\alpha)^n(n\alpha\lambda-1)} \leq \beta \leq \frac{1}{n}$.

Proof. Let us conjecture an equilibrium in which, for all $w \in \{\mathrm{T},\mathrm{F}\}$, $r(w) = w$ for good journalists and $r(w) = t$ for bad journalists. By Bayes' rule, Λ("at least one report says f") $= 0$ and $\Lambda(t,t,...,t) = \frac{\theta}{\theta+(1-\theta)(1-\alpha)^n}$. According to these posteriors, the honest editor optimally chooses a("at least one report says f") $= F$. Additionally, he implements $a(t,t,...,t) = T$ if and only if $\theta \geq \frac{(1-\alpha)^n}{1+(1-\alpha)^n}$.

(1) Consider $\theta < \frac{(1-\alpha)^n}{1+(1-\alpha)^n}$ and let us focus on the case of the good journalist. If $w =$ T and she chooses $r(\mathrm{T}) = t$, her payoff is $\beta(-1-\lambda) + (1-\beta)(1-\frac{1}{n})(-1)$; whereas if she deviates and sends $r(\mathrm{T}) = f$, it is $\beta(-\lambda) + (1-\beta)(-1)$. Hence, $r(\mathrm{T}) = t$ for the good journalist if and only if $\beta \leq \frac{1}{n+1}$. Now, if $w =$ F and the good journalist chooses $r(\mathrm{F}) = f$, her payoff is $\sum_{j=0}^{n-1}\binom{n-1}{j}\alpha^j(1-\alpha)^{n-j-1}[\beta(1-\frac{1}{j+1})(-1) + (1-\beta)(-1-\lambda)]$; whereas if she deviates and sends $r(\mathrm{F}) = t$, it is $\sum_{j=0}^{n-1}\binom{n-1}{j}\alpha^j(1-\alpha)^{n-j-1}[\beta(-1)+(1-\beta)((1-\frac{1}{n-j})(-1)-\lambda)]$. As $\sum_{j=0}^{n-1}\binom{n-1}{j}\alpha^j(1-\alpha)^{n-j-1} = 1$, after some algebra we obtain that the payoff to a good journalist that chooses $r(\mathrm{F}) = f$ is $(1-\beta)(-1-\lambda)-\beta+\beta\sum_{j=0}^{n-1}\binom{n-1}{j}\alpha^j(1-\alpha)^{n-j-1}\frac{1}{j+1} = (1-\beta)(-1-\lambda)-\beta+\beta\frac{1-(1-\alpha)^n}{n\alpha}$. Similarly, the payoff to a good journalist that chooses $r(\mathrm{F}) = t$ is $-\beta-(1-\beta)(1+\lambda)+(1-\beta)\sum_{j=0}^{n-1}\binom{n-1}{j}\alpha^j(1-\alpha)^{n-j-1}\frac{1}{n-j} = -\beta-(1-\beta)(1+\lambda)+(1-\beta)\frac{1-\alpha^n}{n(1-\alpha)}$. Solving for β, we obtain that $r(\mathrm{F}) = f$ for the good journalists if and only if $\beta \geq \frac{\alpha(1-\alpha^n)}{(1-\alpha)(1-(1-\alpha)^n)+\alpha(1-\alpha^n)}$. Lemma 1 in Appendix B shows that $\frac{\alpha(1-\alpha^n)}{(1-\alpha)(1-(1-\alpha)^n)+\alpha(1-\alpha^n)} > \frac{1}{n+1}$. Hence, there is no equilibrium of the type conjectured.

(2) Consider now $\theta \geq \frac{(1-\alpha)^n}{1+(1-\alpha)^n}$. (i) Let us first focus on the bad journalist. If $w =$ T and $r(\mathrm{T}) = t$, her payoff is $\frac{1-n}{n}$; whereas if she deviates and sends $r(\mathrm{T}) = f$, it is $(1-\beta)(-1)$. Hence, $r(\mathrm{T}) = t$ for the bad journalist if and only if $\beta \leq \frac{1}{n}$. Now, if $w =$ F and $r(\mathrm{F}) = t$, her payoff is $(1-\alpha)^{n-1}\frac{1-n}{n} + \sum_{j=1}^{n-1}\binom{n-1}{j}\alpha^j(1-\alpha)^{n-j-1}[\beta(-1)+(1-\beta)(1-\frac{1}{n-j})(-1)]$; whereas if she deviates and sends $r(\mathrm{F}) = f$, it is $\sum_{j=0}^{n-1}\binom{n-1}{j}\alpha^j(1-\alpha)^{n-j-1}[\beta(1-\frac{1}{j+1})(-1) + (1-\beta)(-1)]$. Note that $\sum_{j=1}^{n-1}\binom{n-1}{j}\alpha^j(1-\alpha)^{n-j-1} = 1-(1-\alpha)^{n-1}$ and $\sum_{j=1}^{n-1}\binom{n-1}{j}\alpha^j(1-\alpha)^{n-j-1}\frac{1}{n-j} = \frac{1-\alpha^n}{n(1-\alpha)} - \frac{(1-\alpha)^{n-1}}{n}$. Then, operating as before, we obtain that $r(\mathrm{F}) = t$ for the bad journalist if and only if $\beta \leq \frac{\alpha(1-\alpha^n)}{1-(1-\alpha)^n-\alpha^{n+1}}$. Lemma 2 in Appendix B shows that a sufficient condition for this inequality to hold is $\beta \leq \frac{1}{n}$. (ii) Now, let us consider the good journalist. If $w =$ T and $r(\mathrm{T}) = t$, her payoff is $\frac{1-n}{n}$; whereas if she deviates and sends $r(\mathrm{T}) = f$, it is $\beta(-\lambda) + (1-\beta)(-1)$. Hence, $r(\mathrm{T}) = t$ for the good journalist if and only if $\frac{1}{n} \geq \beta(1-\lambda)$. Now, if $\lambda > 1$, the aforementioned condition always hold; and if $\lambda \in (0,1)$, this condition can be rewritten as $\beta \leq \frac{1}{n(1-\lambda)}$ (a sufficient condition for this inequality to hold is $\beta \leq \frac{1}{n}$). Last, if $w =$ F and $r(\mathrm{F}) = f$, the payoff to the good journalist is $\sum_{j=0}^{n-1}\binom{n-1}{j}\alpha^j(1-\alpha)^{n-j-1}[\beta(1-\frac{1}{j+1})(-1)+(1-\beta)(-1-\lambda)]$; whereas is she deviates

