Essays in Political Economy

Antoni-Ítalo de Moragas Sánchez

Thesis submitted for assessment with a view to obtaining the degree of Doctor of Economics of the European University Institute

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I confirm that chapter 3 was jointly co-authored with Giovanni Andreottola and I contributed 50% of the work.

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Abstract

In the first chapter, I study the effect of disclosing the private interests of decision-makers on the quality of the decisions that are eventually taken. I focus on a delegation relationship where decision makers motivated by career concerns try to build up their own reputation. When private interests of decision makers are not disclosed, taking the correct decision is the only way to increase reputation and the higher the career concerns the more likely it is that correct decisions are taken. When private interests are disclosed, decisions not aligned with these private interests may also increase reputation. I find that, contrary to the common wisdom, disclosure of private interests can induce worse decisions. This happens when the salience of career concerns is high enough and decision makers are poorly informed.

In the second chapter, I analyze how voters optimally aggregate and use information provided by informed biased experts. I find that, when citizens do not observe the individual bias of each expert and their biases are sufficiently correlated, the relationship between the share of experts endorsing an alternative and the share of citizens voting for it is non-monotonic. The explanation is that consensus among experts can be reached either because all experts share the same information or because experts ignore the information they have and provide their advice according to their own biases.

In the third and last chapter, co-authored with Giovanni Andreottola, we present a model of a media market in which a set of news outlets compete to break a news. In our model, each media receives some information on whether a politician in office is corrupt. Media outlets can decide whether to break the story immediately or wait and fact-check, taking into account that if another media breaks the news, the profit opportunity disappears. We show that as the number of competitors increases, each outlet becomes more likely to break the news without fact-checking. Therefore, as the number of media increases, the incumbent politician is more likely to be accused of corruption by the media: this makes the re-election of incumbents more difficult and increases political turnover. In particular, we show that if voters consult with higher priority the media outlets that report about a scandal, increasing the number of competitors decreases the probability of having an honest politician in office.
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Chapter 1
Disclosing Decision Makers
Private Interests

1.1 Introduction

“There is strong shadow where there is much light”
—Johann Wolfgang von Goethe, Götz von Berlichingen, Act I (1773)

When a delegation relationship risks having conflict of interests, disclosure of the conflict of interests is one of the remedies prescribed most often. Advocates of disclosure claim (Stark, 2003) that, by being aware of potential private interests, the public can form its own judgement on whether decision makers put their own personal benefits ahead of their duties. Such knowledge, they claim, will force decision makers to behave according to the public interest instead of their own. Although disclosure, like other accountability practices, may not solve the conflict of interest, it is broadly perceived as a good solution without the negative effects of other remedies like recusal (excluding the interested decision maker from the decision) or divestiture (removing the private interest from the decision maker). This belief explains the popularity of disclosure in different areas.
For example, in politics, the growing distrust in political power has generated a great demand for more financial and personal information about public officials (Cain 2014). Such demand has not always translated into real changes in practice and the level of transparency and public available information still differs within countries and branches of the government. For example, Djankov et al. (2010) analyzed the rules and practice of disclosure of MPs in 175 countries and found that despite 109 of the 175 countries of their sample had disclosure laws, only 63 of them granted public access to the disclosed information. International organizations such as Transparency International, the World Bank or the OECD stand for extending disclosure and public availability to more countries.

In academic research, the ties between academic scientists and private industry have also come under scrutiny. Many universities and peer-reviewed journals have recently adopted disclosure policies that require their employees and authors to declare their financial interests. These policies are taken very seriously and might have severe consequences. The disclosure policy of the European University Institute (EUI) was behind the resignation of the its president Josep Borrell in 2011. His failure to declare his revenues of 300,000 euros a year as a board member of the Spanish energy company Abengoa made his position as president of the EUI unsustainable.

Conflicts of interest are also common in medical practice. Despite the Hippocratic oath by which physicians promise to always act in the patient’s best interest, doctors have long faced the accusation that the gifts they receive from pharmaceutical companies influence their drugs’ prescription practices. This accusation is based on reasonable grounds. DeJong et al. (2016) found that doctors who had enjoyed industry-sponsored meals had higher rates of
prescriptions of the company’s brand-name medication. To address these concerns, the American Senate introduced the Physician Payments Sunshine Act (PPSA) in 2010, requiring medical product manufacturers to disclose any payment made to physicians.

Despite the popularity of disclosure rules to solve conflict of interests, their effects have rarely been studied. In this paper I examine the effect of disclosing the agents’ private interests on the quality of the decisions that are eventually taken. The main contribution of this paper is to identify under which conditions decision makers take more correct decisions when their private interests are revealed.

To do so, I examine a model in which an agent receives a private signal about the state of the world and has to take a decision. The correctness of this decision depends on such state of the world. All agents have private interests that can affect their preferred decision but not all of them care the same way about them. Specifically, there are two types of agents: good and bad. Good agents prefer taking the correct decision independently of their private interests. Bad agents preferred decision depends on their private interests independently of the correctness of the decision. At the same time, agents have career concerns and they want to convince an external evaluator that they are good types because this can create a reputation that can lead to higher wages, promotions or reappointments in the future. The assessment of the evaluator depends on the information he has access to. Without disclosure of the agent’s private interests, the evaluator can only observe the state of the world and the decision taken. With disclosure, in addition to this, the evaluator also observes the private interest of the agent.

The effect of disclosure is ambiguous because it modifies the reputational incen-
tives of bad types but it also distorts the incentives of the good ones. When their private interests are not disclosed, taking correct decisions is the only way for agents to increase their reputation. With disclosure, taking decisions against the agent’s private interests also increases reputation. I derive the conditions for the existence of three different equilibria: an equilibrium such that disclosure has no effect, an equilibrium such that disclosure leads decision makers to take correct decision more often and an equilibrium such that disclosure decreases the probability of taking correct decisions.

The existence of this last equilibrium shows that disclosure of decision makers’ private interests can lead to what Gersen and Stephenson (2014) calls over-accountability. That is, a situation where accountability decreases rather than increases an agent’s likelihood of taking correct decisions. Disclosure should therefore be used wisely. Specifically, when the agent’s career concerns are expected to be high in relation with the importance of the decision, disclosure can be negative because it induces decision makers to take decisions against their private interest independently of the signal they receive. This would be a justification for disclosing only the private interests that exceed a monetary threshold and keep less salient private interest secret.

Finally, I extend the model to a two-period political agency model to see if disclosure can help the voters to screen politicians in the second period. More precisely, I assume that after the decision is taken in period one, voters can keep the incumbent politician or replace him with another, randomly drawn, challenger. In period 2 voters prefer to have a good politician because they are not subject to reelection and the incumbent politician always take his preferred decision. I show that disclosure of the private interests not only can decrease the utility of voters in the first period but it can also decrease the probability
of selecting good politicians in period 2, which decreases voters’ utility in the second period too. The reason is that, when career concerns are high enough, good and bad types take decisions against their private interest and citizens cannot screen them.

The rest of the paper is organized as follows. In the next section, I discuss how this paper is related to the existing literature. Section 3 presents the model. The main results are in Section 4 and 5. Section 6 analyzes a political agency model, Section 7 discusses some of the assumptions of the model. I conclude in Section 8. All formal proofs can be found in the appendix.

