Centre Interuniversitaire sur le Risque, les Politiques Économiques et l'Emploi

Cahier de recherche/Working Paper **09-12**

Confirmatory News

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Avril/April 2009

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This paper is based on the second chapter of my Ph.D. dissertation. I am very much grateful to Jean Tirole for his guidance and advice. I also thank Mattias Dewatripont, Guido Friebel, Andrea Prat, Paul Seabright, Peter Norman Sørensen for their helpful comments. My work has benefited from attention of seminar participants at annual meetings of European Economic Association in Vienna (2006) and American Economic Association in Chicago (2007). Financial support from CIRPÉE is gratefully ackowledged.

Abstract:

This paper investigates how competition in the media affects the quality of news. In our model, demand for news depends on the market perception of the media's ability to receive correct information: it is positive if and only if news is potentially useful for the voting decision. When the media receives information which contradics commonly shared priors, it either reports this information or it confirms the priors: "most likely, my information is correct, but my potential buyers may be unable to assess the quality of news and attribute it according to common priors". We ask whether competition may help to elicit information from the media. Our answer is positive when news covers issues on which the priors are sufficiently precise, or the follow-up quality assessment is a likely event. However, when news concerns controversial issues and it is hardly possible to assess its quality, competitive pressures induce confirmatory reporting.

Keywords: competition in the media, quality of news, common priors, reputational cheap-talk

JEL Classification: L82, L10, D82

1 Introduction

The media reports news about the ongoing political process, and the voters use this information in their decisions at the ballot box. For example, Della Vigna and Kaplan (2006) find that Republicans gained votes in US towns which introduced Conservative Fox News Channel between October 1996 and November 2000; in field experiment by Gerber, Karlan, and Bergan (2006) subscription for a new press outlet increased the probability of voting Democratic in 2005 Virginia gubernatorial election.

The media has a high degree of freedom in reporting: it can lie, if not directly by fabricating news, then at least indirectly, by reporting facts in favour of some view and downplaying other facts. A growing body of literature shows that the media abuses this freedom and biases news. For example, Groseclose and Milyo (2005) compare think tank quotes by the media and the congressmen, and they find that ideological location by almost all sampled outlets lies to the left of the average congressmen.[1]

Most models of media bias advance the view of competition in the media as delivering greater accuracy of news, because it facilitates the detection of lies in reporting when they occur (Gentzkow and Shapiro, 2007); increase difficulties for politicians in capturing the media (Besley and Prat, 2004); mitigates negative impact from advertiser influence (Ellman and Germano, 2004). Mullainathan and Shleifer (2005) emphasize, however, that competition in the media increases the variety-, but not the quality of news: newspapers confirm reader prejudices, and when the prejudices differ, competing outlets separate themselves in the market, in spirit of a classic Hotelling model. In Baron (2004), competition creates differentiation on quality dimension, and it may actually decrease the average quality: readers would like to be aware of bad circumstances; journalists bias reports towards “bad

[1] However, it lies in-between the average Democrat and the average Republican.

news", and newspapers charge the readers for mitigating journalist bias. In a competitive environment, an outlet finds its "niche" in the market: it sells either more biased and cheaper news to more awareness-demanding readers; or more accurate and more expensive news to "braver" readers.

We would like to better understand how competition in the media affects the quality of news. We build a model addressing this issue. We assume that a uniform constituency of voters may buy news to decide upon the vote.[2] Their demand depends on their perception of the media ability to know which voting decision is the best, call it the media *reputation*. They form it on the basis of previously reported news. If they can assess its the quality, that is, tell whether news is "correct" or "wrong", they attribute high reputation for reporting correct news. Otherwise, they attribute high reputation for reporting news which is likely to be correct *à priori*. The media reports so as to increase its future demand. When it receives information contradicting common priors, it hesitates whether to report it or to confirm the priors: "most likely, this information is correct, but the voters may be unable to assess the quality of news".

We consider two media market structures: a monopoly and a duopoly; and we ask which one is more efficient in sustaining informative reporting. Our answer depends on news coverage: a duopoly media market delivers news no less informative than a monopoly media market when it covers issues on which the priors are sufficiently precise or the follow-up quality assessment is a likely event. However, if news concerns controversial issues, and the follow-up quality assessment is hardly possible, news is more informative when the media is a monopoly.

The reason is the following. When news covers issues on which the priors are sufficiently diffused (for example, it concerns some national policy,

[2] The voters attach a value to voting "optimally", either directly as a psychic benefit, or because they take a private decision, say an investment, whose impact depends on the same information as the one relevant to the voting decision.

e.g.: fiscal-, welfare-, international-, or it forecasts "close" election), the voters are eager to buy some news to "get a better idea". If the media is a monopoly, they buy news unless previously reported news turns out to be wrong. Therefore, the media reports any information it receives, whether it confirms common priors or not: most likely, it is correct. A duopoly media market gives more opportunities to the voters: they can choose the source of news; and they can "crosscheck" reports by different media to see whether at least one of them confirms the priors. When the outlets have similar reputations, the voters "crosscheck" their news. Otherwise, they buy news only by the outlet with a higher reputation, because it is sufficient for their voting decision. Competition for reputational leadership creates the incentives to confirm the priors: if one outlet confirms the priors, the other outlet opposes them, and the voters cannot tell which news is correct, they attribute a higher reputation to the outlet that reported confirmatory news, so it wins the market. Given such incentives, the outlets do not engage in confirmatory reporting if and only if the probability of the follow-up quality assessment lies sufficiently high (which may be true for electoral forecasts, but not for news concerning controversial policy issues).