to $r(\mathrm{F}) = t$, her payoff is $(1-\alpha)^{n-1}(\frac{1-n}{n} - \lambda) + \sum_{j=1}^{n-1} \binom{n-1}{j} \alpha^j (1-\alpha)^{n-j-1}[\beta(-1) + (1-\beta)((1-\frac{1}{n-j})(-1) - \lambda)]$. Here again, $r(\mathrm{F}) = f$ for the good journalist if and only if $\beta \geq \frac{\alpha(1-\alpha^n)}{1-\alpha^{n+1}+(1-\alpha)^n(n\alpha\lambda-1)}$. This completes the proof. □

From Proposition 2, we observe that for a partially-informative equilibrium as the one described above to hold, two conditions are required: $\theta \geq \frac{(1-\alpha)^n}{1+(1-\alpha)^n}$ and $\frac{\alpha(1-\alpha^n)}{1-\alpha^{n+1}+(1-\alpha)^n(n\alpha\lambda-1)} \leq \beta \leq \frac{1}{n}$. Simple algebra shows that the lower bound that the second condition establishes is decreasing in λ. Hence, the higher the social concerns of a journalist, the higher the region where the partially-informative equilibrium holds.

More noteworthy are the results derived from the comparative static analysis with respect to parameter n. To this respect, first note that these conditions impose no restriction on a minimum number of journalists, hence implying that there is an equilibrium of this class in the case of only two journalists. Furthermore, it can be shown that this equilibrium exists in the case of a single journalist.[9]

The result that competition is not determinant to guarantee the partial transmission of information is also in the basis of the results that arise from the comparative static analysis. We do this next. The reader can easily check that, as for the first condition, an increase in competition makes the inequality easy to attain. The analysis of the second condition yields, however, not so straightforward results. In order to illustrate them, we next present some figures that depict the regions where a partially-informative equilibrium exists as a function of n (and α). We represent β in the vertical axis and depict the upper bound, $\frac{1}{n}$, in dark blue, and the lower bound, $\frac{\alpha(1-\alpha^n)}{1-\alpha^{n+1}+(1-\alpha)^n(n\alpha\lambda-1)}$, in light green. The referred region is that below the blue surface and above the green one.

Figure 1 about here.

Figure 2 about here.

In line with our previous comment, a comparison between Figures 1 and 2 illustrates the result that the higher the social concerns of the journalists, the higher the region where the partially-informative equilibrium may hold. As for its behavior with respect to n, we observe that as competition increases, the region where a partially-informative equilibrium may exist shrinks. More precisely, not only the range for the admissible values of β shrinks in n, but the values that β can take must decrease too. This means that for an equilibrium as the one described in Proposition 2 to hold, as competition increases, journalists must assign the editor a higher probability of being biased.

[9]The proof of this result is as follows. Let us conjecture an equilibrium in which, for all $w \in \{\mathrm{T}, \mathrm{F}\}$, $r(w) = w$ for the good journalist and $r(w) = t$ for the bad type. By Bayes' rule, $\Lambda(f) = 0$ and $\Lambda(t) = \frac{\theta}{\theta+(1-\theta)(1-\alpha)}$. According to these posteriors, for all $r \in \{t, f\}$, $a(r) = r$ for the honest editor if and only if $\theta \geq \frac{1-\alpha}{2-\alpha}$, in which case $r(w) = t$ is a best response to the bad journalist and $r(w) = w$ is a best response to the good journalist if and only if $\beta \geq \frac{1}{1+\lambda}$.

