The Newsroom Dilemma
Media Competition, Speed and the Quality of Journalism

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Abstract

We model how competing media outlets resolve the speed-accuracy trade-off when investigating rumours in the presence of pre-emption risk and reputational concerns. We first derive a "better right than first" separating equilibrium where only the higher quality firm does investigative journalism. While conventional wisdom highlights that more competition for the same scoop necessarily drives media outlets towards early release of less accurate information, we show that competition can also make investigative journalism incentive compatible for parameters where it is not sustainable in monopoly. This is due to the additional information that competition brings to the reader, that may counterbalance the increased pre-emption risk. Second, we show that an *improvement* in the quality of the first rumour may make the readers *worse off*. Finally, we show that there is a non-monotonic effect of the reader's information availability on the possibility that competition helps investigative journalism. These observations help us understand the effects of technological advancements on the quality of journalistic reporting and, as a consequence, on the political and economic choices of the public.

Keywords: media competition, investigative journalism, pre-emption, career-concern.

JEL Classification: D43, D83, L82

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1 Introduction

Local and national media have long played the crucial watchdog role in modern democracies. Media outlets, through investigative journalism, deliver revelations that have wide impact on the society and its institutions. For instance, *The Hindu*'s Bofors scam exposé in India in 1987 brought the topic of political corruption to the centrestage and eventually led to the defeat of the government in power in the 1989 general elections. More recently, the *The New York Times* exposé on sexual abuse in Hollywood and corporate America has reignited discussions on gender discrimination at workplace. However, in the past decade there has been a growing concern that competition induced by lower entry barriers in the media market due to the Internet is eroding the incentives to conduct such investigations, or even to check the facts properly before publication. Conventional wisdom and relevant contributions in the media studies literature (see section 1.1) suggests that more competition for the same scoop has driven media outlets towards early release of less accurate information. We argue that this is not necessarily the case. Moreover, we highlight a counter-intuitive non-monotonic effect of better rumours on the welfare of the reader, as they may discourage further investigation from high quality outlets.

We conjecture that in the face of competition the resolution of speed-accuracy tradeoff, or simply "the newsroom dilemma", is determined by two opposing forces. Competing media outlets not only care about being pre-empted on stories they are working on, but also about their reputation. While the risk of pre-emption pushes them towards early release of less developed stories, i.e. towards speed, reputation concerns may allay such fears pushing towards later release of well-researched stories, i.e. towards accuracy. This motivates us to build the first model of pre-emption game with career-concerned players in a natural setting.

Our model makes two fundamental observations. In a model of media competition and career concern, we first show that a "better right than first" separating equilibrium where only the higher quality firm does investigative journalism can be more easily sustained in the presence of competition. Lionel Barber, the Editor of *Financial Times* echoes this observation in describing the work culture at FT.

> "We must go beyond providing the first intimation of significant events; the first analysis of those events, (or) the first commentary on their meaning. We must endeavour to put the imprimatur on those sources, assessing them for reliability, quality and context before passing them on to readers. At FT, we have a cast-iron rule: better to be right than first."

Second, we show that an *improvement* in the quality of the first rumour may make the reader

worse off. This is so because it makes the aforementioned equilibrium less likely as the high quality firm views lower informational gain from conducting the investigation, thereby making pre-emption concerns more salient. Thus, bettering the technology through which initial information is generated makes the final information received by the end consumers worse.

These observations help us disentangle what effects what type of technological advancements may have on the media market. Any improvement in technology that lifts barriers to entry and induces more competition does not necessarily lead to reduced consumer welfare. Competing firms, driven by reputational concerns, may fuel more investigative journalism and more fact checking. This incentive, as we discuss later, is more for higher quality firms when faced with more competition.[1] However, any technology driven improvement in the precision of the initial rumours may make the readers worse off.

The Internet has admittedly brought about both these changes. The same technology that has reduced the cost of entry[2] has also made it easier for media outlets to come across better rumours. For instance, citizen whistleblowers from anywhere can connect with media outlets through their social media accounts potentially offering audio-visual evidence collected through their smartphones. Similarly, Google has essentially solved the where-to-start-looking problem, which has made the collection of first few signals more precise. This implies that it is not easy to ascertain the impact that the Internet has had on investigative journalism and consumer welfare.

Following from the latter observation, our model predicts the kind of stories that are more likely to be explored by current media outlets[3]. Since the incentives to separate by investigative journalism are more prevalent when the initial rumours are imprecise, we expect more such stories to break. These presumably include illegal activities and malpractices of more influential individuals and those in position of power who can hide their actions more easily. Thus, a more precise rumour of lower level corruption may be published without investigation, while a very imprecise rumour involving a high-powered position may be explored deeper. Similarly, fairly precise rumours of gender discrimination and sexual abuse of employees in a low to mid-tier firm may go rationally unexplored, but those in a big firm may be explored further.

We build a simple two-period duopoly model to study the effect of competition in an environment where the players are career-concerned and fear pre-emption from their competitor.

[1] We only have monopoly to duopoly result to make this claim, but this should be general enough.