At the same time, when news covers issues on which common priors are more precise (say, some local public project: opening pollution-cleanup sites in Albany, construction of an expressway in Pittsburgh, etc.), the voters are more "picky" at buying news if the media is a monopoly (they already have some prior idea); and they are more eager to "crosscheck" whether some news confirms the priors when the media is a duopoly. They buy news by a monopoly media only if previously reported news turns out to be correct, or at least it is likely to be correct à priori. They "crosscheck" news by different outlets when their previously reported news is coherent, whether it confirms the priors or not (it only should not be clearly wrong). Hence, when the media is a duopoly, it has weaker incentives to confirm the priors, so news is more informative.[3]

The paper is organized as follows: The next section reviews related literature. Section 3 models a monopoly media market. Section 4 describes circumstances in which it delivers informative news. Section 5 extends the basic model to a duopoly media market, and compares the quality of news for different market structures. Section 6 concludes with a brief discussion of possible applications and extensions. Proofs are collected in the Appendix.

2 Related literature

We frame our game as a market for political news. However, our insights apply to any market in which professional intermediaries (e.g.: financial experts, commercial- or political consultants, medical doctors) sell their advice for private decisions. We model a monopoly media reporting as reputational cheap-talk in Ottaviani and Sørensen (2006a,b,c). In their game, an expert reports the prevailing state of the world based on his private signal. The quality of the signal depends on the expert's type or "smartness": the smarter the expert, the better is his signal, hence, the closer its realizations to the prior mean of the state. In order to appear as smart as possible, the expert biases report to the prior mean (likewise, in our model a monopoly media signals its high quality by foregoing its information and confirming common priors when they are sufficiently precise). In a game with multiple experts equilibrium reporting is the same as in the basic one-expert game, if the experts continue to receive von Neumann-Morgenstern payoffs and hold conditionally independent signals (Section 7, 2006a); and it is excessively differentiated in the winner-takes-it-all competition (2006c).

Our counterpart to the game with multiple experts is a game with two

[3] More precisely, for either market structure news is informative if and only if the probability of the follow-up quality assessment lies above some threshold. This threshold, however, is lower when the market is a duopoly.

media outlets. We do not assume any functional dependence between the media absolute- or relative reputation in the market and its payoff or demand: it is positive if and only if news is perceived to be useful for the voting decision. This approach is novel in the literature. Otherwise, reputational cheap-talk by the media has already been discussed by Gentzkow and Shapiro (2007); however, when they consider a game with several media outlets, they eventually focus on reporting by one outlet assuming that the other media report perfect information which the readers can buy as a "feedback".

Our paper is complementary to a growing literature on reputational herding. This literature analyses *sequential* reporting by several agents with reputational concerns, assuming conditional correlation (either positive or negative) of signals by "smart" agents. In a seminal model by Scharfstein and Stein (1990), two agents (managers) make investment decisions, on the basis of their private signals about investment profitability: an agent's signal is informative if he is "smart" and diffused if he is "dumb". If both agents are smart, they have the same signals; otherwise, their signals are independent. One agent decides first. Because the same decisions signal smartness, the agent moving the second mimics decision by the first mover: there is reputational herding.[4] The mirror image is antiherding: if signals by smart agents are less correlated than signals by dumb agents, an agent behaves differently from his precessor (Hirshleifer, 1993; Graham, 1999). Similarly, in Li (2006), an agent who receives two signals of increasing quality makes different reports following the signals ("changes his mind"), because his information should improve faster if he is smart. Effinger and Polborn (2001) investigate whether there is herding or antiherding depending on concerns for relative reputation. They assume that there a value of being "the only smart" agent in the market. When it is sufficiently low, the second mover herds, avoiding

[4] Reputational herding differs from informational herding: an agent may mimic behavior if his precessors because it is more indicative than his own information (Banerjee, 1992).

performing worse than the first mover. Otherwise, he antiherds, signalling that either he or his precessor is smart, but not both.

We do not assume stronger- or weaker conditional correlation of signals by high-quality media, so the outlets have no incentives to herd or antiherd on each other's reports. Indeed, they could not mimic or oppose each other's reports even if they wished, because they report simultaneously. However, they "herd" on common priors, because they are concerned with their relative reputation: an outlet would like to have reputation no lower than the other media - otherwise, its news is redundant for the voting decision, so it is not sold.[5] This is because the decision is discrete: reminiscent of Dewatripont and Tirole (1999), in which an information collector rewarded on decision-basis has weak incentives to search for additional information.[6]

3 Basic model

Consider a game in which a monopoly media sells political news to a uniform constituency of voters in two-periods.[7] It is commonly known that the period-specific state of the world x is either 0, with probability $p \geqslant \frac{1}{2}$; or 1, with probability $1-p$. The states in different periods are independent.[8] Prevailing state is hidden from the players. The voters would like to synchronize their vote $v \in \{0,1\}$ with the state: their payoff is equal to $vx + (1-v)(1-x)$.

Remark 1 The voters care only for picking the efficient voting decision, and not for the relative efficiency of different decisions.

[5] Concern for relative reputation is endogenous, unlike in Effinger and Polborn (2001).

[6] To simplify exposition of limited demand for additional information, we assume "nested" information structure, however, this assumption is not crucial.

[7] Timing of the game is summarized at the end of the section.

[8] For notational convenience, we omit a period indicator for variable x, as well as for other period-specific variables that we introduce later.

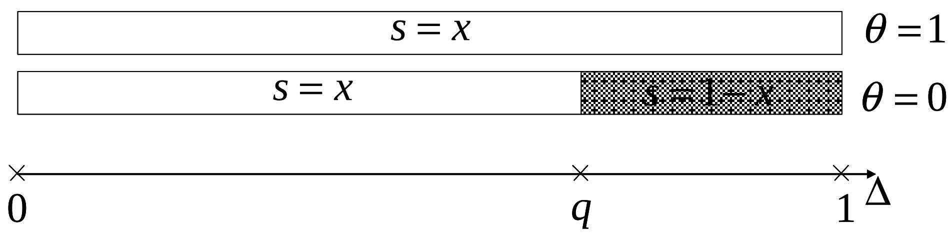

Figure 1: "Nested" information structure.