1.2 Related Literature

This paper is linked to three different literatures. First, there is now a sizable literature on the effects of transparency of the decisions taken by careerist decision makers. From this literature, the paper most closely related to mine is the one by Fox (2007). In his political agency model, a lawmaker has to choose a policy and a representative voter is uncertain about the lawmaker’s preferences. In particular, the voter does not know whether the lawmaker is unbiased and his preferences are aligned with voters’ preferences or biased and with different preferences. When the policy choice is not observed by the voter, lawmakers choose their preferred policy. When the choice is observed, lawmakers select policies that lead the voter to believe that they are unbiased.

In Prat (2005), Visser and Swank (2007), Levy (2007), Meade and Stasavage (2008), Gersbach and Hahn (2008), Swank et al. (2008), Fox and Van Weelden (2012) and Swank and Visser (2013) decision makers are heterogeneous in the precision of their signals and they want to signal that their information is precise. On the contrary, in Stasavage (2007) and Fox (2007) decision makers differ in their preferences and they want to signal to the voters that they share their same preferences. Finally in Mattozzi and Nakaguma (2016), decision makers differ both in the precision of the information and on their preferences. In all these models, transparency can be negative because if agents care about their reputation and their action is observed, they may choose the action that makes them appear smarter which is not always the best action.
The main difference with Fox (2007) is the information that is disclosed. In my model, the information disclosed is not the action taken by the decision maker, but the direction of his bias which, in Fox (2007) is always disclosed. This difference sheds light on the mechanism behind Fox (2007) finding. In particular, I show that the negative effects of transparency in Fox (2007) depend critically on the disclosure of the private interest. In particular, I show that when private interest is known, transparency of the action can decrease the probability of a correct decision, a finding that is in line with Fox (2007) and Stasavage (2007). However, when the private interest is unknown, transparency of the action can only lead to more correct decisions.

Second, my model also relates to the literature on the disclosure of biases in expert advice settings. In particular, Li and Madarász (2008) extend the cheap-talk model of Crawford and Sobel (1982) and study how the results change when the receiver is informed about the bias of the sender. In their model, disclosure can hurt the receiver because it can reduce the quality of the communication. The intuition is that when receiver does not know the direction of the bias of the sender, he does not know whether the sender had incentives to overstate or to understate the state of the world and, if his preferences are concave, it is optimal for the receiver to follow the advice of the sender. This induces the sender to communicate always his preferred decision and, if the preferences of the sender and the receiver are sufficiently close, the receiver will benefit from this communication. On the contrary, when the receiver knows the bias of the sender, the sender has to pool messages which reduces communication and hurts the sender and, in some circumstances, also the receiver.

The difference between this paper and Li and Madarász (2008) is that in the model presented here, the biased agent takes a pay-off relevant action (delegation) and in Li and Madarász (2008), the agent’s utility depends exclusively on how the receiver interprets his message (advice). The logic of the bad equilibrium is therefore qualitatively different and, more important, the situations that can be captured by both models differ too. For instance, expert advice models are not adequate to capture the effect of disclosure of private interests in politics because politicians do not advise but take decisions on our behalf. Given the attention that disclosure in politics has attracted, we devote an extension of the model to carefully characterize the effects of disclosure in a simple political agency model.

Finally, the paper is also related to the pandering literature that studies under which conditions agent’s career concerns leads to worse decisions. I show that the bad effects of career concerns are only present when the private interests of the agent are observed by the evaluator. When they are not, higher career concerns always increase the probability of taking correct decisions.

1.3 The Model

There is an agent $D$ who has to take a decision $d$. For simplicity we will assume that there are only two possible decisions $d \in \{a, b\}$. In politics, this can represent a politician choosing between contracting firm $a$ or firm $b$ for a public project or, in medical practice it can be a doctor prescribing a drug from two different pharmaceutical companies. Before the decision is taken, the agent observes a private signal $s \in \{a, b\}$ about the state of the world.

---

3This is shown in Morris (2001), Ely and Välimäki (2003), Maskin and Tirole (2004), Ely et al. (2008), Acemoglu et al. (2013) and Che et al. (2013).

4In section 6 we will study what happens when the number of actions is $n > 2.$
$w \in \{a, b\}$. The state of the world is unknown but it is common knowledge that both states can occur with equal probability. The signal is only partially informative of the realized state of the world. In particular, we will assume that $q = Pr(s = w|w) > \frac{1}{2}$ and we will refer to $q$ as the precision of the signal.

The correctness of the decision always depends on the state of the world. Specifically, a decision is correct when it matches the state of the world ($d = w$).

The agent always has a private interests $\beta \in \{a, b\}$ towards one of the alternatives. You can think that when $D$ is linked with firm $\beta$ and, consequently, he can benefit from contracting it. It is common knowledge that both private interests are equally likely and uncorrelated with the state of the world $w$.

Even if all decision makers have some private interest, not all of them care the same way about it. In particular we will assume that a fraction $\mu \in (0, 1)$ of decision makers care about taking correct decisions regardless of their private interests and the remaining $1 - \mu$ care about taking the decision that coincides with their private interest regardless of the state of the world.\footnote{We could relax the assumption such that both types care about taking the decisions that coincide with their private interest but they differ in the intensity of the preferences.}

We will refer to the former as good decision makers ($\theta = 1$) and to the latter as bad decision makers ($\theta = 0$).\footnote{Notice that the type of the decision maker is defined by the couple $(\beta, \theta)$, however for exposition convenience we will use exclusively $\theta$ as a type.}

In addition to the decision maker $D$, there is an evaluator $E$. As in other career concerns models\footnote{See \cite{Levy2004}, \cite{Levy2007} or \cite{MattozziNakamura2016}.}, the evaluator does not have any utility function and his task is simply to update his beliefs about the type of the decision maker rationally (i.e. using Bayes rule whenever possible). If $E$ believes that $D$ is a good decision maker, that is a decision maker that cares about taking correct decisions, $D$ can be rewarded. In politics we can think about $E$ as the electorate, in medical care we can interpret him as a patient that can choose
to stay with the same doctor or convincing his relatives to consult him in the future. We will refer to these beliefs as the reputation $R$ of the decision maker.

The utility of a decision maker of type $\theta$ with private interest $\beta$, when taking a decision $D$ in a state of the world $w$ is given by:

$$U_{\theta}(\beta, w, d) = \theta 1_{d=w} + (1 - \theta) 1_{d=\beta} + \phi R$$

(1.1)

where $\phi \in \mathbb{R}_+$ measures the importance of reputation $R$.

We will study two different institutional settings: one with disclosure of the private interest and the other without. The only difference between these institutional settings is precisely the information available to the evaluator when he updates his beliefs about the type of the decision maker. In particular, with opacity, the evaluator only observes the decision taken and the state of the world. Thus, his beliefs are $R(w,d) = E[\theta|w,d]$ . With disclosure, in addition to this, the evaluator also observes the private interest of the decision maker and $R(w,\beta, d) = E[\theta|w,\beta,d]$.