[2] by completely eliminating print costs on the one hand, and reducing the cost of setting up a shop and advertising on the other

[3] This admittedly requires a story-by-story interpretation of our model so that beliefs are formed about the quality of the firm on each independent stories. One may imagine different models with different parameters for each type of story.

Two media outlets compete for eyeballs[4] as each receives a rumour about an unknown state that they can further investigate. The pre-emption concern is captured by a scoop value that accrues only to the first player to publish (and report the state). However, each outlet also cares about what the readers think about it, which determines future readership. Reputation is built on the outlet's type, which may be high or low depending on their ability to conduct further investigation (measured by the cost of doing investigative journalism). This, for example, may arise from cost advantages that one firm has over the other. Consumers offer their future readership based on whether they believe the outlet can do more investigative journalism, which is more likely to come from a higher quality outlet.

The two firms make publication decisions based on whether they received the rumour and whether they decided to investigate the rumour. Upon publication and the subsequent verification of the state, the consumers update their beliefs on the type of each outlet which ultimately determine the overall payoffs. We assume that the reader does not observe the actual length of investigative journalism, but only which outlet has published, in what sequence and what state they endorsed.

Our analysis focuses on deriving the "better right than first" (pure strategy) separating equilibrium where only the higher quality firm investigates rumours to build reputation. We first prove that there exists a range of parameters where such an equilibrium can be obtained more easily with than without pre-emption risk , i.e. with competition. This is due to the additional informational gains that are available in competition: the actions of the other player are useful in learning the type of the first one. We show that there is a range of parameters where this information availability effect dominates the pre emption concern, that of course pushes toward earlier publication.

Interestingly, this effect of competition-related information availability is crucially related with the "transparency" of the setting. In both extreme cases, where the publication timing is either completely observable to the reader or completely unobservable, then competition does not bring extra relevant information, hence it just increases the pressure toward earlier publication. In the intermediate case we are considering, instead, competition induces a trade off that can be resolved in more differentiation. We believe this result is novel, and different from the existing literature on pre-emption games and from the effect of media competition on the speed-accuracy trade off. Moreover, it is consistent with stylized facts on how different outlets react to the increased competitive pressure.

Next, we show that the range of parameters for which such an equilibrium exists can reduce

[4]which usually translates into advertising revenue

when the precision of initial rumours increases: the high type has less to gain from separation in terms of precision of its own information. As a consequence, it is less willing to pay the cost. The interesting corollary is the non monotonic effect of rumour's precision on the welfare of the reader. On the one hand, an increase in the precision of the rumour makes the publication of the low type more accurate, but at the same time it reduces the incentive to separate for the high quality outlet.

Our model generally covers settings that have elements of pre-emption and career concerns. The newsroom dilemma may exist for competing researchers working to solve similar problems hoping to convince a market about their ability. This also true for competing technology firms trying to build products and technology to match consumer preferences. In both these situation, we show that better the initial research idea, the more likely it is that a lower research effort is exerted on further enhancing it. From the consumer's point this is better than having no idea, but it also shows that research may stop earlier than expected.

1.1 Stylized facts and media studies literature

The speed-accuracy trade off in media outlets is something widely recognized by practitioners, but surprisingly understudied in the media economics literature. For example, the BBC Academy website points out that "Every journalist has to resolve the conflicting demands of speed and accuracy. [...] If you're working on a breaking news story, it's important to remember that first reports may often be confused and misleading. [...] That's why it's important to weight the facts you have".

The terms of this trade off are of course affected by the surrounding environment. The media studies literature highlights two important determinant of the rise of "speed driven journalism". The first one is the adoption of 24 hours news cycles (Lee 2014, Starbird et al. 2018), whose implication is the possibility of being pre-empted at any point in time. Newspapers used to have editions, hence a piece of information could be verified until the night before publication, almost without fear of someone else breaking the news. This is no longer the case, now. As Howard Kurtz, from Washington Post, describes, "In the last year, the pendulum has swung in our newsroom to putting things on the Web almost immediately [...]. You know, everybody wants it now-now-now. [...] But the sacrifice clearly is in the extra phone calls and the chance to briefly reflect on the story that you're slapping together" (Rosenberg and Feldman 2006).

The second one is the increased competitive pressure. As pointed out by Barber (2017), "Technology has also flattened the digital plain, creating the illusion that all content is equal. It has made it possible for everyone to produce and distribute content that looks equally credi-

ble". As a consequence, outlets cannot count just on their pre-existing reputation in order to get eyeballs, and being the first one breaking the news is increasingly important. As pointed out by Rosenberg and Feldman (2008): "Why do experienced journalists telecast unscreened material in volatile situations? Because they can, and because they are driven by powerful, rush-to-report heard instinct, the one commanding them to beat or at least keep astride of the competition and not be left behind".

Importantly, however, reputational concerns are still relevant, as pointed out by the Reuters Handbook of Journalism, and they are based precisely on the ability to check the facts before releasing them: "Reuters aims to report facts, not rumours. Clients rely on us to differentiate between fact and rumour and our reputation rests partly on that".