The media receives private signal

$$s = \begin{cases} x, \text{ if } \Delta \leqslant q; \\ \theta x + (1-\theta)(1-x), \text{ if } \Delta > q \end{cases} \tag{1}$$

on prevaling state. The signal depends on: (i) the media *quality* θ, which is high ($\theta = 1$) with probability $\frac{1}{2}$; and low ($\theta = 0$) with probability $\frac{1}{2}$; and (ii) realization of random variable Δ drawn from uniform distribution on the interval $[0, 1]$, as depicted on Figure 1. The media signal is "correct", unless in the shaded region where both the media quality is low, and Δ lies above threshold q.[9] Distributions of parameters θ or Δ are commonly known, but their realizations are hidden from any player.

The media reports news $n \in \{0, 1\}$ about the state: it can report any news regardless of its signal.[10] For concreteness, we assume that being indifferent, the media "truthfully" reports its signal. Because we are only interested in the media reporting when its incentives to report are controversial, we assume that the priors are no more precise than signal by an "average" quality media,

[9] Say, realization $\Delta \leqslant q$ means that the state is easy to learn, and the media receives "correct" signal regardless of its quality; while realization $\Delta > q$ means that the state is difficult to learn, and the media receives "correct" signal if and only if its quality is high.

[10] Assumption that the media does not know realizations of parameters θ and Δ limits the set of its feasible reporting strategies.

but no less precise than signal by a low-quality media, that is,[11]

$$q \leqslant p \leqslant \frac{1+q}{2}. \tag{2}$$

The media sells news at an arbitrary small price, which for notational convenience we take to be null; and it receives payoff that is proportional to its readership (say, advertisers pay it a price "per eyeball"): for simplicity, there is no pricing game in the model.

After the first vote,[12] the voters receive information that allows them to update beliefs about the media quality, that is: previously reported news; and "feedback" signal φ which is equal to the first-period state, with probability δ; and to $\varnothing$, with probability $1-\delta$.

Timing of events

Nature draws the media quality θ.

<u>Date 1</u>:

a. Nature draws state x and parameter Δ.

b. The media receives private signal s and reports news n.

c. Voters can buy news at an arbitrary small price. They vote.

d. News n becomes public. The voters receive "feedback" signal φ. They update their beliefs about the media quality.

<u>Date 2</u>: Events from date 1.a to date 1.c repeat.

[11] When $p > \frac{1+q}{2}$, the media should forego its signal s and confirm the priors all the time, because $\Pr(x=0 \mid s=1) = \frac{p(1-q)}{(1-p)(1+q)+p(1-q)}$ lies higher than $\Pr(x=1 \mid s=1) = \frac{(1-p)(1+q)}{(1-p)(1+q)+p(1-q)}$. When $p < q$, the media should not care what to report because its news is demanded even if its quality is known to be low.

[12] We assume that there is the vote at date 1.c only to preserve symmetry between the periods. Otherwise, it is redundant: only drawing of the state and the media reporting need to be repeated.

4 Monopoly media market

Let us describe reporting in a pure strategy perfect Bayesian equilibrium of the game. In the last period, the media reports its signal: it has no reason to lie. In the first period, it chooses among four reporting strategies: (i) $n = s$, call it *informative* reporting; (ii) $n = 0$, call it *uninformative* reporting; and the mirror images. For concreteness, we focus on strategies (i) and (ii).

Trivially, uninformative reporting is a part of a "babbling" equilibrium in which the voters learn nothing new about the media quality in the first period, and they buy news in the second period: by inequality (2), news by an "average" quality media is better information than the priors. Let us describe circumstances in which informative reporting is a part of an equilibirum. We proceed as follows: first, we describe the second-period demand for news when the voters believe that the media reports its signal at date $1.c$; then, we find the range of parameters for which the media does not deviate from reporting its signal at date $1.c$ given this demand.

Media reputation and demand for news The voters buy news at date 2 if and only if they perceive it being more informative than the priors:

$$q + (1-q)\Pr(\theta = 1 \mid \varphi, n) > p. \tag{3}$$

Their demand for news is non-decreasing in their posteriors $\Pr(\theta = 1 \mid \varphi, n)$ about the media quality, call them the media *reputation*, as it appears in the left-hand-side of inequality (3). By Bayes rule, we find

$$\Pr(\theta = 1 \mid \varphi = x,\ n = x) > \Pr(\theta = 1 \mid \varphi = \varnothing,\ n = 0) \geqslant$$
$$\Pr(\theta = 1 \mid \varphi = \varnothing,\ n = 1) > \Pr(\theta = 1 \mid \varphi = x,\ n \neq x). \tag{4}$$

That is, the media reputation is the highest, when previously reported news is *correct* ($n = \varphi = x$); and the lowest, when it is *incorrect* ($n \neq \varphi = x$), because the media signal may be mistaken only if its quality is low. Furthermore, the media reputation is the second-highest, when news is *confirmatory* ($n = 0$, $\varphi = \varnothing$); and the second-lowest, when it is *unsupportive*, ($n = 1$, $\varphi = \varnothing$), because the media receives signal "0" with a higher probability when its quality is high (the priors are informative):

$$p > pq + (1-p)(1-q). \tag{5}$$

The more precise the priors, less eager the voters are to buy news, as it appears in the right-hand-side of inequality (3): recall Remark 1. As long as the prior probability that vote "0" is efficient lies below threshold[13]

$$\underline{p} = \frac{1 + q^2 - (1-q)\sqrt{1+q^2}}{2q}, \tag{6}$$

they buy news, unless the previous report is clearly wrong; otherwise, they buy news only if the previous report is either correct or at least confirmatory.