To further illustrate this point, let us consider the next example, in which $\lambda = 0.5$. In this case, the following sets for the admissible values of β are obtained:

	$\alpha = 0.9$	$\alpha = 0.5$	$\alpha = 0.1$
$n = 1$	$\beta \in [0.\hat{6}, 1]$	$\beta \in [0.\hat{6}, 1]$	$\beta \in [0.\hat{6}, 1]$
$n = 2$	$\emptyset$	$\beta = 0.5$	$\beta \in [0.3\hat{6}, 0.5]$
$n = 3$	$\emptyset$	$\emptyset$	$\beta \in [0.262, 0.\hat{3}]$
$n = 10$	$\emptyset$	$\emptyset$	$\emptyset$

From the results in Propositions 1 and 2, we observe that there is not a clear-cut answer to the question of whether competition is good or not. We know that if we are interested in an equilibrium in which all the journalists are sincere, then a certain degree of competition is required. But in this case it is also required that the editor is perceived to be an honest type. Otherwise, and independently of how many journalists there are, no transmission of information occurs. In this case, however, our results show that another interesting class of equilibrium arises. That in which journalists, depending on their types, specialize and tailor their reports to the type of editor they want to please. This is a natural equilibrium in our set-up, in which both the senders and the receiver have private information. For this equilibrium to exit, however, we need that the journalists perceive the editor to be biased.[10] Interestingly, we obtain that in this case competition adds nothing but only restricts the set where partial information may occur.

Before going into the next section, let us remark the result that no other partial-informative equilibrium, apart from the one described in Proposition 2, exists.[11] This means that, for intermediate values of β, i.e., when there is high uncertainty about the type of the editor, no information transmission occurs and media bias is then to arise. Thus, in this case, not only the bad journalists find it unattractive to write informative reports, but the good journalists are unable to transmit their information to the editor too. This result is in contrast to Cummins and Nyman (2005) who, in a different set-up, obtain that for firms to reveal their private information to a consumer, the uncertainty about the latter's prior must be maximal.[12] This is a natural result in their set-up, in which the firm's signals independence induces them to herd on the consumer's prior, being this effect out of scene only when the consumer's prior is balanced. Otherwise, herding occurs, which means that experts choose not to reveal their signals, but to cater their recommendations to the consumer's initial prior. In our model, however, the journalists' signals are identical so herding does not take place. The source of our disruption is then the existence of (bad) journalists that are extremely concerned for approval. This concern preludes the existence of an equilibrium in which the good journalists

[10] Although, as highlighted in the example above, this perception cannot be too extreme.

[11] The proof of this result is in Appendix A.

[12] In Cummins and Nyman (2005), the firms and the consumer play the role of the journalists and the editor, respectively, in our set-up.

write informative reports, unless the editor is perceived to be quite likely of a type. Roughly speaking, as uncertainty vanishes, the bad journalists become surer about what to write down in their report to have it published. It gets rid of mimic behavior by this journalists and allows information transmission if not from them, at least from the good journalists.

4 The role of the uncertainty

We now remove the assumption that the journalists are uncertain about the preferences of the editor. In contrast, we assume that his preferences are known. More precisely, we consider that the editor is honest (an honest type) and that this is common-knowledge.[13] Hence, his utility, $U_E(a, w)$, is either 0, if (T, T) or (F, F); and -1, if (T, F) or (F, T)..

The aim of this section is to learn about the conditions for informative writing to occur when the uncertainty about the preferences of the editor is not at stake. A comparison of the results in this section to those previously obtain would allow us then to pin down the effects that the uncertainty has on the incentives of the journalists to write informative reports. Interestingly, we obtain that, in some circumstances, a bit of uncertainty may actually pay.

Our first result here refers to the possibility of an equilibrium in which all the journalists reveal their information to the editor. Similarly to the result in the previous section, we obtain that for an equilibrium of this class to hold, a certain degree of competition is required. The lower bound, $n \geq 3$ happens to be the same, with the difference that if $n = 1$, transmission of information is now possible, whereas it was not before.[14] The intuition is straightforward: The journalist wants to please the editor and she now knows that he likes informative reports. In this case, it is in the interest of the two types of journalist to be sincere.

Proposition 3. *In the modified version of the model, there is an informative equilibrium in which all the journalists write informative reports if and only if* $n \geq 3$.

Proof. Let us conjecture an equilibrium in which, for all $w \in \{\mathrm{T}, \mathrm{F}\}$, $r(w) = w$ for both types of journalist. By Bayes' rule, $\Lambda(t, t, ..., t) = 1$ and $\Lambda(f, f, ..., f) = 0$. Let Λ("all reports say t but one") $= x \in [0, 1]$ and Λ("all reports say f but one") $= y \in [0, 1]$. According to these posteriors, the editor optimally chooses $a(t, t, ..., t) = T$ and $a(f, f, ..., f) = F$. Additionally, he implements a("all reports support t but one") $= T$ if and only if $x \geq \frac{1}{2}$ and a("all reports support f but one") $= F$ if and

[13] Note that the case in which the editor is known to be biased is not of interest. In this case, the journalists would always report that the alleged malpracticed is true, and no informative reporting would occur. This would result in persistent media bias.

[14] Consider $n = 1$. Let us conjecture an equilibrium in which, for all $w \in \{\mathrm{T}, \mathrm{F}\}$, $r(w) = w$ for both types of journalist. In such an equilibrium, Bayes' rule determines that the editor trusts the journalist's report, i.e., for all $r \in \{t, f\}$, $a(r) = r$. In this case, the good journalist finds it optimal to reveal, and the bad journalist is indifferent, as for all $r \in \{t, f\}$, her payoff is 0.

only if $y \leq \frac{1}{2}$. Consider $y > \frac{1}{2}$ (with $x \in [0,1]$). If $w =$ F and $r(\text{F}) = f$, the payoff to a bad journalists is $\frac{1-n}{n}$; whereas her payoff if she deviates to $r(\text{F}) = t$ is 0. Similarly, consider $x < \frac{1}{2}$ (with $y \in [0,1]$). If $w =$ T and $r(\text{T}) = t$, the payoff to a bad journalist is $\frac{1-n}{n}$; whereas her payoff if she deviates to $r(\text{T}) = f$ is 0. Consider now $x \geq \frac{1}{2}$ and $y \leq \frac{1}{2}$. For all $w \in \{\text{T}, \text{F}\}$, if $r(w) = w$, the payoff to a bad journalist is $\frac{1-n}{n}$; whereas her payoff if she deviates to $r(w) \neq w$ is -1. Analogously for the good journalist.