The model we are building here try to combine all those insights in a unified analysis of the speed-accuracy trade off and the competing forces that determine its direction.

1.2 Related literature

The paper contributes to three streams of the literature. First of all, we contribute to the literature on pre-emption games and R&D races (Hopenhayn and Squintani 2011 & 2016, Bobtcheff et al. 2015) adding reputational concerns. It is worth noting that Bobtcheff et al. (2015) have a similar "separating" result for different types of firm, but in a set up without reputation. Here we point out that reputation, combined with actions partially revealing the type of the opponent, can be a different force leading to separating strategies in pre-emption games. Secondly, we contribute to the literature on strategic information release (Guttman 2010, Guttman et al. 2013, Gratton et al. 2017) endogenizing the information acquisition choice and adding reputational concerns. With respect to Gratton et al. (2017), we add pre-emption concerns.

Thirdly, we contribute to the literature on media competition and quality of news (Sobbrio 2013, Prat and Strömberg 2013, Strömberg 2015, Allcott and Gentzkow 2017, Barrera et al. 2017, Andreottola and De Moragas 2017), highlighting the speed-accuracy trade off and the signalling value of investigative journalism.

Other related papers are Chen and Suen (2016), Gentzkow and Shapiro (2006) and Aghamolla (2016). Chen and Suen (2016) looks at media competition and endogenous attention allocation. They do not have the speed-accuracy trade off, but they show that increased competition reduces outlets' investment in reporting quality, but it increases the overall influence of the media industry. Their model is not a reputation one and the basic trade-offs they explore are different. Gentzkow and Shapiro (2006) is a model of media bias and reputation building, showing that

competition reduces the bias. The model explores a completely different trade off (looking at the content of the reporting directly, rather than at the timing) and also the "positive" effect of reputation comes from a different channel, i.e. the fact that - with competition - the reader is more and more likely to eventually learn the true state. This does not apply to our model, as the reader will, eventually, learn the state for sure, and competition does not affect the revelation incentives in this way. Aghamolla (2016) looks at a model of herding between financial analysts with endogenous information acquisition. This paper is different because reputational concerns are explicitly modelled (the posterior enters directly in the payoff function), there is a signalling value of timing and explicit pre-emption concerns. Also, in general, this is not a model of herding.

2 The Model

2.1 Players, types, actions and payoffs

The basic model is a two periods one, with $t = 1, 2$. There are three players: two media outlets i, j (but we will consider the monopoly case as well) and one representative reader.
The state of the world θ is binary and unknown to the players. Formally, $\theta \in \{A, B\}$ with common prior $Pr(\theta = A) = \frac{1}{2}$.
Outlets can be of two types, high and low quality, depending on how efficient they are in investigative journalism, and this is private information of each individual outlet. Formally, the type of outlet i is $\omega^i \in \{L, H\}$, with a common prior $Pr(\omega^i = H) = q = \frac{1}{2}$.
Each outlet privately observes one signal s_t^i at the beginning of every period. We assume that s_1^i is free and iid conditional on the state. Its precision is $Pr(s_1 = \theta|\theta) = \phi > \frac{1}{2}$. s_2^i comes at a type-specific cost and, if acquired, it is perfectly revealing of the true state of the world.
In terms of actions, in period 1 outlets can choose to acquiring a new signal ($a_1^i \alpha$) that arrives in period 2 at a cost c_ω, refraining from publishing until period 2 ($a_1^i = np$), that happens at no cost, or publishing immediately endorsing one of the states $a_1^i \in \{p_A, p_B\}$). The action space of period 2 is the same, with the exception of np not being available any more.
In terms of payoffs, we disregard the reader as she is non strategic and the content comes for free. Outlets' payoffs are composed of three elements:

1. A scoop value π to the first outlet publishing the story[5], that can be interpreted as readership from costumers willing to try the outlet before the reputation building;

[5]This captures the pre-emptive nature of the media market, highlighted in many different papers, e.g. Besley and Prat 2006.

2. A reputation value of γ^i, given by the reader's posterior on the quality of outlet i calculated after the revelation of the true state. In particular, $\gamma^i = Pr(\omega^i = H|\bar{a}^i, \bar{a}^j, \theta)$. In terms of interpretation, this captures the idea that future readership depends on reputation, based on the truthfulness of what previously published. $\bar{a}^i$ represents what the reader understands from the pre-emption game between the outlets, and it will be explained in greater details below.

3. A cost c_ω, paid in period 1 if $a_1^i = \alpha$. We assume $c_L = \infty$, $c_H = c \geq 0$. c is common knowledge among the outlets. From the point of view of the reader, it is drawn from F_c.