The strategy of $D$ is to choose $d$ conditional on his type $\theta$, his private interest $\beta$ and the signal $s$, thus it is a mapping $\alpha_{\theta}(\beta,s) \rightarrow \{a,b\}$. The following pure strategies will be useful to characterize the equilibria. We will say that a decision maker follows his signal if $\alpha_{\theta}(\beta,s) = s$ and he contradicts his signal if $\alpha_{\theta}(\beta,s) \neq s$. Analogously, a decision maker follows his private interest if $\alpha_{\theta}(\beta,s) = \beta$ and contradicts it if $\alpha_{\theta}(\beta,s) \neq \beta$.

To summarize, the timing is as follows:

1. The state of the world $w$ and the private interest $\beta$ and the type $\theta$ of the agent are realized.

2. The agent observes the signal $s$ and takes a decision $d$. 
3. Without disclosure, the evaluator observes $d$ and $w$. With disclosure, the evaluator observes $d$, $w$ and $\beta$. The evaluator forms a posterior $R$ on the agent’s type.

4. Payoffs are realized.

We will solve the model using the concept of Perfect Bayesian Equilibrium. I will only consider equilibria such that good types play pure strategies\(^8\). Moreover, when multiple equilibria exist I will focus on equilibria that maximize the probability of taking correct decisions.

### 1.4 No Disclosure

Before analysing the behaviour of decision makers with disclosure we need to study what happens without it as a benchmark. Without disclosure, the reputation of decision makers cannot depend on their private interest $\beta$ because the evaluator does not observe it. Thus, the beliefs of the evaluator given the observation $(d, w)$ and his conjecture of $\alpha$ are:

$$R(w, d) = \frac{\mu \sum_{\beta', s'} P_r(s = s'|w) P_r(\alpha(1, \beta', s') = d)}{\mu \sum_{\beta', s'} P_r(s = s'|w) P_r(\alpha(1, \beta', s') = d) + (1 - \mu) \sum_{\beta', s'} P_r(s = s'|w) P_r(\alpha(0, \beta', s') = d)}$$

(1.2)

Now, given that both states and both private interests are equally likely and uncorrelated it is straight-forward to see that in equilibrium good types always follow the signal\(^9\).

**Proposition 1.** For all $(q, \mu)$, in equilibrium: (i) When $\phi \leq \bar{\phi}_S(q, \mu)$, good

\(^8\)This rules out equilibria that are not attractive. If good types played non-degenerate mixed strategies in equilibrium, they could get higher reputation and higher utility from any deviation if the evaluator updated his beliefs. Notice that this is not the case for bad types.

\(^9\)Clearly there are other equilibria. In these equilibria either good types always take the same decision independently of the signal and the private interest or they contradict the signal they receive. It is straight-forward to check that all these equilibria reduce the utility with respect to the equilibrium we analyse.
Decision makers follow their signal and bad decision makers follow their private interest. (ii) When $\phi > \bar{\phi}_S(q, \mu)$ good decision makers follow their signal and bad decision makers mix between following the signal and the private interest.

Without disclosure, good types follow their signal and maximize the likelihood of taking the correct decision. This happens because the reputation incentives are aligned with their preferred decision. This is not the case for bad types. When they receive a signal opposed to their private interest, bad types experience a trade-off between their reputation (following the signal) and their present utility (following the private interest). Unsurprisingly, when the career concerns are low enough, they follow their private interest but when they are higher, they mix between following the private interest and following their signal.

**Corollary 2.** When the private interests of the agent are not disclosed, the probability of a correct decision is always increasing in the career concerns of the agent.

As the previous corollary shows, higher career concerns always increase the probability of correct decisions. Given that good types always follow the signal, the results are driven by the behaviour of bad types. In particular, when bad types are mixing the probability of following the signal increases when the reputational concerns increase.\(^{10}\) The reason why higher career concerns increase the probability of correct decisions is that, without disclosure, the only way to increase reputation is by taking correct decisions. As we will see in the next section, this is not going to be the case with disclosure.

\(^{10}\) Notice, however, that no matter how much decision makers care about reputation, bad types, in equilibrium, will not perfectly mimic good types because if they did, the reputation from taking correct decisions would coincide with the reputation from taking any other decision and all career incentives would vanish.
1.5 Disclosure

Once we have analysed the behaviour of the agents without disclosure of their private interests, we can study the effect of its disclosure. When the evaluator knows the private interest $\beta$ of the agent, taking the correct decision is not the only relevant information the evaluator has in order to assess the reputation of the decision maker. In particular, the evaluator will also take into account whether the decision taken coincides with the private interest of the decision maker. The beliefs of the evaluator given the observation $(\beta, d, w)$ and his conjecture of $\alpha$ are:

\[
R(\beta, w, d) = \frac{\mu \sum_{s'} Pr(s=s'|w)Pr(\alpha(1,\beta,s')=d)}{\mu \sum_{s'} Pr(s=s'|w)Pr(\alpha(1,\beta,s')=d)+(1-\mu) \sum_{s'} Pr(s=s'|w)Pr(\alpha(0,\beta,s')=d)}
\]

(1.3)

As a first step, we will derive reputation incentives that will characterize the equilibria with disclosure of the private interest of decision makers:

**Lemma 3.** In equilibrium, $R(\beta, \beta^c, \beta) \leq R(\beta, \beta, \beta) \leq R(\beta, \beta, \beta^c) \leq R(\beta, \beta^c, \beta^c)$

With disclosure, given that the cost of contradicting the private interest is always larger for bad agents than for good ones, contradicting the private interest always signals higher reputation than following it. Moreover, conditional on contradicting or following the private interest, taking the correct decision also increases the reputation given that good types incur a cost from not taking correct decisions. Recall that, without disclosure, good agents always maximized both their reputation and their present utility by following the signal. With disclosure, this is only the case when the signal and the private interest do not coincide:

**Lemma 4.** In equilibrium, $\alpha(1, \beta, s) = s$ when $s \neq \beta$,

When good agents receive a signal different from their private interest, they
experience no trade-off because following the signal maximizes both the probability of taking their preferred decision and their reputation. Thus, when the signal does not coincide with their private interest, good agents always follow the signal. However, when a good type receives a signal that coincides with his private interest, he experiences a trade-off between his preferred decision and his reputation. In the rest of this section we will prove the conditions for the existence of three different types of equilibria. First we will study the “Nothing Changes” equilibria, that is, equilibria where good types follow the signal and bad types follow their private interest. Second we will study the the Disciplining Effect Equilibria such that good types follow their signal and bad types mix between following the signal and their private interest. Finally we will study the Pandering Equilibria such that good types contradict their private interest and ignore the signal. Let’s start analysing the “Nothing Changes” equilibria;

**Proposition 5.** There exists an equilibrium such that good agents follow their signal and bad agents follow their private interest if and only if \( \phi < \bar{\phi}_D(q, \mu) \)

When reputational incentives are low enough, reputation does not induce either good nor bad decision makers to shift from their preferred decision and, therefore, good decision makers follow the signal and bad decision makers follow the private interest. Recall that this was already the case in the equilibrium without disclosure. However, disclosure tightens the conditions for its existence:

**Corollary 6.** \( \bar{\phi}_D < \bar{\phi}_S \)

Disclosure induces larger reputational incentives to depart from the preferred decision. On the one hand, good decision makers have incentives to contradict their private interest (without disclosure they had no incentives to do it) and,
on the other hand, bad decision makers anticipate a larger drop of his reputation if they take a wrong decision aligned with their private interest. Let $\phi_1$ and $\phi_0$ be the maximum reputational concerns that make good and bad decision makers not deviate from this equilibrium (notice that $\bar{\phi}_D = \min\{\phi_0, \phi_1\}$).