Lemma 1 *When the voters believe that $n = s$, their second-period demand is as follows. When $p < \underline{p}$, where threshold $\underline{p}$ is given by equation (6), they buy news unless $n \neq \varphi = x$. When $p \geqslant \underline{p}$, they buy news either if $n = \varphi = x$ or else if both $n = 0$ and $\varphi = \varnothing$, but not otherwise.*

Pandering to the future demand Because the media is paid "per eyeball", it panders date $1.c$ news to the future demand described by Lemma 1. Does it report its signal? Obviously yes, if the signal is "0": news "0" is likely to be correct, and it confirms the priors. The answer is less obvious if the signal is "1". The answer is still positive when the priors are sufficiently diffused ($p < \underline{p}$), so that the media would only like to report no incorrect news (its signal should be more informative than common priors). However, when the priors are more precise ($p \geqslant \underline{p}$), the media would like to report either correct or confirmatory news. Therefore, it reports news "1" if and only if

[13] Threshold $\underline{p}$ and all thresholds that we find hereafter are depicted on Figure 2.

the probability that this news turns out to be correct ($\varphi = x = 1$) lies no lower than the probability that either it turns out to be wrong ($\varphi = x = 0$) or it remains unclear whether it is correct or not ($\varphi = \varnothing$). That is,

$$\delta \Pr(x = 1 \mid s = 1) \geqslant \delta \Pr(x = 0 \mid s = 1) + 1 - \delta. \tag{7}$$

This incentive constraint is met if and only if both: the follow-up feedback on the quality of news is a likely event ($\delta > \frac{1}{2}$); and precision of the priors lies no higher than threshold

$$p^m = \frac{(2\delta - 1)(1 + q)}{(2\delta - 1)(1 + q) + 1 - q}. \tag{8}$$

(threshold p^m lies above threshold $\underline{p}$ when $\delta > \frac{1+q+\sqrt{1+q^2}}{2+2q}$, but not otherwise; for example, in the upper layers on Figure 2, but not in the lower layer).

Proposition 1 (quality of a monopoly media news) *A monopoly media reporting is informative either if $p < \underline{p}$, where threshold $\underline{p}$ is given by equation (6); or else if both $\delta > \frac{1}{2}$ and $p \leqslant p^m$, where threshold p^m is given by equation (8).*

In words, a monopoly media reports informative news if and only if the priors on the issue that it covers are sufficiently diffused. Note that the quality of news is increasing in the quality of the media signal (both thresholds p^m and $\underline{p}$ are increasing in q); and it is non-decreasing in the probability that the voters can assess the quality of reported news (threshold p^m is increasing in δ). Importantly, when the priors are sufficiently diffused ($p < \underline{p}$), news is informative even if the voters cannot assess its quality.

5 Competitive media market

Let us extend our basic model to a game with two outlets in the market, index them with $i = 1, 2$, and let index $-i$ refers to the competitor by outlet

i. At the beginning of the game, Nature independently draws their qualities from the same distribution as the quality of a monopoly media in the basic game. Events at date $1.a$ are the same as in the basic game. At date $1.b$, the outlets receive private signals on the state: signal s_i by outlet i depends on its quality θ_i and realization of parameter Δ, as it is described by system of equations (1) with s and θ being indexed with i. The outlets simultaneously report news: $n_i \in \{0, 1\}$ denotes news by outlet i (as in the basic game, the media can report any news regardless of its signal). At date $1.c$, the voters can buy either report or both reports (each report is available at an arbitrary small price), and they vote. At date $1.d$, the reported news becomes public, the voters receive either perfect or empty "feedback" signal φ, and they update their beliefs about the media quality. At date 2, the events from date $1.a$ to date $1.c$ repeat.

Let us describe circumstances in which the duopoly media market sustains symmetric equilibrium with informative reporting, and compare our insights to Proposition 1. We proceed as in the previous section: first, we describe the second-period demand for news based on beliefs that date $1.c$ reporting is informative; then, we find parameters for which an outlet does not deviate from informative reporting given this demand.

Buy two-, one-, or no reports? At date 2, the voters have three undominated strategies: (i) buy no news and vote "0"; (ii) buy news by the media with the highest reputation, and vote as it reports; (iii) buy news by both outlets and vote "0" unless they both report "1". Strategy (ii) is more efficient than strategy (i) if and only if

$$q + (1 - q) \max_{i=1,2} \{\Pr(\theta_i = 1 \mid \varphi, n_1, n_2)\} > p: \tag{9}$$

this is straightforward generalization of inequality (3). Strategy (iii) is more efficient than than strategy (i) if and only if

$$q + (1 - q)\left((1 - p)\Pr(\theta_1 = \theta_2 = 1 \mid \varphi, n_1, n_2) + \right.$$
$$\left. + p\left(1 - \Pr(\theta_1 = \theta_2 = 0 \mid \varphi, n_1, n_2)\right)\right) > p; \tag{10}$$

and it is more efficient than strategy (ii) if and only if

$$(1 - p)\Pr(\theta_1 = \theta_2 = 1 \mid \varphi, n_1, n_2) + p\left(1 - \Pr(\theta_1 = \theta_2 = 0 \mid \varphi, n_1, n_2)\right) >$$
$$> \max_{i=1,2}\left\{\Pr(\theta_i = 1 \mid \varphi, n_1, n_2)\right\}. \tag{11}$$

Indeed, strategy (iii) is efficient in the following circumstances: the media receives correct signal regardless of its quality ($\Delta \leqslant q$); only a high-quality media receives correct signal ($\Delta > q$), and either the state is "1" and both outlets have high quality ($x = 1$, $\theta_1 = \theta_2 = 1$), or the state is "0" and at least one outlet has high quality ($x = 1$, $\theta_1 + \theta_2 > 0$). Hence, the expected efficiency of strategy (iii) is equal to the left-hand-side of inequality (10).