2.2 Timing

The timing is as follows:

1. At $t = 1$ each outlet privately observes s_1^i;

2. Outlets simultaneously decide a_1^i;

3. If both outlets publish, the game ends and the reader observes the content of their publications and the fact that they published simultaneously. Otherwise, the game goes to period 2;

4. At $t = 2$, s_2^i is realized for every outlet that choose $a_1^i = \alpha$;

5. All the outlets that have not published before choose a_2^i;

6. At the end of the pre-emption game (whenever it is), the voter observes $\bar{a}^i, \bar{a}^j$ and θ and updates her beliefs on the type of each outlet;

Basically, the model consists in a pre-emption game played between the two outlets, whose outcome is only partially observed by the reader. In particular, the reader does not observe t directly, in order to capture the idea that she cannot properly observe the amount of research journalism contained in an article from the timing of its publication. However, the reader is able to see whether both outlets publish simultaneously or one publishes after the other. In other words, if, at the end of the pre-emption game, only one outlet has published something, the reader observes the content of that publication and the fact that the other outlet has not published, but she cannot observe when the first outlet has published. If both outlets publish at the same period, the reader cannot distinguish the period where this happens. Finally, if outlets publish at different periods, the reader knows that one publication arrived after the other.
Formally, the reader observes $\bar{a}^i, \bar{a}^j$ where for example $\bar{a}^i = p_A, \bar{a}^j = p_B$ in case of simultaneous

publication, while $\bar{a}^i = (p_A, 1), \bar{a}^j = (p_B, 2)$ if player i chooses p_A in period 1 and player j chooses p_B in period 2.

2.3 Solution concept and equilibria selection

In this preliminary version of the model, the solution concept we use is the Perfect Bayesian Nash Equilibrium in pure strategies. As even the simple model is quite a complex game, we focus on specific equilibria. In particular, we look at equilibria where publication in period 2 is always optimal for any signal received up to that point. Moreover, we focus on equilibria where outlets optimally follow the signal they receive (i.e. they endorse the state that is more likely to be the true one given their signal). Finally, we define an outlet performing *investigative journalism* as an outlet that, after receiving the rumour about a story, decides to wait for the second signal.

In this preliminary version of the paper the focus will be on pure strategy "better right than first" equilibria, where only the high type engages in investigative journalism while the low type chooses a "speed driven strategy". Formally, if $\omega^i = H$ and $\omega^j = L$, on path actions are $a_1^i = \alpha$, $a_2^i = p = s_2^i$, $a_1^j = p = s_1^j$. In particular, we age going to compare conditions for the existence of those equilibria in monopoly and duopoly.

2.4 Discussion

Before proceeding to the analysis, it is worth discussing in details the assumptions we are making.

The fact that the reader observes just $\bar{a}^i, \bar{a}^j$, but neither t nor the number of informative signals received (or their content) captures the idea that the reader whether a story is published by i or not, and whether it is true or false, but not the actual amount of research made. In fact, this is hardly observable from outside the newsroom. Of course it maps in a probabilistic way into the accuracy of a story, which is something that can be checked way more easily. Note that we could make the state revelation probabilistic as well.

The important assumption, here, is the fact that the action of player i can, potentially, convey some information about the type of player j. For example, in the "better right than first" equilibrium we are looking at, a wrong endorsement from player j simultaneous to the correct publication of player i reveals that i is a low type as well, or the fact that j publishes before i reveals that i is a high type.

The fact that publication implies endorsing one of the states makes the analysis more tractable, as well as the assumption on the increasing precision of signals. Note that we plan to

allow for some noise in the arrival of signals (i.e. making it probabilistic) and we plan to relax the assumption that the second signal is fully revealing. Finally, $q = \frac{1}{2}$ is just for analytical convenience,

3 Results

3.1 General points

The problem is quite a complex one, potentially with many cases to be considered. However, there are are few simplifying results that we summarize in a series of lemmas. All the proofs are in Appendix A.

Lemma 1 *Conditional on receiving at least one informative signal, the most likely state is the one stated by the signal.*

Lemma 1 is just a standard result in this type of environment and follows from the flat priors on the state. The consequence is that, if the outlet is interested in matching the publication with the state, then it is optimal to follow either the only informative signal or the second one, if there are two informative signals and they are conflicting. A consequence of this is that we do not need to care too much about the actual realization of signals. As long as there is a gain in matching the state, each outlet will just follow the most informative one received. What matters is just whether, in case of more than one informative signal, the two are conflicting or not.

Corollary 1 *As long as there is a gain in matching the state, each outlet follows the most precise informative signal received.*

Moving to the signal structure, there are some useful results following from that structure and the flat priors over the state. In particular:

Lemma 2 *If each outlet follows the most informative signal, the following results hold:*

1. *The probability of matching the state after having received one informative signal is ϕ;*
2. *Irrespective of the signals obtained by player i, from its point of view the expected probability of player j matching the state, conditional on j receiving one informative signal, is ϕ;*

Lemma 2 will be helpful in writing the incentive compatibility conditions on the players, where each of them has to take into account the (probabilistic) number of signals received by

the opponent and the probability of matching the state.

It is useful to define more precisely some of the strategies we will focus our attention on.