Last, note that if $n = 2$, $x = y$, which means that out-of-the-equilibrium-path, the editor implements either T or F. From the previous analysis we know that there is no equilibrium in those cases.[15] This completes the proof. □

A comparison of Propositions 1 and 3 reveal that, as far as for the informative equilibrium concerns, the results with and without uncertainty are qualitatively the same. In both cases, a certain degree of competition is required (although the requirement in the case of uncertainty is stiffer than in the present case). Additionally, note that for an equilibrium to exist in the previous scenario, the probability of the editor being honest must be high enough. This is in line with the existence of an equilibrium in the current case, in which the editor is known to be honest.

We next analyze the possibility of partial informative reporting, namely, information transmitted by exclusively one type of journalist. Contrary to the case with uncertainty, we now obtain that there is no equilibrium of this type. The reason being that with certainty, there is no longer the possibility of a type-to-type matching. This obliges bad journalists to appear as good types (in order to get their reports published), which provokes mimic behavior and prevents the possibility of differentiation, i.e., the possibility of transmitting information.

Proposition 4. *In the modified version of the model, there is no partially-informative equilibrium.*

Proof. Let us conjecture an equilibrium in which, for all $w \in \{\text{T}, \text{F}\}$, $r(w) = w$ for one type of journalist (either good or bad) and $r(w) = t$ for the other type

[15] Note that the assumption that the journalists receive perfectly informative signals about the state of the world is not important to this result ($n = 2$). To see it, let us suppose that a journalist's signal is correct with probability σ, and assume that signals are conditionally independent. If $\sigma > \theta > \frac{1}{2}$, it can be shown that $a(t,t) = T$, $a(f,f) = F$ and $a(t,f) = T$, which inhibits information transmission from the bad journalist. Similarly, if $\theta < \frac{1}{2}$. However, the key assumption that prevents information from being transmitted in the case of two journalists is the possibility of journalists being bad. To see it, consider they all were good. In this case, the two journalists would be sincere if $\lambda \geq \frac{1}{2}$, as the possibility of having their report published would not pay for the disutility of having the wrong report printed. If the journalists were bad instead, no transmission of information would occur. The intuition is as follows: If $n = 2$ and a bad journalist conjectures that if $r_1 \neq r_2$, the editor will optimally choose to implement F (T), that journalist benefits from deviating and reporting f (t) when the state of the world is T (F); fooling the editor, who believes the state is F (T) in this case. Note that for a bad journalist to have this belief, it has to be the case that, in equilibrium, there is either a type of journalist that is pooling at t (f) or both types of journalists are being truthful ($r_1 \neq r_2$ is out of the equilibrium path). In any case, if $w =$ T ($w =$ F), the journalists are conjectured to send t (f) in equilibrium.

of journalist (analogously, if $r(w) = f$). By Bayes' rule, Λ("at least one report says f") $= 0$ and either $\Lambda(t, t, ..., t) = \frac{\theta}{\theta+(1-\theta)\alpha^n}$ or $\Lambda(t, t, ..., t) = \frac{\theta}{\theta+(1-\theta)(1-\alpha)^n}$, depending on whether the journalist who pool at t are the good type or the bad type, respectively. According to these posteriors, the editor optimally chooses a("at least one report says f") $= F$. Additionally, he implements $a(t, t, ..., t) = T$ if and only if θ is greater or equal than some threshold. This threshold is either $\frac{\alpha^n}{1+\alpha^n}$ or $\frac{(1-\alpha)^n}{1+(1-\alpha)^n}$, depending on whether the journalists who pool at t are the good type or the bad one, respectively. Consider θ is equal or above that threshold. If $w =$ T and $r(\mathrm{T}) = t$, the payoff to a bad journalist is $\frac{1-n}{n}$; whereas her payoff if she deviates to $r(\mathrm{T}) = f$ is 0. Consider now θ is below the threshold. If $w =$ T and $r(\mathrm{T}) = t$, the payoff to a bad journalist is -1; whereas her payoff if she deviates to $r(\mathrm{T}) = f$ is 0. Hence, there is no equilibrium of the type conjectured. □

The result in Proposition 4 shows that no partial-informative equilibrium exists. This, together with the fact that an informative equilibrium requires of $n \geq 3$ (Proposition 3), yields the conclusion that no information transmission can be sustained if $n = 2$ and the editor is known to be honest. As a result, media bias is to arise in this case. Hence, we can conclude that, under some circumstances, facing a bit of uncertainty is not actually harmful, but may help the (good type) journalists to reveal their information and so, to improve the accuracy of the news we receive from the media.