When $\phi_0 < \phi_1$, bad types require a lower $\phi$ than good types to deviate from the equilibrium, that is, following the signal when it does not coincide with their private interest. When $\phi_0 > \phi_1$, good types are the ones more prone to deviate and contradict their signal when it coincides with their private interest.

**Lemma 7.** $\phi_0 < \phi_1$ if and only if $\mu > \bar{\mu}(q)$ and $\bar{\mu}(q)$ is decreasing in $q$.

The previous lemma characterizes the $(\mu, q)$ that guarantees that $\phi_0 < \phi_1$. In particular we have that $\mu$ and $q$ have to be large enough. The intuition of the result is the following. When the precision of the signal is high, good decision makers have high opportunity costs of contradicting private interest. In addition to this, high precision of the signal also induces good decision makers to take the appropriate decision with higher probability and, therefore, the reputational incentives of contradicting the private interest instead of following the signal are lower. With respect to the proportion of good decision makers,
the larger the fraction of good decision makers is, the larger is the reputation of taking the appropriate decision which again decreases the incentives of good decision makers to contradict their private interest. Once we have found the conditions such that \( \phi_0 < \phi_1 \), we can characterize the conditions for the existence of the Disciplining Effect Equilibrium:

**Proposition 8.** There exists Disciplining Effect Equilibrium such that good decision makers follow their signal and bad decision makers mix between following the signal and the private interest if and only if \( \mu \geq \bar{\mu}(q) \) and \( \phi \in [\phi_0, \phi_1] \).

The previous proposition states that when the precision of the signal is high enough and career concerns are neither too large nor too low, there exists an equilibrium such that good decision makers follow their signal and bad decision makers mix between following their signal and their private interest. Recall that, without disclosure when career concerns were high enough, there already existed an equilibrium such that bad decision makers mixed between their private interest and their signal. The next corollary shows in which equilibrium bad types follow their signal more often.

**Corollary 9.** In the Disciplining Effect Equilibrium, bad decision makers follow the signal with higher probability than without disclosure.

The previous result shows that disclosure can be effective at disciplining bad decision makers and induce them to follow their signal more often. The intuition is that when good types follow the signal, taking a decision aligned with the private interest of the decision maker that does not match the state of the world is a strong signal of being a bad type. Therefore, the incentives for following the signal are higher with this equilibrium than without disclosure. Once we have presented the Disciplining Effect Equilibrium we can present to the Pandering Equilibrium:
Proposition 10. There exists an equilibrium such that good decision makers always contradict their private interest if and only if $2q - 1 < \phi$. In particular, this equilibrium is such that: (i) If $\phi \in (2q - 1, 1]$, good decision makers contradict their private interest and bad decision makers follow it. (ii) If $\phi \in (1, \frac{1}{\mu})$, good decision makers contradict their private interest and bad decision makers mix between contradicting and following it. (iii) If $\phi \geq \frac{1}{\mu}$, good and bad decision makers contradict their private interest.

When the precision of signal received by decision makers is low with respect to their reputational concerns, it is optimal for good decision makers to contradict their private interest in equilibrium. Intuitively, contradicting the private interest always increases the reputation of a decision maker. Thus, the higher the career concerns are, the higher the benefits of contradicting the private interest. This strategy comes at the cost of taking their preferred decision less often. Notice that this cost depends on the precision of the signal. In particular, the lower the precision of the signal is, the lower the cost of contradicting the private interest and therefore, it is more profitable to contradict the private interest. Actually, when $q$ tends to $\frac{1}{2}$, this cost vanishes.

Regarding bad types, recall that when good decision makers do not follow their signal but they just contradict their private interest, they have no incentives to follow the signal but, in any case, to contradict their private interest. Of course, bad types have less incentives than good types to contradict their private interest.

By construction, the first equilibrium cannot coexist with the other two but this is not the case for the last two. The next corollary characterizes the coexistence of Disciplining Effect equilibrium and Pandering equilibrium:

Corollary 11. For any $(\mu, q)$, if a Disciplining Effect Equilibrium exists, a
Pandering Equilibrium exists too.

This result is not surprising given that the utility of a good type when following the signal is lower than the utility of a bad type when following his private interest. For bad types it is more costly to depart from their preferred decision than to good types. This would not be the case if we make different informational assumptions. For instance we could assume that decision makers observe the state of the world and the evaluator only observes a signal of it. This assumption would be beyond the scope of this models. We leave this exercise for future research.

Once we have derived all the equilibria with disclosure, we can provide the main result of the paper. In order to compare the institutional setting with disclosure of private interests and the one without, we select the equilibria that maximize the probability of correct decisions in both settings.

**Proposition 12.** (i) When \( \phi < \phi_0 \), disclosure has no effect. (ii) When \( \phi \in [\phi_0, \phi_1] \), disclosure increases the probability of a correct decision. (iii) When \( \phi > \phi_1 \), disclosure decreases the probability of a correct decision.

When career concerns are low, disclosing the private interest does not make any difference. When career concerns are intermediate and agents are sufficiently informed, the disclosure of the agent’s private interests increases the probability of taking correct decisions. In the rest of the situations, the probability of a correct decision without disclosure is at least as large as with disclosure.

### 1.6 The Political Agency model

In this section we reframe the model into a standard political agency model where the decision maker instead of caring about reputation per se, cares about reelection. In such a political agency model we can capture the sorting effect
of disclosure, that is, we can analyse if disclosure helps voters to reelect good politicians which could be another rationale for disclosure of politicians’ private interests. Notice that if decision makers did not change their strategies with disclosure, disclosure would always improve sorting because, given that the strategy of bad types depends on their private interest, knowing the private interest gives information about the type of the decision maker. The problem, however, is that disclosure changes the strategies of decision makers. Therefore the effect of disclosure on sorting is not trivial.

We will assume that there are two periods $t = 1, 2$. At period 1, there is an incumbent politician and between period 1 and 2 voters decides whether to reelect the incumbent or appoint a new politician. For simplicity we will assume that the reelection probability of the incumbent is linear in his reputation and the career concerns parameter $\phi$ now measures how much politicians value reelection.

In each period $t$, the office-holder takes a decision $d_t \in \{a, b\}$ and the state of the world ($w_1$) of the first period is not correlated with the state of the world ($w_2$) of the second one. However, if the incumbent is reelected, his type is the same. We may think that the decision to be taken in the second period is not related to the decision taken in period 1.

Notice that in period 2, the optimal strategy of a decision maker is to take his preferred decision because he is not subject to reelection and he does not have incentives to maximize his reputation. In particular, in period 2, good decision makers will take $d_2 = s_2$ and bad decision maker will take $d_2 = \beta_2$. Voters always prefer to have good politicians in the second period than in the first one.

**Lemma 13.** When the private interests are not disclosed, the probability of
having a good decision maker in the second period is: (i) constant when $\phi < \phi_S$ and (ii) decreasing in $\phi$ when $\phi \geq \phi_S$.