Definition 1 *A strategy implies immediate publication if* $a_1^i = p_{\tilde{\theta}}^i$*, where* $\tilde{\theta}$ *is a guess about the true state.*

Definition 2 *A strategy implies investigative journalism if* $a_1^i = \alpha$*.*

Note that, for now, we are focusing on equilibria where publication in period 2 is always optimal, i.e. where $a_2^i = p_{\tilde{\theta}}\ \forall i$ if $a_1^i \neq p_{\tilde{\theta}}$. This is just for simplicity, as it allows us to focus on the period 1 investigative journalism decision, shutting down other issues. A more complete analysis of the game will, of course, consider all the other cases as well.

Finally, note that the reader knows that each outlet is simply following the most precise informative signal received, when publishing. Taking this into account, and since the state of the world is revealed, the reader updates her beliefs on the quality of each outlet using information on whether what each outlet published was right or wrong and, when possible, on the sequence of the publication. Formally, define $\gamma^i_{x^i,x^j,\zeta}$, with $x^i \in \{R, W, \emptyset\} X \{1, 2, \emptyset\}\ \forall i$ the reader's updated beliefs on outlet i after observing that outlet i and j got the story right, wrong or published no story and outlet i published before, after, at the same time of outlet j, or alone. For example, $\gamma^i_{(R,2),(W,1)}$ is the updated probability of outlet i being a high quality one when outlet i endorses the right state of the world, outlet j endorses the wrong one and outlet i publishes after outlet j.

We are now ready to move to the analysis of the equilibria arising in different market configurations and with different information sets. It has to be noted that, in general, there are two competing forces at play: on the one hand, it is a pre-emption game (in duopoly of course): being the first one publishing the news is important, and as a consequence the tendency toward "speed driven journalism" will always be there. On the other hand, however, there are reputational concerns: it is not clear to the reader, ex ante, which outlet is good and which outlet is bad, and of course matching the state (i.e. something more likely to happen with investigative journalism) may help this respect.

3.2 Monopoly

Let us start with the simplest case: there is only one media outlet and its type is known to the reader.

Proposition 1 *If there is one media outlet and* ω *is known to the reader, then the outlet will never engage in investigative journalism.*

In this case, none of the aforementioned incentives is at play. There is obviously no pre-emption risk and there is nothing to do in terms of reputation. The outlet will get $\pi + 1[\omega = H]$ in any case, hence it is pointless to pay any cost.

The case of monopoly with unknown type is more interesting. Proposition 2 summarizes the main results, reminding that.

Proposition 2 *If there is one media outlet and ω is not known to the reader, the separating equilibrium of interest exists iff*

- $c \leq (1-\phi)(\gamma_R - \gamma_W) := c_M$;
- $\gamma_\emptyset \leq \pi + \phi\gamma_R + (1-\phi)\gamma_L$

Intuitively, pre-emption risk is absent in this case (in fact, π does not play any role, on path, in those conditions). The low quality outlet will never do investigative journalism, hence the only relevant choice is for the high quality one. In this case, it must be that the additional cost c of choosing $a_1^i = \alpha$ is more than compensated by the expected reputational gains from endorsing the correct state.
This is the first condition of proposition 1, noticing that in the equilibrium where only the high type performs investigative journalism it must be that $\gamma_R = \frac{1}{1+\phi}$ and $\gamma_W = 0$, by Bayes rule. However, $\gamma_\emptyset$ (i.e. the posterior after observing no publication) is off path. The second condition just states that $\gamma_\emptyset$ cannot be too big, so that publication is incentive compatible for every type even with as little information as possible.

3.3 Duopoly

The main effect of competition is the introduction of pre-emption risk. When pre-emption is relevant and reputation building is not, then the equilibrium where the high quality outlet performs investigative journalism does not exists.

Proposition 3 *If there are two media outlets and ω is known to the reader, then none of them will engage in investigative journalism.*

Intuitively, there is nothing to gain from investigative journalism, as ω is known. But there is pre-emption risk, so none of the outlets has any incentives to wait before publishing.

The case of competition plus hidden types is of course the most interesting one. In this case, both incentives (pre-emption concern and reputation building) are simultaneously relevant and interact with each other.

Proposition 4 *If there are two media outlet and ω is not known to the reader, the separating equilibrium of interest exists iff*

- $c \leq \frac{1}{2}(1+\gamma_{R,R}(1-\phi^2)) - \frac{1}{2}\pi = c_D$;
- $\phi(1+\gamma_{R,R}(1-\phi)) \leq \pi \leq (1+\gamma_{R,R}(1-\phi^2))$