5 Conclusion

We propose a model in which n journalists have superior information on an event to the editor of a newspaper. The journalists write down a report on that event and send it to the editor, who decides which piece of news is to be published. Journalists want their report to appear in the newspaper and so, have an incentive to match their report to the editor's preferences. We posit a situation in which this preferences are unknown to the journalists. In this scenario, we analyze the effects of competition and uncertainty on the incentives of the journalists to write informative reports.

We obtain that if the editor is perceived to be honest, informative reporting is possible, provided that a certain level of competition is met. On the contrary, if the editor is perceive to be biased, only partial-informative reporting can occur, and this is an equilibrium even in the case of one single journalist. For intermediate beliefs on the type of the editor, i.e., high levels of uncertainty, information transmission is not sustained, which results in media bias. As for the role of uncertainty, unexpectedly we obtain that, under some circumstances (low level of competition), a bit of uncertainty may actually pay, as it may help the journalists to transmit their information.

Besides the framework of a paper's news desk, our results have implications for public procurement processes, job promotions, lobbying and other situations where more than one expert compete for a unique prize, i.e., the public officer's approval. To any of these cases, our conclusion is that information transmission can sometimes be achieved with low levels of competition, and that under certain circumstance, a bit of uncertainty may actually pay.

6 Appendix

Appendix A

We show that, apart from the configuration described in Proposition 2, there is no other equilibrium in which a single type of journalist is sincere. Note that, for all $r \in \{t, f\}$, $a(r) = T$ for the biased editor. We prove it in two steps.

(i) Let us conjecture an equilibrium in which, for all $w \in \{\mathrm{T}, \mathrm{F}\}$, $r(w) = w$ for bad journalists and $r(w) = t$ for good journalists. By Bayes' rule, Λ("at least one report says f") $= 0$ and $\Lambda(t, t, ..., t) = \frac{\theta}{\theta+(1-\theta)\alpha^n}$. According to these posteriors, the honest editor optimally chooses a("at least one report says f") $= F$. Additionally, he implements $a(t, t, ..., t) = T$ if and only if $\theta \geq \frac{\alpha^n}{1+\alpha^n}$.

(1) Consider $\theta \geq \frac{\alpha^n}{1+\alpha^n}$ and let us focus on the case of the bad journalist. If $w = \mathrm{T}$ and she chooses $r(\mathrm{T}) = t$, her payoff is $(1 - \frac{1}{n})(-1)$; whereas if she deviates and sends $r(\mathrm{T}) = f$, it is $(1 - \beta)(-1)$. Hence, $r(\mathrm{T}) = t$ for the bad journalist if and only if $\beta \leq \frac{1}{n}$. Now, if $w = \mathrm{F}$ and the bad journalist chooses $r(\mathrm{F}) = f$, her payoff is $\sum_{j=0}^{n-1} \binom{n-1}{j} \alpha^j (1-\alpha)^{n-j-1} [\beta(1 - \frac{1}{n-j})(-1) + (1 - \beta)(-1)]$; whereas if she deviates and sends $r(\mathrm{F}) = t$, it is $\alpha^{n-1} \frac{1-n}{n} + \sum_{j=0}^{n-2} \binom{n-1}{j} \alpha^j (1 - \alpha)^{n-j-1} [\beta(-1) + (1-\beta)(1 - \frac{1}{j+1})(-1)]$. After some algebra we obtain that $r(\mathrm{F}) = f$ for the good journalist if and only if $\beta \geq \frac{(1-\alpha)(1-(1-\alpha)^n)}{1-\alpha^n-(1-\alpha)^{n+1}}$. We next show that $\frac{(1-\alpha)(1-(1-\alpha)^n)}{1-\alpha^n-(1-\alpha)^{n+1}} > \frac{1}{n}$, hence, there is no equilibrium of the type conjectured. To see it, note that $1-\alpha^n-(1-\alpha)^{n+1}$ we can rewritten as $(1-\alpha)(1-(1-\alpha)^n)+\alpha(1-\alpha^{n-1})$ which, since $\alpha \in [0, 1]$, is positive. Then, $\frac{(1-\alpha)(1-(1-\alpha)^n)}{1-\alpha^n-(1-\alpha)^{n+1}} > \frac{1}{n}$ if and only if $w(\alpha, n) = n(1 - \alpha)(1 - (1 - \alpha)^n) - 1 + \alpha^n + (1 - \alpha)^{n+1} > 0$. We prove it by induction:
(i) First, note that $w(\alpha, 2) = \alpha(1 - \alpha)^2 > 0$ for all $\alpha \in (0, 1)$.
(ii) Next we show that, if $w(\alpha, n) > 0$, then $w(\alpha, n + 1) > 0$. A sufficient condition for this to hold is $w(\alpha, n + 1) = n(1 - \alpha) - \alpha - n(1 - \alpha)^{n+1} - (1 - \alpha)^{n+1} + n\alpha(1 - \alpha)^{n+1} + \alpha(1 - \alpha)^{n+1} + \alpha^{n+1} + (1 - \alpha)^{n+2} > w(\alpha, n) = n(1 - \alpha) - n(1 - \alpha)^n + n\alpha(1 - \alpha)^n - 1 + \alpha^n + (1 - \alpha)^{n+1}$. After some algebra, it can be written as $\alpha^n + (1-\alpha)^n < 1 + n\alpha(1-\alpha)^n$. Note that $\alpha^n + (1-\alpha)^n \leq 1$, as $\alpha^n + (1-\alpha)^n = 1$ for $n = 1$ and both α^n and $(1-\alpha)^n$ are decreasing in n. This completes the proof.