When the private interest of decision makers is not disclosed we have a trade-off between the disciplining effect and the sorting effect: when bad types mimic the decision taken by good types, the decision taken in the first period will benefit the voters but it will be more difficult for the voters to screen the incumbent politician in order to increase the likelihood of having a good type in the following period. This is the usual trade-off between discipline and sorting: disciplining bad types improves the decision but it makes more difficult to screen them.

**Lemma 14.** When private interests are disclosed, the probability of having a good decision maker in the second period is: (i) constant when $\phi < \phi_0$. (ii) decreasing when $\phi \in [\phi_0, \phi_1)$, (iii) increasing when $\phi \in [\phi_1, 1)$ and (iv) decreasing when $\phi \geq 1$.

With disclosure, the trade-off between the disciplining effect and the sorting effect is not present anymore when $\phi$ is large enough. The reason is that when $\phi > 1$, bad types start mimicking good types. This does not increase the probability of taking correct decisions because good types pander and contradict their private interest independently of their signal. Thus by mimicking good types, voters are less able to screen good politicians and sorting is reduced. In particular, when $\phi > \frac{1}{\mu}$, there is no sorting at all and the probability of having a good decision maker in the second period coincides with the probability of having a good decision maker in the first one.

Once we have studied the sorting effect of each informational setting we can compare both to see when disclosure increases the probability of having a good decision maker in the second period and when it decreases it.
**Proposition 15.** Disclosure of the politician’s private interest, (i) When $\phi < \phi_D$, increases the probability of having a good politician. (ii) When $\phi \in (\phi_0, \phi_1)$ decreases the probability of having a good politician. (iii) When $\phi \in (\phi_1, \phi_m)$ increases the probability of having a good politician. (iv) When $\phi > \phi_m$ decreases the probability of having a good politician.

When career concerns are low, disclosure does not change the behaviour of politicians but voters can use the information on their private interests to better screen politicians and, consequently, the effect of disclosure on voter’s utility is positive. When career concerns are intermediate, disclosure increases the probability of correct decisions in the first period but decreases the probability of having a good politician in the second one or increases the probability of having a good politician in the second period at the cost of having less correct decisions in the first one. When this happens the effect of disclosure is ambiguous. Finally, when career concerns are high enough, disclosure decreases both the probability of correct decisions in the first period and the probability of having a good politician in the second one and the effect of disclosure on voters’ utility is negative.

### 1.7 Extensions

#### 1.7.1 Multiple decisions

So far we have assumed that there were only two possible states of the world and, consequently, two only possible private interests, actions and signals. In this section I study what happens when there are $n > 2$ of them. More precisely, the space of states (and private interests) is given by $\Omega = \{w_1, \cdots, w_n\}$, all states are ex-ante equally likely $Pr(w = w_i) = \frac{1}{n}$ and, the signal is infor-

\[11\] It depends on how much voters value the second period with respect to the first one.
Figure 1.2 – Values of $q$ and $\mu$ such that a Disciplining Effect equilibrium exists. From $n = 2$ (dark) to $n = 6$ (light)

mative, that is, the precision of the signal is such that $q = Pr(s = w|w) > \frac{1}{n}$.

The first consequence of expanding the space of the states is that it creates higher incentives to follow the signal. From the perspective of good agents, contradicting the signal is more costly because the probability of taking their preferred decision when doing so is $\frac{1-q}{n-1}$ which is decreasing in $n$. From the perspective of bad agents, the cost is also higher because the probability of obtaining good reputation contradicting the signal is lower too. Thus, the larger is the space the larger is the area where that the disclosure Disciplining Effect equilibrium exists:

**Proposition 16.** If $\mu > \mu(q,n)$, there always exists a $\phi > 0$ such that a Disciplining Effect equilibrium exists. Moreover, $\mu(q,n)$ is decreasing in $n$.

The second consequence of expanding the set of states is that the Pandering Equilibrium leads to more correct decisions than with only two possible states. The reason is that, when $n = 2$, contradicting the private interest implies ignoring the signal because there is only one way to contradict the private interest (the complement of the private interest is a singleton). This is not the case when $n > 2$. In particular, among all the possible decisions that
involve contradicting the private interest, good decision makers can choose the one that matches the signal except when the private interest and the signal coincide. Less information is lost.

As $n$ increases, the probability that the private interest coincides with the signal decreases but the probability of taking a wrong decision conditional on contradicting the signal increases. The next proposition shows that the first effect always dominates the second.

**Lemma 17.** *The probability of taking an appropriate decision contradicting the private interest is increasing in $n$.*

When $n = 2$, the Pandering equilibria always reduces the correct decisions with respect to the equilibrium without disclosure because given that good types ignored the signal, bad types did it too. When $n > 2$, good types do not ignore the signal in the Pandering Equilibrium and this can serve as an incentive for bad type to follow the signal. Thus, as the next proposition shows, the decrease of correct decisions driven by having good types pandering instead of following the signal can be compensated by the disciplining effect on bad types.

**Proposition 18.** *When $n > 2$, there exists a $\hat{\phi} > 0$ such that the Pandering equilibrium with disclosure increases the probability of a correct decision. $\phi > \hat{\phi}$.*

Thus, interestingly when $n$ is large enough disclosure increases the probability of a correct decision even when good types pander. Notice that this happens precisely when the career concerns are high enough because bad types need high career concerns to contradict their private interest.
1.7.2 Observability of the state of the world

In this section we will discuss what happens when we relax the assumption that the evaluator perfectly observes the state of the world when he assesses the reputation of the agent. First, notice that if the state of the world was not observed, given that the distribution of private interests and states of the world is symmetric, the evaluator could only infer the type of the decision maker based on whether he followed or contradicted his private interest. In particular, given that the evaluator can not assess whether the decision maker took the correct decision, following the signal cannot lead to high reputation. Without disclosure, all types ignore their career concerns and good types follow their signal and appropriate decisions and bad types follow their private interest. Disclosing does not change the behaviour of bad types as long as good types keep following the signal. Suppose all types played the same strategy they would play without disclosure. Then the reputation from following the private interest is lower than the reputation from contradicting the private interest. Now, notice that good types are more prone than bad types to contradict their private interest when the signal is aligned with the private interest because their loss of immediate utility is \((2q - 1)\) whereas the loss of bad types would be 1. Thus, any equilibrium with disclosure, is either a nothing changes equilibrium or a Pandering equilibrium and disclosure can only reduce efficiency.

The same reasoning applies if instead of assuming that the state of the world is not observed, we assume that the observability is noisy for example if we assume that the evaluator receives a signal \(s' \in \Omega\) of the state of the world such that \(q' = Pr(s' = w|w) \in (.5, 1)\). When \(q\) is large enough we are in the situation studied in sections 4 and 5 and when \(q\) is low enough we are in the
one studied in the previous paragraph. To wrap up, if the evaluator does not observe perfectly the state of the world, the bad effects of disclosure are more pronounced than when it does.