In order to understand proposition 3, it is important to highlight that, in term of beliefs, $\gamma_{R,R} = \frac{1}{1+\phi^2}$ and $\gamma_{W,.} = \gamma_{.,W} = \gamma_{.,R2} = 0$ by Bayes rule. Intuitively, if both outlets get the state right, they may be both high types or both "lucky" low types. However, if they publish simultaneously and one of them is wrong, then they must be both low types. In general, the point is that the reader has an extra piece of information, in this case, as she can use the result of outlet j in order to learn something about outlet i. On the other hand, there are of course some off path beliefs, and we need them to be sufficiently small. Note that, if D1 is applied, then $\gamma_{W2,.} = \gamma_{\emptyset,.} = 0$, hence our equilibrium is robust to that refinement.
Looking now at the two conditions of proposition 4, the first one is the usual threshold on the cost. It must be not too expensive to acquire the second signal. As expected, c_D is decreasing in π, which plays a relevant role now. If pre-emption is very salient (i.e. π is high), then separation happens for a smaller range of c. On the other hand, the positive side of the condition is given by the expected reputational gains of matching the correct state (and publishing second). Finally, the right hand side of the restriction on π is there to ensure that c_D is positive (separation does not exists otherwise), while the LHS says that the scoop value has to be sufficiently big to make publication in period 1 incentive compatible for a low quality outlet, vis-a-vis just waiting without acquiring a new signal.

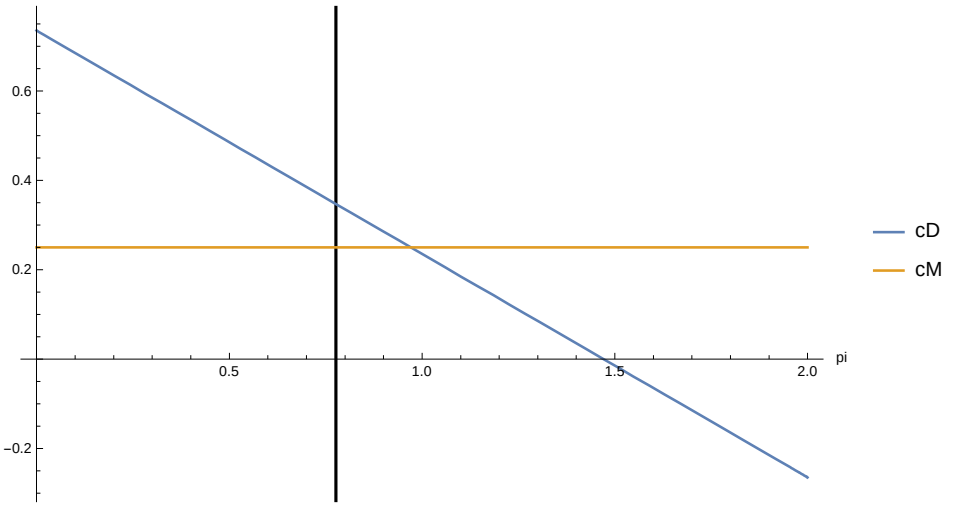
3.4 Monopoly vs duopoly

The comparison between monopoly and duopoly, when reputation building is relevant, provides some interesting insights. First of all, we can show that the reputational gains from separation are always higher in duopoly.

Lemma 3 *The reputational gains from separation are always higher in duopoly than in monopoly.*

The reason lies in the availability of additional information: the comparison between the endorsements of player i and j, together with the fact that, now, player i can publish after

Figure 1: c_M (orange) and c_D (blue) as a function of π assuming $\phi = 0.6$. The black line is $\pi = \phi(1 + \gamma_{R,R}(1 - \phi))$.



player j, help the high quality outlet in signalling its type through separation, making it more willing to pay the cost. In this respect, it is worth noticing that $1 > \gamma_{R,R} > \gamma_R$ and hence, by waiting, the high quality outlet will get either something bigger than γ_R or 1.
This information availability effect, however, is counterbalanced by the pre-emption concern, that makes c_D decreasing in π. Combining the two conditions, and taking into account the fact that, in duopoly, a separating equilibrium exists only for sufficiently high π, we derive the following result.

Proposition 5 *There exists a nonempty interval of π values where the separating equilibrium of interest can exist in both market configurations and $c_D > c_M$.*

Basically, what proposition 5 says is that there is a nonempty set of parameters where investigative journalism is possible in duopoly but not in monopoly.
A good way to illustrate proposition 5 is figure 1, where the blue line is c_D and the orange line is c_M. Separation happens when c (on the vertical axis) is below the orange (in monopoly) or the blue (in duopoly) line, and we have π on the horizontal axis. Separation in duopoly requires π to be sufficiently big (above the black line), hence the range of parameters where separation happens in monopoly but not in duopoly is the triangle in the middle of the figure.

Intuitively, in monopoly, reputational gains are given by the increased probability of getting the state right. In duopoly, the reader can use one extra piece of information: the action of the other outlet. Hence, competition induces a trade off between those two forces pushing in opposite direction. Importantly, this trade off is not obvious: the main point of proposition 5 is precisely to point out that, differently from the wisdom of the crowd in media studies literature,

competition does not necessarily lead to a faster release of less accurate information.