If date $1.c$ reports differ, the voters attribute different reputations to the outlets, and they buy news only by the outlet with a higher reputation: recall remark 1 (formally, inequality (9) is met, and inequality (11) is violated). The winner of the market is the outlet that has reported correct news, if the voters can assess its quality; otherwise, it is the outlet that has reported confirmatory news.

Lemma 2 (exclusive readership) *When the voters believe that $n_i = s_i$, and $n_1 \neq n_2$, in the second period they buy only news by the outlet that has reported: (i) x, if $\varphi = x$; (ii) "0" otherwise.*

When date $1.c$ reports are the same, the outlets share the same reputation. If the reports are clearly wrong, the reputation is null, and the voters buy no news. Otherwise, the voters prefer to crosscheck news rather than to relying on just one report (inequality (11) is met). Do the voters crosscheck news or simply vote "0" (is inequality (10) met)? They crosscheck news if previously reported news is correct or at least confirmatory. If it is unsupportive, the voters crosscheck news, if and only if precision of the priors p lies no higher than threshold

$$\overline{p} = \frac{1 + 3q^2 - (1 - q)\sqrt{1 + 3q^2}}{2q(1 + q)}. \tag{12}$$

Remark 2 Threshold $\overline{p}$ lies above threshold $\underline{p}$ that is given by equation (6), as depicted on Figure 2.

The reason is that news by different outlets with the same reputation is complementary, hence, easier to sell than just one report, in particular when previously reported news is unsupportive.

Lemma 3 (multioutlet readership) *When the voters believe that $n_i = s_i$, and $n_1 = n_2$, they buy news by both outlels at date 2 if $n_1 = n_2 = \varphi = x$; or if both $n_1 = n_2 = 0$ and $\varphi = \varnothing$; or else if $n_1 = n_2 = 1$, $\varphi = \varnothing$ and $p < \overline{p}$, where threshold $\overline{p}$ is given by equation (12). Otherwise, they buy no news.*

Reporting by a competing media outlet Does an outlet report its signal at date 1.c when its future readership is described by Lemmas 2 and 3? As in the monopoly media case, the answer is "yes", if the signal is "0", and "maybe" if it is "1". When the priors are very precise ($p \geqslant \overline{p}$), an outlet faces the same incentives as if it was alone in the market: it sells news at date 2 if and only if its first-period report is either correct or at least confirmatory. Hence, it reports its signal if and only if precision p of the priors lies no higher than threshold p^m that is given by equation (13). When the priors are less precise ($p < \overline{p}$), an outlet has weaker incentives to confirm them, because it may sell its news after unsupportive report if report by the other outlet is also unsupportive. When outlet i receives signal "1", it reports "1" if and only if[14]

$$\delta \Pr(x=1 \mid s_i=1)+(1-\delta)\Pr(s_{-i}=1 \mid s_i=1) \geqslant \delta \Pr(x=0 \mid s_i=1)+(1-\delta)\,; \tag{13}$$

or, equivalently, if and only if p lies below threshold

$$p^c = \frac{\delta(3+q)+q-1}{4\delta}. \tag{14}$$

Remark 3 Threshold p^c lies below threshold p^m, as depicted on Figure 2, because inequality (13) is weaker than inequality (7).

Proposition 2 (quality of a duopoly media news) *A duopoly media market sustains informative reporting either if (i) $\overline{p} < p \leqslant p^c$ where threshold $\overline{p}$ is given by equation (6) and threshold p^c is given by equation (14); or else if (ii) both $\delta > \frac{1}{2}$ and $p \leqslant p^m$, where threshold p^m is given by equation (8).*

Competition in the media and quality of news Let us compare Propositions 1 and 2 to see which market structure is more efficient in eliciting information from the media. Remarks 2 and 3 hint at the following three possibilities. (i) Threshold p^c given by equation (14) lies below threshold $\underline{p}$ given by equation (6), or, equivalently, δ lies below threshold

$$\underline{\delta} = \frac{2\sqrt{1+q^2}+2-q}{4+3q}, \tag{15}$$

as depicted in the lower layer on Figure 2. (ii) Threshold p^c lies at least as high as threshold $\underline{p}$, but threshold p^m given by equation (8) lies lower than threshold $\overline{p}$ given by equation (6); equivalently, δ lies no lower than threshold $\underline{\delta}$, but lower than threshold

$$\overline{\delta} = \frac{1+q+\sqrt{1+3q^2}}{2+2q}, \tag{16}$$

[14] We index the incentive constraint (7) with i and add term $(1-\delta)\Pr(s_{-i}=1 \mid s_i=1)$ to its left-hand-side.