(2) Consider now $\theta < \frac{\alpha^n}{1+\alpha^n}$ and let us first focus on the bad journalist. If $w = \mathrm{T}$ and $r(\mathrm{T}) = t$, her payoff is $\beta(-1) + (1 - \beta)(1 - \frac{1}{n})(-1)$; whereas if she

deviates and sends $r(\text{T}) = f$, it is $(1-\beta)(-1)$. Hence, $r(\text{T}) = t$ for the bad journalist if and only if $\beta \leq \frac{1}{n+1}$. Now, if $w = \text{F}$ and $r(\text{F}) = f$, her payoff is $\sum_{j=0}^{n-1}\binom{n-1}{j}\alpha^j(1-\alpha)^{n-j-1}[\beta(1-\frac{1}{n-j})(-1)+(1-\beta)(-1)]$; whereas if she deviates and sends $r(\text{F}) = t$, it is $\sum_{j=0}^{n-1}\binom{n-1}{j}\alpha^j(1-\alpha)^{n-j-1}[\beta(-1)+(1-\beta)(1-\frac{1}{j+1})(-1)]$. Operating as before we obtain that $r(\text{F}) = f$ for the bad journalist if and only if $\beta \geq \frac{(1-\alpha)(1-(1-\alpha)^n)}{(1-(1-\alpha)^n)-\alpha(\alpha^n-(1-\alpha)^n)}$. We next show that $\frac{(1-\alpha)(1-(1-\alpha)^n)}{(1-(1-\alpha)^n)-\alpha(\alpha^n-(1-\alpha)^n)} > \frac{1}{n+1}$, hence, there is no equilibrium of the type conjectured. To see it, first note that $(1-(1-\alpha)^n)-\alpha(\alpha^n-(1-\alpha)^n) > 0$. Then, $\frac{(1-\alpha)(1-(1-\alpha)^n)}{(1-(1-\alpha)^n)-\alpha(\alpha^n-(1-\alpha)^n)} > \frac{1}{n+1}$ if and only if $(n+1)(1-\alpha)(1-(1-\alpha)^n)-(1-(1-\alpha)^n)+\alpha(\alpha^n-(1-\alpha)^n) > 0$ which, after some algebra, can be rewritten as $n(1-\alpha)(1-(1-\alpha)^n)-\alpha(1-\alpha^n) > 0$. Let us denote $w(\alpha, n) = n(1-\alpha)(1-(1-\alpha)^n)-\alpha(1-\alpha^n)$. We next prove $w(\alpha, n) > 0$ by induction:
(i) First, note that $w(\alpha, 2) = 3\alpha(1-\alpha)^2 > 0$ for all $\alpha \in (0,1)$.
(ii) Next we show that, if $w(\alpha, n) > 0$, then $w(\alpha, n+1) > 0$. A sufficient condition for this to hold is $w(\alpha, n+1) = n(1-\alpha)+(1-\alpha)-n(1-\alpha)^{n+2}-(1-\alpha)^{n+2}-\alpha(1-\alpha^{n+1}) > w(\alpha, n) = n(1-\alpha)-n(1-\alpha)^{n+1}-\alpha(1-\alpha^n)$. After some algebra, it can be written as $\alpha^{n+1}+(1-\alpha)^{n+1} < 1+n\alpha(1-\alpha)^n$. Note that $\alpha^{n+1}+(1-\alpha)^{n+1} \leq 1$, as $\alpha^{n+1}+(1-\alpha)^{n+1} \leq 1$ for $n = 1$ and both α^{n+1} and $(1-\alpha)^{n+1}$ are decreasing in n. This completes the proof.

(ii) Let us finally conjecture an equilibrium in which, for all $w \in \{\text{T}, \text{F}\}$, $r(w) = w$ for one type of journalist (either good or bad) and $r(w) = f$ for the other type of journalist. By Bayes' rule, Λ("at least one report says t") $= 1$ and either $\Lambda(f, f, ..., f) = \frac{\theta(1-\alpha)^n}{\theta(1-\alpha)^n+(1-\theta)}$ or $\Lambda(f, f, ..., f) = \frac{\theta\alpha^n}{\theta\alpha^n+(1-\theta)}$, depending on whether the journalists who pool at f are the bad type or the good type, respectively. According to these posteriors, the honest editor optimally chooses a("at least one report says t") $= T$. Additionally, he implements $a(f, f, ..., f) = F$ if and only if θ is smaller or equal than some threshold. This threshold is either $\frac{1}{1+(1-\alpha)^n}$ or $\frac{1}{1+\alpha^n}$, depending on whether the journalists who pool at f are the bad type or the good type, respectively. Consider θ is equal or below that threshold and let us focus on the case of the bad journalist. If $w = \text{F}$ and she chooses $r(\text{F}) = f$, her payoff is $\beta(1-\frac{1}{n})(-1)+(1-\beta)(-1)$; whereas if she deviates and sends $r(\text{F}) = t$, it is 0. Consider now θ is above that threshold. If $w = \text{F}$ and the bad journalist chooses $r(\text{F}) = f$, her payoff is -1; whereas if she deviates and sends $r(\text{F}) = t$, it is 0. This completes the proof.