3.5 Reader's welfare

Proposition 5 has interesting consequences in terms of welfare of the reader. In order to be able to study that, however, we need some additional assumptions. In particular, let us assume that:

1. The reader has to take an action (e.g. vote) $\beta \in \{A, B\}$ after the pre-emption game but before the revelation of the state;
2. The reader wants to match the state. Formally, if $\beta = \theta$, $U_R = 1$. $U_R = 0$ otherwise;
3. There are two media outlets and the reader reads one of them;
4. Whenever the "better right than first" equilibrium is sustainable, it will be played by the outlets. Otherwise, a "speed driven journalism" equilibrium[6] where no outlet performs investigative journalism is played;
5. $\pi \geq \phi \left(1 + \frac{(1-\phi)}{1+\phi^2}\right)$, so the separating equilibrium in duopoly exists, for some parameters;

If those assumptions are verified, the effect of more precise rumours on the ex ante reader's welfare is non monotonic, as established by proposition 6.

Proposition 6 *If 1-5 are verified, the effect of ϕ on the reader's ex ante welfare is non monotonic.*

Intuitively, from the point of view of the reader her own ex ante welfare is defined by W, where

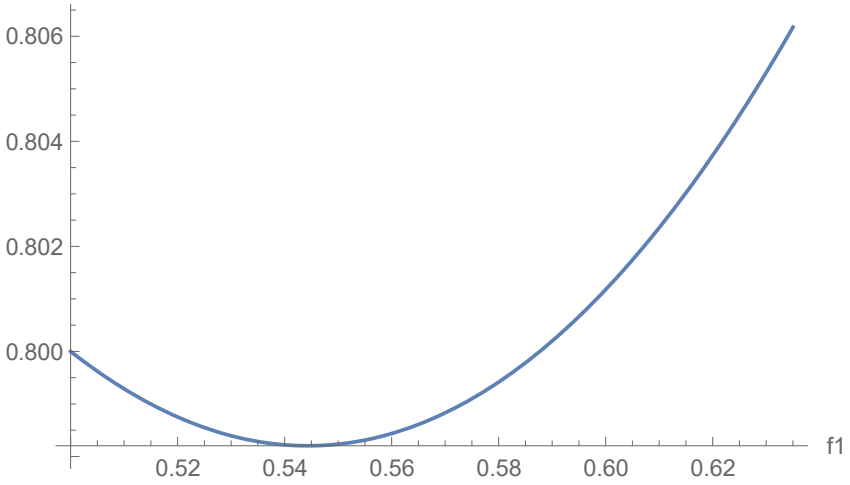
$$W = \left(\frac{1}{2}\right)^2 \phi + \left(1 - \left(\frac{1}{2}\right)^2\right) [F_c(c_D) + (1 - F_c(c_D))\phi]$$

If both outlets are of low quality, then each of them will be precise with probability ϕ. As acting according to a low quality outlet endorsement is still better than sticking to the prior, the reader will follow the recommendation and will get a utility of 1 with probability ϕ. If at least one of the outlet is of high quality, then there will be a "better right than first equilibrium" if $c < c_D$, i.e. with probability $F_c(c_D)$. However, c_D is decreasing in ϕ, as a more precise rumour implies that there is a smaller reputational gain from the perfect signal that comes with separation.[7]

[6] Note that this equilibrium always exists, as long as the off-path reputation of publishing second is not too high.

[7] Note that the relevant lower bound on π necessary for the equilibrium, i.e. $\phi \left(1 + \frac{1-\phi}{1+\phi^2}\right)$ is increasing in π, and this makes the

Figure 2: W as a function of ϕ, assuming $\pi = 0.8$ and $F_c \sim U[0, 0.5]$.



In terms of welfare, better rumours are good news for the reader, if separation does not happen. However, they also discourage separation, hence the non monotonicity. Figure 2 represents an example of the aforementioned non monotonicity assuming a uniform distribution for F_c.

4 Conclusion

This model shows that conventional wisdom on the effect of competition and technological innovation on the media market needs to be taken *"cum grano salis"*. In particular, we prove that competition in itself may make easier, for high quality outlets, to separate their strategy from low quality ones, engaging in investigative journalism more often than in monopoly. Moreover, an improvement in signal quality may be detrimental for readers' welfare, if it reduces the incentives to separate, in equilibrium, and increases the range of parameters where the "speed-driven journalism" equilibrium is played.

We plan to extend the current analysis in several directions. First of all, we can look at more general environments with different informational assumptions (e.g. heterogeneous prior) and more than two firms. Moreover, we can look at competition from platforms of different types (more or less concerned with reputation, more or less fast in publishing news etc). Finally, we can introduce more meaningful reader, and study how those technological changes impact on their choices and welfare.

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Appendix A Proofs

Proof of Lemma 1.

Suppose that one informative signal has been received. Without loss of generality, suppose that $s_t^i = A$. It is easy to see that $Pr(\theta = A|s_t^i = A) > Pr(\theta = B|s_t^i = A$. This implies

$$\frac{\phi\frac{1}{2}}{\phi\frac{1}{2} + (1-\phi)\frac{1}{2}} > \frac{(1-\phi)\frac{1}{2}}{\phi\frac{1}{2} + (1-\phi)\frac{1}{2}}$$

which is true because $\phi > \frac{1}{2}$.

■

Proof of Lemma 2.