1.7.3 Strictly careerist good decision makers

One of the critical assumptions of the model was that good decision makers care about taking the correct decision. In this section I study what happens when good decision makers only have career concerns, that is their utility is simply $\phi R$. Without disclosure, we can still sustain the equilibrium such that good decision makers follow their signal and bad decision makers either follow their private interest or they mix between following the signal and the private interest.

When we analyze the disclosure case, it is straight-forward to see that good decision makers will always pander and propose the policy that goes against their private interest. Thus, the only possible equilibria with disclosure is the pandering equilibrium of the previous section and, when good decision makers do not care about the decision they take, disclosure always reduces the probability of a correct decision.

**Proposition 19.** When good decision makers only have career concerns, in equilibrium, good decision makers always contradict their private interest and disclosure always reduce the probability of a correct decision.

1.8 Conclusion

In this paper, I have shown that disclosure of careerist decision makers’ private interests can have different consequences. In particular, when reputational concerns are intermediate and decision makers are sufficiently informed, dis-
closure of decision makers’ private interests increases the probability of taking a correct decision. However, when career concerns are higher or decision makers are less informed, disclosure can decrease the probability of taking correct decisions. These results hold with different model specifications. Moreover, I extend the model into a political agency model where I show that disclosure can help voters to select better politicians but it can also hinder their ability to do it. In particular, disclosure can simultaneously worsen the decision taken and the selection of politicians.

When private interests are disclosed, decision makers can be evaluated not only on the correctness of their decisions but also on whether these decisions were aligned with their interests. This can prevent decision makers from putting their interests in front of their duties because they can be judged more severely. However, this also distorts the accountability process because decision makers instead of being only accountable for the correctness of the decisions they are also accountable for the profits they obtain.

Disclosure increases accountability but it comes at the cost of distorting the accountability mechanism. This does not mean that disclosure of decision makers’ private interest should never be enforced. The benefits can exceed the costs when decision makers are sufficiently informed or when the decision maker has multiple possible decisions. However, in other situations disclosure is not desirable.
Chapter 2

When experts agree: why voters ignore experts’ consensus

2.1 Introduction

One of the major concerns about the democratic system is that citizens may not have enough information about the issues they are called to vote upon. This concern has usually been overcome by the use of heuristics or information shortcuts (Lupia, 1994): voters do not need to fully understand the consequences of their vote in each election; they just need to employ information shortcuts, for example, following the advice of better informed citizens and experts in particular.

Recently, however, we have witnessed several situations where voters have voted against the consensus of experts. One of the most striking examples was the Brexit referendum. The market research company Ipsos MORI asked about the economic consequences of Brexit to members of the Royal Economic Society and standard citizens. Regarding the short run consequences, 88% of these experts replied that Brexit would have a negative impact on UK’s GDP. This opinion was only shared by 49% of standard citizens. When it comes

to the long run, 72% of experts predicted a negative effect for only 35% of citizens. On June 23rd, 52% of British citizens voted in favour of leaving the EU.

Another well-known example is the 2016 US Presidential Election. The Wall Street Journal reached out all forty five surviving former members of the White House Council of Economic advisers under the past eight presidents and none of them expressed support for Donald Trump. One week before the elections, three hundred and seventy economists, including eight Nobel Prize winners, co-signed a letter alerting that Trump was a dangerous choice for the country and advising voters not to vote for him. On November 9th, Donald Trump won the 2016 Presidential Elections.

Distrust of experts’ consensus also affects natural sciences. Cook et al. (2013) examined 11944 abstracts of climate peer-reviewed papers and they found that, among abstracts expressing a position on global warming, 97% endorsed the position that humans are causing global warming. Moreover, according to Benestad et al. (2016) the remaining 3% are all flawed. However, only 41% of US citizens believe that global warming is happening and human caused (Leiserowitz, 2006). As of 2017, the USA has still not ratified the Kyoto Protocol.

If voters do not follow the advice of those who know the most in circumstances where they all agree, the logic of the heuristic device might be more complex than previously thought. When after the Brexit Referendum, Paul Johnson, director of the Institute for Fiscal Studies stated “It is clear that economists’ warnings were not understood or believed by many. So we economists need to be asking ourselves why that was the case, why our near-unanimity did not cut through.” he was implicitly assuming that broader consensus among experts
should lead to larger persuasion of voters. This assumption is consistent with a set of models of Bayesian learning. Consider, for example, a simple model of Bayesian learning where experts get an independent signal of a state of the world and conceal that signal. In such environment, the largest the consensus of experts, the higher the probability that their advice is correct. Moreover, this result is robust to the introduction of biased experts who always provide the same advice no matter the signal they receive.

The goal of this paper is to provide an explanation of why the relation between the share of experts endorsing an alternative and the share of citizens voting for it could be non-monotonic. More precisely, I propose a model of expert advice and voting over two alternatives where imperfectly informed experts have potentially some private bias towards one of the alternatives. I show that as long as the biases of the experts are not correlated, the share of votes of each alternative increases with the number of experts who endorse it. However, when the correlation of experts’ biases is high enough, the relationship is non-monotonic. In particular, an alternative endorsed by a bare majority can receive more electoral support than an alternative endorsed by a larger majority.

The intuition for this result is that consensus among experts can be reached either because (a) all of them received the same signal or (b) because they were all biased towards the same alternative. In (a) this consensus is informative of the correctness of experts’ advice but in (b) it is not. When there is no consensus, it means that experts were not biased towards the same decision and they advised according to the signals they received. When there is a consensus, whether it is reached because of (a) or (b) it clearly makes a lot of a difference. Given that voters do not observe neither the signal received by
experts nor their bias, they cannot distinguish between \((a)\) and \((b)\).

How does this result depend on the information of voters? I extend the model to allow citizens to get unbiased but imperfect information by their own in addition to the advices of experts and I show that the non-monotonicity still holds. Moreover, when citizens are moderately confident about their information, an alternative can only obtain the majority of votes if most experts, but not all of them, endorse it. Interestingly, when voters are overconfident of their own information, this can happen even when it would optimal for citizens to always follow the majoritarian advice of experts.

\section{2.2 Related Literature}

The puzzle that citizens may be more persuaded by experts who share some sort of disagreement has been addressed empirically by \cite{Sapienza2013}. In their paper, they compare the answers to a common set of policy questions from experts drawn from the Economic Expert Panel at the University of Chicago Booth School of Business (EEP) and common US citizens drawn from the representative sample of US population used for the Chicago Booth/Kellogg School Financial Trust Index (FTI). They find that, on average, the percentage of agreement differs 35 percentage points among these groups. Interestingly, this difference is even larger when there is strong consensus among the experts. Moreover, whether citizens are informed or not about the consensus among experts about a particular policy before the question is asked, changes the differences very little. In particular, the belief that stock prices are hard to predict goes down from 55\% to 42\% when citizens are informed that all experts’ experts agree that it is. The present paper offers an explanation of why this may happen.
Another two closely related papers are Darmofal (2005) and Johnston and Ballard (2016). Darmofal (2005) studies the factors that induce citizens to disagree with expert opinion on public policy questions and he finds that citizens are more likely to disagree with expert opinion when the political elites they favor challenge this opinion. Johnston and Ballard (2016) show how American citizens react to the consensus of experts on different economic policy issues. They find moderate changes in public opinion when citizens are informed of economists consensus. Interestingly, when this consensus is not attributed to economists but to a generic sample of people, the responsiveness is larger.