Appendix B

Lemma 1. *For all $\alpha \in (0,1)$ and $n \geq 2$, $\frac{\alpha(1-\alpha^n)}{(1-\alpha)(1-(1-\alpha)^n)+\alpha(1-\alpha^n)} > \frac{1}{n+1}$.*

Proof. Operating on the inequality we obtain that $\frac{\alpha(1-\alpha^n)}{(1-\alpha)(1-(1-\alpha)^n)+\alpha(1-\alpha^n)} > \frac{1}{n+1}$ if and only if $n > \frac{(1-\alpha)(1-(1-\alpha)^n)}{\alpha(1-\alpha^n)}$. Let us denote $f(\alpha) = \frac{(1-\alpha)(1-(1-\alpha)^n)}{\alpha(1-\alpha^n)}$. Applying L'Hôpital's rule, we obtain $\lim_{\alpha\to 0} f(\alpha) = n$ and $\lim_{\alpha\to 1} f(\alpha) = \frac{1}{n}$. Then, to complete the proof, we have to show that $f'(\alpha) < 0$. We obtain $f'(\alpha) = \frac{\alpha(1-\alpha^n)[n(1-\alpha)^n-(1-(1-\alpha)^n)]}{\alpha^2(1-\alpha^n)^2} - \frac{(1-\alpha)(1-(1-\alpha)^n)((1-\alpha^n)-n\alpha^n)}{\alpha^2(1-\alpha^n)^2} < 0$ if and only if the numerator is negative. Rearranging, $f'(\alpha) < 0$ if and only if $g(\alpha) = \alpha(1-\alpha^n)[(1-\alpha)^n(n+1)-1] + (1-\alpha)(1-(1-\alpha)^n)(\alpha^n(n+1)-1) < 0$. Note that $g(0) = 0$ and $g(1) = 0$. Additionally, $g(\alpha) = g(1-\alpha)$, i.e., the function is symmetric around one half. Then, it is sufficient to prove that $g'(\alpha) < 0$ for all $\alpha \in (0, \frac{1}{2})$. We obtain $g'(\alpha) = \frac{-n(n+1)[(1-\alpha)^n\alpha^2-\alpha^n(1-\alpha)^2+\alpha^n(1-\alpha)^n(1-2\alpha)]}{\alpha(1-\alpha)} < 0$ if and only if $(1-\alpha)^n\alpha^2-\alpha^n(1-\alpha)^2+\alpha^n(1-\alpha)^n(1-2\alpha) > 0$. As $\alpha < \frac{1}{2}$, $\alpha^n(1-\alpha)^n(1-2\alpha) > 0$ and $(1-\alpha)^n\alpha^2 - \alpha^n(1-\alpha)^2 = (1-\alpha)^2\alpha^2[(1-\alpha)^{n-2} - \alpha^{n-2}] > 0$. This completes the proof. □

Lemma 2. *For all* $\alpha \in (0,1)$ *and* $n \geq 2$, $\frac{1}{n} < \frac{\alpha(1-\alpha^n)}{1-(1-\alpha)^n-\alpha^{n+1}}$.

Proof. First note that $1-(1-\alpha)^n-\alpha^{n+1}$ we can rewritten as $(1-\alpha)(1-(1-\alpha)^{n-1}) + \alpha(1-\alpha^n)$ which, since $\alpha \in [0,1]$, is positive. Then, $\frac{1}{n} < \frac{\alpha(1-\alpha^n)}{1-(1-\alpha)^n-\alpha^{n+1}}$ if and only if $w(\alpha, n) = n\alpha(1-\alpha^n) - 1 + (1-\alpha)^n + \alpha^{n+1} > 0$. We prove it by induction:
(i) First note that $w(\alpha, 2) = \alpha^2(1-\alpha) > 0$ for all $\alpha \in (0,1)$.
(ii) Next we show that, if $w(\alpha, n) > 0$, then $w(\alpha, n+1) > 0$. A sufficient condition for this to hold is $w(\alpha, n+1) = n\alpha + \alpha - 1 + (1-\alpha)^{n+1} - n\alpha^{n+2} > w(\alpha, n) = n\alpha - 1 + (1-\alpha)^n - n\alpha^{n+1} + \alpha^{n+1}$. After some algebra, it can be written as $\alpha^n + (1-\alpha)^n < 1 + n\alpha^n(1-\alpha)$. Note that $\alpha^n + (1-\alpha)^n \leq 1$, as $\alpha^n + (1-\alpha)^n = 1$ for $n = 1$ and both α^n and $(1-\alpha)^n$ are decreasing in n. This completes the proof. □

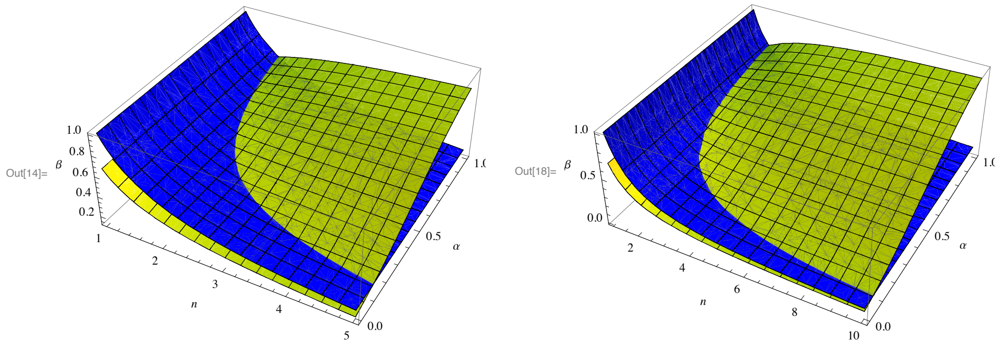

Figure 1: $\lambda = 0.5$. Regions of existence of an equilibrium for $n = 5$ and $n = 10$.