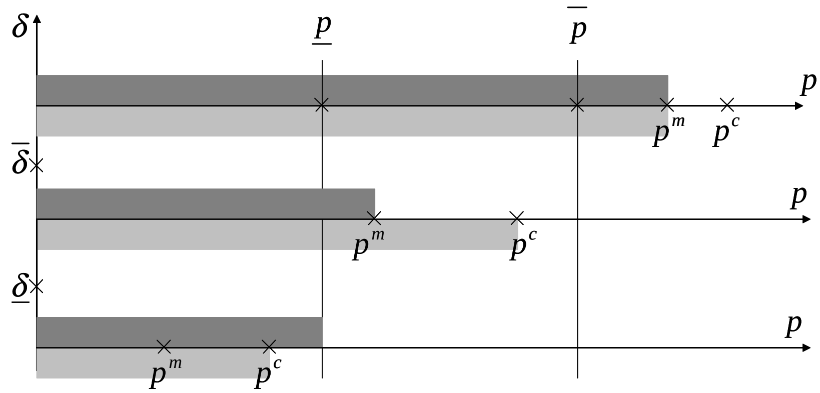

Figure 2: A monopoly media market sustains informative reporting in dark shaded areas. A duopoly media market sustains informative reporting in light shaded areas. Higher layers correspond to higher values of parameter δ.

as depicted in the intermediate layer on Figure 2. (iii) Threshold p^m lies at least as high as threshold $\overline{p}$, or, equivalently, δ lies at least as high as threshold $\overline{\delta}$: this situation is illustrated by the upper layer on Figure 2.

Figure 2 shows that competition in the media has an ambigous impact on the quality of news. In the lower left cell, competitive pressures make it more difficult to sustain informative reporting. The reason is that the priors are sufficiently diffused ($p < \underline{p}$), and so the voters are eager to learn more about the prevailing state. If there is only one outlet in the market, they buy news, unless previously reported news is clearly incorrect. Therefore, the media reports its signal which is likely to be correct. When there are two outlets in the market, the voters can choose the source of news. Therefore, each outlet faces a more elastic demand: it rewards either correct- or at least confirmatory reports. Because it is quite unlikely that the voters can assess whether reported news is correct or not ($\delta < \underline{\delta}$), the outlets easily engage in confirmatory reporting.

Remark 4 (premium for exclusive readership) If we assume (following

Ambrus and Reisinger, 2006) that advertizers pay a higher price per "eyeball" of an exclusive reader than per "eyeball" of a multioutlet reader, competitive pressures induce confirmatory reporting even more (see the Appndix).

In the central cell on Figure 2, the situation is reverced: news is more informative when there are two outlets in the market. Indeed, vote "0" is quite likely to be correct ($p \geqslant \underline{p}$). When there is one outlet in the market, the voters are "picky" about buying its report: they buy it if previously reported news is either correct, or at least confirmatory; otherwise they simply vote "0". The voters are more inclined to buy two reports ("let's check whether at least one of them confirms that vote "0" is efficient"). Therefore, they create weaker incentives to confirm the priors when there are two outlets in the market.

For all other values of parameters p and δ, either media market structure is equally efficient in sustaining informative reporting. Note that this means that a duopoly market delivers more information to the voters, because the probability of event that an outlet receives correct signal is increasing in the number of outlets in the market.

Corollary *A monopoly media market is more efficient in sustaining informative reporting than a duopoly media market when both $p < \underline{p}$ and $\delta < \underline{\delta}$, where threshold $\underline{p}$ is given by equation (6), and threshold $\underline{\delta}$ is given by equation (15). The opposite is true when both $\underline{\delta} < \delta < \overline{\delta}$ and $\underline{p} < p < \overline{p}$, where threshold $\overline{p}$ is given by equation (12), and threshold $\overline{\delta}$ is given by equation (16).*[15] *For all other values of parameters p and δ, either media market structure is equally efficient in eliciting information from the media.*

[15] The higher the quality of the media signal, the larger scope for the competition: both thresholds $\underline{p}$ and $\overline{\delta}$ are increasing in q, while threshold $\underline{\delta}$ is decreasing in q.

6 Applications and extentions: concluding discussion

According to the above corollary, competition may help to elicit information from the media if common priors on the issues covered by news are sufficiently precise, or the follow-up quality assessment is a likely event. However, if news concerns controversial issues, and it is hardly possible to asses its quality, competitive pressures induce confirmatory reporting. This is our main insight. Let us outline some issues for the future research.

News coverage One possible line of research is to endogenize news coverage, and investigate how it depends on the media market structure. Even at a first glance, there are many interesting effects. If we focus on the media coverage decision prior to information receival, we may find that a monopoly outlet covers issues on which the priors are diffused, so as not to engage in confirmatory reporting taking a risk of being detected; while a competitive outlet covers issues on which the priors are more precise, so as to take a chance of winning reputational leadership by confirming them.

If selective reporting of available information is concerned, we may find that competition in the media helps to detect "slanting" of relevant information when it takes place. Say, the media receives signals on two issues, and then reports on one issue - either one it chooses to cover. News coverage is important when the media signal on only one issue does not confirm common priors: ideally, the media should aware the voters about it. A monopoly media, however, is not going to report news contradicting common priors on one issue when it can confirm them on the other issue: this is "safer", because the signal confirming the priors is more likely to be correct. A competing media, has at least some incentives to report "unpopular" but relevant news, because its rival may report it and this report may turn out to be correct.

Voter competence and quality of news Furthermore, it could be interesting to investigate the impact of voter competence on the quality of news, depending on the media market structure. The voters who receive their own information may provide stronger reputational concerns, hence, the incentives to confirm the priors when the media is a monopoly, because they have relatively low demand for news. At the same time, they may increase the quality of news in a competitive media environment, because they assess it on the basis of not just common priors, but also their own signal. A further step could be considering voters differentiated in competence: because they attribute reputation to the media in different ways, competition may lead to differentiation in quality of news.