Regarding the theoretical literature, this article is related to the literature on information transmission between informed experts and an uninformed decision maker. The seminal paper of Crawford and Sobel (1982) on strategic information transmission has been extended to study situations with multiple experts such as Gilligan and Krehbiel (1989), Austen-Smith (1993), Battaglini (2002), Wolinsky (2002), Krishna and Morgan (2004) and Gerardi et al. (2009). Nevertheless, all these articles study cheap talk environments and the issue of non-monotonicity between the number of experts endorsing a decision and the likelihood that this decision is preferred by the decision maker is not present.

This article also relates to the recent literature on disagreement. There is a number of theories that attempt to explain why people disagree and why this disagreement persists: confirmation bias (Rabin and Schrag, 1999), overconfidence (Ortoleva and Snowberg, 2015), correlation neglect (Levy and Razin, 2015) or pre-screening (Cheng and Hsiaw, 2016). The latter shares two important features with this article: experts are not strategic and citizens face a joint uncertainty of the desirable alternative and the expert credibility. However, the results and the mechanisms of their paper are substantially different.
2.3 The Model

An electorate composed by a continuum of voters has to choose between two alternatives $R$ and $S$, with $R \in (0, 1)$ referred to as the Reform and $S = -R$ as the Status Quo. We will assume a simple majority rule: the alternative $d \in \{S, R\}$ that gets more votes is implemented\(^2\). Each voter $i$ has a preference parameter towards the Status Quo $v_i$ distributed according to a uniform distribution on $[-1, 1]$. In addition to this parameter, the utility of a voter $i$ also depends on the realization of a state of the world $\omega \in \{-1, 1\}$. We will assume that both states are equally likely. More precisely, the utility of a voter $i$ when a decision $d$ is taken in a state of the world $\omega$ is given by:

$$u_i(\omega, d) = -(\omega + v_i - d)^2$$  \hspace{1cm} (2.1)

Voters do not observe the state of the world but they receive the advices of $n$ informed experts. Each expert $j$ receives an individual private signal $s_j \in \{-1, 1\}$ of the state of the world. More precisely $Pr(s_j = \omega|\omega) = q$. In addition to this signal, each expert has a bias $\beta_j \in \{-1, 0\}$. We will say that the expert is biased (towards Status Quo\(^3\)) when $\beta_j = -1$ and neutral when $\beta_j = 0$. The utility of an expert $j$ coincides with the utility of voters substituting the idiosyncratic preference parameter for the expert bias:

$$u_j(\omega, d) = -(\omega + \beta_j - d)^2$$  \hspace{1cm} (2.2)

Notice that the optimal decision of a biased expert is $S$ regardless of the state of the world and the optimal decision of a neutral expert is $\omega$. We will assume

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\(^2\)When both alternatives obtain the same number of votes we will assume that Status Quo is implemented.

\(^3\)The case where experts can be biased towards both alternatives is discussed in one of the extensions and does not change the main results of the model.
that each expert \( j \) provides an advice \( a_j \in \{S, R\} \) and, for simplicity, this advice always coincides with his optimal decision. Thus, the advice \( a_j \) of an expert \( j \) is:

\[
a_j(\beta_j; s_j) = \begin{cases} 
S & \text{if } \beta_j = -1 \\
 s_j & \text{if } \beta_j = 0
\end{cases}
\]

(2.3)

In order to capture the potential correlation among experts’ biases, we will assume that there is an underlying state of the bias \( b \in \{L, H\} \) with \( \Pr(b = H) = p_H \in [0, 1] \). We will say that the state of the bias is high when \( b = H \) and low when \( b = L \). Conditional on the state of the bias \( b \), the probability that each expert \( j \) is biased is independent and is given by \( \sigma_b \in [0, 1] \). We will assume that bias is more likely in a high state of the bias than in a low one, that is, \( \sigma_L \leq \sigma_H \). Notice that when \( \sigma_L = \sigma_H \), biases are fully uncorrelated and when \( \sigma_L = 0 \) and \( \sigma_H = 1 \) biases are fully correlated. Voters do not observe the state of the bias.

Given that the correlation among experts’ bias is a key feature of our modelling assumptions, it is important to clarify its interpretation. The rationale for assuming this correlation is that experts are not representative of the whole population (they work in particular economic sectors such as universities, think tanks or institutions) and they can have particular interests that differ with those of the rest of the society. The importance of these interests are captured by the state of the bias: when the state of the bias is high, the decision to be taken has large impact on these interests and it is more likely that experts will advise according to them, whereas when the state of the bias is low, we may think that the relative importance of these interests are lower and experts will be more likely to advise according to the interests of society\(^4\).

\(^4\)Instead of assuming that biases are correlated we could assume that the precision of the signals they receive are correlated. For example, experts could be informed or uninformed.
We will assume that \( n = 3 \) which is the simplest environment that allows us to distinguish between majority and consensus in expert’s advice and, given that we have a continuum of voters and each of them is pivotal with probability 0 we will assume that voters vote sincerely, that is, each voter chooses the alternative that he expects to provide higher utility to himself. The timing of the model is the following:

1. State of the world \( \omega \) and the state of the bias \( b \) are realized.

2. Experts receive signals \( s_j \) of the state of the world and observe their bias \( \beta_j \).

3. Experts give advices \( a_j \) to voters.

4. Elections are held and each voter elects the alternative that maximizes his utility.

### 2.4 Analysis

First of all we will prove that, despite the heterogeneity of voters’ preferences, in each state of the world the optimal decision of all voters coincides:

**Lemma 1.** Let \( d^*_i(\omega) \) be the optimal decision of a voter \( i \). For all \( i \),

\[
d^*_i(\omega) = \begin{cases} S & \text{if } \omega = -1 \\ R & \text{if } \omega = 1 \end{cases}
\]

(2.4)

The intuition is that the salience of the common component of citizens’ preferences overweights the private one. Given that all citizens share the same optimal decision in each state of the world, we will say that a decision \( d \) is correct when \( d = d^* \) and wrong otherwise. Notice that despite all voters prefer a
correct decision with respect to a wrong one, given that voters do not know the realization of the state $\omega$ and they have different individual parameters, they will vote different alternatives. In particular, a voter with preference parameter $v_k = -1$ will always vote for Status Quo whereas a voter with preference parameter $v_l = 1$ will always vote for the reform.