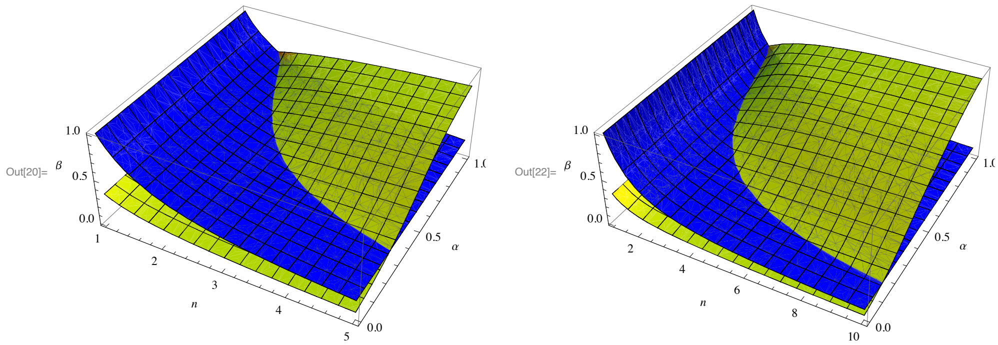

Figure 2: $\lambda = 2$. Regions of existence of an equilibrium for $n = 5$ and $n = 10$.

References

Anderson, Simon P. and John McLaren (2012), 'Media mergers and media bias with rational consumers', *Journal of the European Economic Association* **10**(4), 831–859.

Andina-Díaz, Ascensión (2009), 'Media competition and information disclosure', *Social Choice and Welfare* **33**(2), 261–280.

Andina-Díaz, Ascensión (2012), 'Screening and signaling in communication', *Scandinavian Journal of Economics* **114**(2), 480–499.

Ansolabehere, Stephen, Rebecca Lessem and James M. Snyder (2006), 'The orientation of newspaper endorsements in U.S. elections, 1940-2002', *Quarterly Journal of Political Science* **1**(4), 393–404.

Austen-Smith, David (1993), 'Interested experts and policy advice: Multiple referras under open rule', *Games and Economic Behavior* **5**(1), 3–43.

Baker, Matthew J. and Lisa M. George (2010), 'The role of television in household debt: Evidence from the 1950's', *The B.E. Journal of Economic Analysis Policy* **10**(1), 1–38.

Besley, Timothy and Robin Burgess (2002), 'The political economy of government responsiveness: Theory and evidence from India', *Quarterly Journal of Economics* **117**(4), 1415–1451.

Cummins, Jason G. and Ingmar Nyman (2005), 'The dark side of competitive pressure', *RAND Journal of Economics* **36**(2), 361–377.

Djankov, Simeon, Caralee McLiesh, Tatiana Nenova and Andrei Shleifer (2003), 'Who owns the media?', *The Journal of Law and Economics* **46**(2), 341–381.

Ellman, Matthew and Fabrizio Germano (2009), 'What do the papers sell? a model of advertising and media bias', *The Economic Journal* **119**(537), 680–704.

Enikolopov, Ruben, Maria Petrova and Ekaterina Zhuravskaya (2011), 'Media and political persuasion: Evidence from russia', *American Economic Review* **101**(7), 3253–85.

Gentzkow, Matthew (2006), 'Television and voter turnout', *The Quarterly Journal of Economics* **121**(3), 931–972.

Gentzkow, Matthew and Jesse M. Shapiro (2006), 'Media bias and reputation', *Journal of Political Economy* **114**(2), 280–316.

George, Lisa M. and Joel Waldfogel (2006), 'The new york times and the market for local newspapers', *American Economic Review* **96**(1), 435–447.

Groseclose, Tim and Jeffrey Milyo (2005), 'A measure of media bias', *The Quarterly Journal of Economics* **120**(4), 1191–1237.

Krishna, Vijay and John Morgan (2001), 'A model of expertise', *Quarterly Journal of Economics* **116**(2), 747–775.

Lazarsfeld, Paul F., Bernard Berelson and Hazel Gaudet (1948), *The People's Choice*, New York: Columbia University Press.

Mullainathan, Sendhil and Andrei Shleifer (2005), 'The market for news', *The American Economic Review* **95**(4), 1031–1053.

Olszewski, Wojciech (2004), 'Informal communication', *Journal of Economic Theory* **117**(2), 180–200.

Ottaviani, Marco and Peter Norman Sorensen (2006), 'Professional advice', *Journal of Economic Theory* **126**(1), 120 – 142.

Stromberg, David (2004), 'Radio's impact on public spending', *The Quarterly Journal of Economics* **119**(1), 189–221.

Watson, Joel (1996), 'Information transmission when the informed party is confused', *Games and Economic Behavior* **12**(1), 143–161.