First part.
Wlog suppose $s_1^i = A$ is the sole informative signal received by player i. Then, if i chooses to publish, it will endorse state A. Also, by Bayes rule,

$$Pr(\theta = A|s_t^i = A) = \frac{\phi\frac{1}{2}}{\phi\frac{1}{2} + (1-\phi)\frac{1}{2}} = \phi$$

as claimed.

Second part.

$$Pr(s_t^j = A|s^i)Pr(\theta = A|s_t^j = A, s^i) + Pr(s_t^j = B|s^i)Pr(\theta = B|s_t^j = B, s^i) \tag{A.1}$$

However, note that, for a generic s_t^j, by Bayes rule,

$$Pr(s_t^j|s^i) = \frac{Pr(s_t^j, s^i)}{Pr(s^i)}$$

and

$$Pr(\theta = s_t^j|s_t^j, s^i) = \frac{Pr(s_t^j, s^i|\theta = s_t^j)Pr(\theta = s_t^j)}{Pr(s_t^j, s^i)}$$

As a consequence, (A.1) can be simplified to

$$\frac{Pr(s_t^j = A, s^i|\theta = A)Pr(\theta = A)}{Pr(s^i)} + \frac{Pr(s_t^j = B, s^i|\theta = B)Pr(\theta = B)}{Pr(s^i)} \tag{A.2}$$

However, since signals are independent conditional on the state,

$$Pr(s_t^j, s^i|\theta = s_t^j) = Pr(s_t^j|\theta = s_t^j)Pr(s^i|\theta = s_t^j)$$

Moreover, $Pr(s_t^j|\theta = s_t^j) = \phi$. Hence, (A.2) becomes

$$\phi\frac{Pr(s^i|\theta = A)Pr(\theta = A) + Pr(s^i|\theta = B)Pr(\theta = B)}{Pr(s^i)} = \phi \tag{A.3}$$

as claimed.

■

Proof of Proposition 1.

Every type of outlet gets $\pi + 1[\omega = H]$ so it is pointless to pay any cost for investigative journalism.

■

Proof of Proposition 2.

■

Proof of Proposition 3.

If ω is known, then by publishing in period 1 each type of outlet receives a payoff of $\pi(1-\sigma)+\frac{\pi}{2}\sigma+1[\omega=H]$, where σ is the probability that the competitor publishes in period 1 as well. Paying the cost and not publishing are of course dominated strategies. By waiting and publishing in period 2 an outlet gets payoffs of $(1-\sigma)\frac{\pi}{2}+1[\omega=H]$, that is dominated by immediate publication. Hence, in the unique equilibrium, $\sigma=1$. ■

Proof of Proposition 4.

■

Proof of Lemma 3.

Abstracting form c and π, and assuming that the required separating equilibria exist, then the reputational gains in monopoly are given by $(1-\phi)\gamma_R$ and in duopoly by $\frac{1}{2}(1+\gamma_{R,R}(1-\phi^2))$ substituting the equilibrium values for γ_R and $\gamma_{R,R}$ and comparing the two we obtain that the latter is bigger than the former when $2\geq\phi-\phi^2$, that is always true for $\phi\in\left(\frac{1}{2},1\right)$.

■

Proof of Proposition 5.

As c_D is decreasing in π while c_M is constant, it is sufficient to show that, at the value of π where the separating equilibrium starts to be incentive compatible, $c_D>c_M$. Substituting $\pi=\phi(1+\gamma_{R,R}(1-\pi))$ in **??**, we obtain

$$c\leq\frac{1}{2}(1-\phi)(1+\gamma_{R,R})$$

In order to be greater than c_M, we need

$$\frac{1}{2}(1-\phi)\left(1+\frac{1}{1+\phi^2}\right)>\frac{1-\phi}{1+\phi}$$

that simplifies to $2-\phi+\phi^2>0$, that is always verified for $\phi\in\left(\frac{1}{2},1\right)$.

■

Proof of Proposition 6.

The ex ante welfare of the reader is given by

$$W=\left(\frac{1}{2}\right)^2\phi+\left(1-\left(\frac{1}{2}\right)^2\right)\left[F_c(c_D)+(1-F_c(c_D))\phi\right]$$

This takes into account the fact that two low type outlets will always publish immediately, hence by reading one of them the reader will be correct with probability ϕ. if at least one of the outlets is a high type (this happens with probability $1-\left(\frac{1}{2}\right)^2$) then a better right than first equilibrium may exist. By assumption 4 above, high types will separate whenever they can, hence whenever c is below c_D. This, from the point of view of the reader, happens with probability $F_c(c_D)$.
by taking the derivative of W with respect to ϕ we obtain

$$\frac{\partial W}{\partial\phi}=\left(1-\left(\frac{1}{2}\right)^2\right)\left[-F_c(c_D)+\frac{\partial F_c}{\partial c_D}\frac{\partial c_D}{\partial\phi}(1-\phi)\right]+1$$

The term in the squared parenthesis is clearly negative, hence the effect is ambiguous.
■