News and political accountability News influences policy choices by elected officials (Besley and Burgess, 2002; Snyder and Strömberg, 2004; Strömberg 2001, 2004). Does the media work as a "watchdog" promoting socially efficient governance? Straightforward reinterpretation of our corollary tells that the answer is ambiguous: political news may decrease bias in public policy towards "popular" or à priori efficient, when common priors are sufficiently precise or the probability of ex post feedback is sufficiently high; and increase this bias otherwise. It suffices to assume that a politician has reputational concerns similar to the media outlet (because she would like to win re-election); the voters update their beliefs upon her and the media ability to identify socially efficient public policy on the basis of previously reported news and policy choices; and they decide upon re-election and their demand for news depending on these beliefs. The counterpart of a monopoly media reporting is the politician's behaviour in a hypothetical environment without the media. The counterpart of a duopoly media reporting, is her behaviour when the media reports political news.

We hope that these preliminary considerations may motivate the future research on issues that concern the media performance.

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A Appendix

A.1 Proof of Lemma 1

$$\text{By Bayes rule: } \Pr(\theta = 1 \mid \varphi = x,\ n = x) = \frac{1}{1+q}; \tag{17}$$

$$\Pr(\theta = 1 \mid \varphi = \varnothing,\ n = 0) = \frac{p}{p(1+q) + (1-p)(1-q)}; \tag{18}$$

$$\Pr(\theta = 1 \mid \varphi = \varnothing,\ n = 1) = \frac{1-p}{(1-p)(1+q) + p(1-q)}; \tag{19}$$

$$\Pr(\theta = 1 \mid \varphi = x,\ n \neq x) = 0. \tag{20}$$

Posteriors given by equations (17)-(20) are ordered by set of inequalities (4).

Suppose that $n = 0$ and $\varphi = \varnothing$. By equation (18), inequality (10) is met at both limits of interval (2). By monotonicity:

$$\frac{\partial}{\partial p}\Pr(\theta = 1 \mid \varphi = \varnothing,\ n = 0) = \frac{1-q}{\left(p(1+q) + (1-p)(1-q)\right)^2} > 0, \tag{21}$$

it is met for any p in interval (2). By inequality (4), it is also met for any p in interval (2) when $n = \varphi = x$. Suppose that $n = 0$ and $\varphi = \varnothing$. By equation (19), inequality (10) is met when $p = q$, but not when $p = \frac{1+q}{2}$. By monotonicity:

$$\frac{\partial}{\partial p}\Pr(\theta = 1 \mid \varphi = \varnothing,\ n = 1) = -\frac{1-q}{\left((1-p)(1+q) + p(1-q)\right)^2} < 0, \tag{22}$$

there exist threshold $\underline{p}$ such that inequality (3) is met when $p < \underline{p}$, but not when $\underline{p} \leqslant p < \frac{1+q}{2}$. This threshold equalizes the left- and the right-hand-side of inequality (3) for $\varphi = \varnothing$, $n = 1$. It is given by equation (6). It remains to note that inequality (3) is not met when $\varphi = x \neq n$ for any p in interval (2).

A.2 Proof of Proposition 1

The media reports $n = s$ at date 1.c if and only if it delivers at least as high expected demand for news at date 2 as reporting $n \neq s$. Using Lemma 1 to describe date 2 demand for news, we find that if $s = 0$, the media reporting is informative is and only if:

$$1 - \delta + \delta \Pr(x = 0 \mid s = 0) \geqslant 1 - \delta + \delta \Pr(x = 1 \mid s = 0) \tag{23}$$

in the region where $p < \underline{p}$; and

$$\delta \Pr(x = 0 \mid s = 0) + 1 - \delta \geqslant \delta \Pr(x = 1 \mid s = 0) \tag{24}$$

in the region where $\underline{p} \leqslant p < \frac{1+q}{2}$. Both inequalities (23) and (24) are true, because

$$\Pr(x = 0 \mid s = 0) = \frac{p(1+q)}{p(1+q) + (1-p)(1-q)} \tag{25}$$

(computed by Bayes rule) lies higher than

$$\Pr(x = 1 \mid s = 0) = \frac{(1-p)(1-q)}{p(1+q) + (1-p)(1-q)}. \tag{26}$$

Suppose that $s = 1$. When $p < \overline{p}$, the media reporting is informative if and only if

$$1 - \delta + \delta \Pr(x = 1 \mid s = 1) \geqslant 1 - \delta + \delta \Pr(x = 0 \mid s = 1),$$

which is equivalent to true inequality $1 + q > 2p$: once again, we use Bayes rule to find

$$\Pr(x = 1 \mid s = 1) = \frac{(1-p)(1+q)}{(1-p)(1+q) + p(1-q)}, \text{ and} \tag{27}$$

$$\Pr(x = 0 \mid s = 1) = \frac{p(1-q)}{(1-p)(1+q) + p(1-q)}. \tag{28}$$

When $\underline{p} \leqslant p < \frac{1+q}{2}$, the media reports $n = s$ if and only if inequality (7) is met, which by equations (27) and (28) is equivalent to both $\delta > \frac{1}{2}$ and $(2\delta - 1)(1+q)(1-p) \geqslant p(1-q)$, or, after doing some straightforward algebra, to both $\delta > \frac{1}{2}$ and (8).

A.3 Proof of Lemma 2

$$\text{By Bayes rule, } \Pr(\theta_i = 1 \mid n_i = x, n_{-i} \neq x, \varphi = x) = 1; \tag{29}$$

$$\Pr(\theta_1 = \theta_2 = 0 \mid \varphi, n_1 \neq n_2) = \Pr(\theta_1 = \theta_2 = 1 \mid \varphi, n_1 \neq n_2) = 0; \tag{30}$$

$$\Pr(\theta_i = 1 \mid n_i = 0, n_{-i} = 1, \varphi = \varnothing) = p. \tag{31}$$

When $n_i = 0$, $n_{-i} = 1$, $\varphi = \varnothing$ inequality (11) is violated by equations (30) and (31), while inequality (9) is met. The same is true when $n_i = x$, $n_{-i} \neq x$: see equations (30) and (29).

A.4 Proof of Lemma 3

$$\text{By Bayes rule: } \Pr(\theta_i = 1 \mid n_1 = n_2 \neq \varphi = x) = 0; \tag{32}$$

$$\Pr(\theta_1 = \theta_2 = 1 \mid n_1 = n_2 = 1, \varphi = \varnothing) = \frac{1-p}{(1-p)(1+3q) + p(1-q)}; \tag{33}$$

$$\Pr(\theta_1 = \theta_2 = 0 \mid n_1 = n_2 = 1, \varphi = \varnothing) = \frac{p(1-q) + q(1-p)}{(1-p)(1+3q) + p(1-q)}; \tag{34}$$

$$\Pr(\theta_i = 1 \mid n_1 = n_2 = 1, \varphi = \varnothing) = \frac{(1-p)(1+q)}{(1-p)(1+3q) + p(1-q)}; \tag{35}$$

$$\Pr(\theta_1 = \theta_2 = 1 \mid n_1 = n_2 = 0, \varphi = \varnothing) = \frac{p}{p(1+3q) + (1-p)(1-q)}; \tag{36}$$

$$\Pr(\theta_1 = \theta_2 = 0 \mid n_1 = n_2 = 0, \varphi = \varnothing) = \frac{pq + (1-q)(1-p)}{p(1+3q) + (1-p)(1-q)}; \tag{37}$$

$$\Pr(\theta_i = 1 \mid n_1 = n_2 = 0, \varphi = \varnothing) = \frac{p(1+q)}{p(1+3q) + (1-p)(1-q)}; \tag{38}$$

$$\Pr(\theta_1 = \theta_2 = 1 \mid n_1 = n_2 = \varphi = x) = \frac{1}{1+3q}; \tag{39}$$

$$\Pr(\theta_1 = \theta_2 = 0 \mid n_1 = n_2 = \varphi = x) = \frac{q}{1+3q}; \tag{40}$$

$$\Pr(\theta_i = 1 \mid n_1 = n_2 = \varphi = x) = \frac{1+q}{1+3q}. \tag{41}$$

1. Suppose that $n_1 = n_2 = \varphi = x$. By equations (39)-(41), we find, after doing some algebra, that inequality (11) is equivalent to $2p > 1$, which is true.

By equations (39) and (40), we find, that the left-hand-side of inequality (10) lies higher than $\frac{q+1}{2}$. Hence, this inequality is met (recall inequalities (2)).
2. Suppose that $n_1 = n_2 = 0$, $\varphi = \varnothing$. By equations (36)-(38), inequality (11) is equivalent to $2p > 1$. By equations (36) and (37), the left-hand-side of inequality (10) lies above $\frac{q+1}{2}$ if and only if $2p(1+2pq) > 2pq + 1 - q$, which is true.
3. Suppose that $n_1 = n_2 = 1$, $\varphi = \varnothing$. By equations (33)-(35), inequality (11) is equivalent to $2p > 1$ (true). Using equations (33) and (34) evaluated at the extremes of interval (2), we find that inequality (10) is met when $p = q$, but not when $p = \frac{1+q}{2}$. The difference between the left- and the right-hand-side of this inequality decreases in p:

$$sign\left(\frac{\partial}{\partial p}\left((1-p)\Pr\left(\theta_1 = \theta_2 = 1 \mid \varphi, n_1, n_2\right) - p\Pr\left(\theta_1 = \theta_2 = 0 \mid \varphi, n_1, n_2\right)\right)\right) =$$

$= sign\left[1 - 2pq + q^2\left((1-2p)^2 + 2 - 2p\right)\right] > 0$ for $p \leqslant \frac{1+q}{2}$. Threshold $\overline{p}$ given by equation (12) equalizes the left- and the right-hand-side of inequality (10) for $n_1 = n_2 = 1$, $\varphi = \varnothing$: the voters crosscheck news when $p < \overline{p}$, and they read no news otherwise.
4. When $n_1 = n_2 \neq x$, neither inequality (10) or (11) is met, by equation (32).

A.5 Proof of Proposition 2

By Bayes rule, $\Pr\left(s_{-i} = 1 \mid s_i = 1\right) = \dfrac{(3q+1)(1-p) + p(1-q)}{2\left((1-p)(1+q) + p(1-q)\right)}$. (42)

Consider interval $p < \overline{p}$. Using equations (27), (28),[16] and (42), and doing some straightforward algebra we find that the incentive compatibility constraint (13) is met if and only if $p \leqslant p^c$, where threshold p^c is given by equation (14).

[16] We index equations (27) and (28) with i.

A.6 Proof of Remark 4

Let us normalize the media advertizing revenue per multioutlet reader to 1, and denote with $B > 1$ the revenue per exclusive reader. Trivially, a premium for exclusive readership does not change anything for a monopoly media market, where all readers are exclusive. However, it creates additional incentives to confirm the priors in a duopoly media market. Indeed, the counterpart of the media incentive constraint (13) is a stronger inequality:

$$\delta\left(B\Pr\left(x=1,s_{-i}=0\mid s_i=1\right)+\Pr\left(x=1,s_{-i}=1\mid s_i=1\right)\right)+$$

$$+\left(1-\delta\right)\Pr\left(s_{-i}=1\mid s_i=1\right)\geqslant\delta(\Pr\left(x=0,s_{-i}=0\mid s_i=1\right))+$$

$$B\Pr\left(x=0,s_{-i}=1\mid s_i=1\right))+\left(1-\delta\right)\left(B\Pr\left(s_{-i}=1\mid s_i=1\right)+\Pr\left(s_{-i}=0\mid s_i=1\right)\right).$$