The only relevant information a voter $i$ has before casting his vote is the number of experts advising each alternative. Let $\Pi_k$ be the perceived probability that the state of the world is Status Quo conditional on $k$ experts supporting it. Given that voters are sincere, a voter $i$ votes for Status Quo if and only if $E[U_i(s)|(k,n-k)] \geq E[u_i(r)|(k,n-k)]$ and this happens if and only if:

$$v_i \leq 2\Pi_k - 1 \quad (2.5)$$

**Lemma 2.** The share of votes for Status Quo is $2\Pi_k - 1$ which is increasing in $\Pi_k$.

Not surprisingly, given that voters value taking correct decisions, an increase in the probability that the decision is correct increases the electoral support for that decision. In the next sections we will concentrate our attention on the relationship between the number of experts advising an alternative and the probability that this alternative is correct. In particular we will study what happens when $\sigma_L = \sigma_H$ (uncorrelated bias) and when $\sigma_L = 0$ and $\sigma_H = 1$ (fully correlated bias).
2.4.1 Uncorrelated Bias

When $\sigma_H = \sigma_L = \sigma$, the probability that an expert $j$ advises Status Quo when $\omega = S$ is $\sigma + (1-\sigma)q$ and in state of the world $R$ is $\sigma + (1-\sigma)(1-q)$. Therefore,

$$\Pi_k = \frac{\pi(S, k)}{\pi(S, k) + \pi(R, k)}$$

(2.6)

where

$$\pi(S, k) = \binom{3}{k}(\sigma + (1-\sigma)q)^k(1 - (\sigma + (1-\sigma)q))^{3-k}$$

(2.7)

$$\pi(R, k) = \binom{3}{k}(\sigma + (1-\sigma)(1-q))^k(1 - (\sigma + (1-\sigma)(1-q)))^{3-k}$$

(2.8)

Lemma 3. When experts’ biases are uncorrelated, the share of votes for Status Quo is increasing in the number of experts advising it.

Notice that this result applies both when experts are always neutral ($\sigma = 0$) or when they are biased with some probability ($\sigma > 0$). In both scenarios, the likelihood of a policy being correct increases on the number of experts advising for it. Increasing the probability of being biased ($\sigma > 0$) makes the advice of experts less informative but does not change the monotonicity.

2.4.2 Correlated Bias

In this section we introduce correlation between the bias of experts. For simplicity, we will study the fully correlation case such that $\sigma_L = 0$ and $\sigma_H = 1$. That is, all experts are neutral when $b = L$ and all experts are biased when $b = H$. Now, suppose that $k < 3$, that is, at least one expert advises the reform. This expert has to be necessarily neutral but if this expert is neutral, this means that all experts are neutral and voters know for certain that
\( b = L \) and the expression of \( \Pi_k \) is the one we derived when we studied the uncorrelated bias for \( \sigma = 0 \).

Thus, we can restrict our analysis to the case \( k = 3 \). There are different situations where all agents advise Status Quo, either all agents received a Status Quo signal independently of the state of the bias or the state of the bias is high and all experts are biased. When the state of the bias is high, the probability that the state of the world is \( S \) is just the ex-ante probability which we assumed it was \( \frac{1}{2} \). Therefore that Status Quo is correct when all experts advice it is given by:

\[
\Pi_n = \frac{(1 - p_H) \pi(S, n) + \frac{p_H}{2}}{(1 - p_H)(\pi(S, n) + \pi(R, n)) + p_H}
\]  

Once we have computed the probability that Status Quo is correct depending on the advices of experts we can present the first result:

**Proposition 4.** When experts biases are correlated, there exists a \( \hat{p} \in (0, 1) \) such that:

(i) When \( p_H \leq \hat{p} \), the share of votes for Status Quo is increasing in the number \( k \) of experts advising it.

(ii) When \( p_H > \hat{p} \), the share of votes for Status Quo is non-monotonic in the number \( k \) of experts advising it. In particular, it is increasing when \( k < 3 \) but the share of votes for Status Quo is higher when \( k = 2 \) than when \( k = 3 \).

(iii) The threshold \( \hat{p} \) is increasing in \( q \).

Interestingly, when \( p_H > \hat{p} \), there is a non-monotonic relationship between the number of experts supporting Status Quo and the probability that Status Quo is the correct. In particular, when \( p_H > \hat{p} \), unanimity makes Status Quo less
likely to be correct than a majority with one dissent expert. The intuition is that consensus among experts can be reached either because all of them received the same signal or because their bias is so strong that they are not responsive to the signal. In the first scenario the probability that the advice is correct is large but in the second one, the advice is not informative.

2.5 Informed citizens and overconfidence

So far we assumed that experts were the only source of information of citizens and even when consensus was less informative than a simple majority, a majority of voters would still follow the advice of experts. Therefore, the non-monotonicity result had no effect for elections with majority vote. In this section we will assume that voters have access to other information to illustrate why some reforms that wouldn’t pass when a simple majority of experts advise against them, can pass when all experts advise against them.

Let’s assume that, in addition to observing experts’ advices, all citizens get a common signal $\theta_c \in \{-1, 1\}$ of the state of the world with precision $q_c =$
We allow citizens to be overconfident about the precision of their signal, that is, instead of thinking that their precision is $q_c$, they think that their precision is $q'_c \geq q_c$. Nevertheless, they are aware that $q'_c < q$ (which implies $q_c < q$), that is, not only their signal is less informative than the signal of an expert but they are aware of it. Let $\pi_k(\theta_c)$ denote the probability that status quo is the correct when citizens receive a signal $\theta_c$ and $k$ experts advise it and let $\pi'_k(\theta_c)$ be the subjective probability of citizens.

We will concentrate on the case where biases are correlated since this is the one that can hold the non-monotonicity result. In particular, we will derive the conditions such that citizens only follow experts advice when there is a simple majority and follow their signal otherwise despite the fact that following expert’s consensus would increase their welfare.

**Lemma 5.** When most experts advise the reform, the reform is implemented independently of the prior of voters.

When most experts advise the reform, given that citizens know that experts are better informed than them and they can’t be biased towards the reform, citizens think that the reform is more likely to be correct and a majority of citizens vote for the reform. Thus, the interesting case is what happens when most experts advise Status Quo.

**Proposition 6.** When most experts advise Status Quo,

1. if $\theta_c = -1$, Status Quo is implemented.

2. if $\theta_c = 1$ and and one expert advises the reform, Status Quo is implemented.

3. if $\theta_c = 1$ and all experts advise Status Quo, there exists a $p \in (0, 1)$ such that Status Quo is implemented if and only if $p_H \leq p$. 
We have just proven that the reform can be implemented when all experts advise Status Quo but, given the correlation of experts’ biases, it could be the case that voters maximize the probability of taking correct decisions and, therefore, we shouldn’t worry when voters ignore experts’ consensus. However, in the following corollary we show that this is not always the case.

**Corollary 7.** When \( q'_c > q_c \), there exists a \( \bar{p} \in (p, 1) \) such that if \( p_H \in (p, \bar{p}) \) the reform is implemented when all experts advise Status Quo and Status Quo is more likely to be correct than the reform.

This result shows that when voters are poorly informed but they are very overconfident about their information, voters ignore expert’s consensus when they would be better off by following their advice. The intuition is that overconfident voters do not aggregate correctly the advice of experts and overestimate the probability that all experts are biased when experts’ unanimous advice does not coincide with voters’ prior. When there is no consensus, even overconfident voters follow experts’ majoritarian advice because disagreement among experts proves that they are not biased and, despite being overconfident, voters think that experts are still better informed than them.

## 2.6 Extensions

### 2.6.1 Larger number of experts and partially correlated bias

We have already shown that the relationship between the number of experts advising Status Quo and the probability that Status Quo is correct can be non-monotonic. In particular we have shown that it can decrease when we move from two experts advising Status Quo to all experts advising Status Quo. A reasonable concern is that when the number of experts \( n \) is arbitrarily large,
the non-monotonic result only holds for the very extreme case of unanimity. In this section we will assume that the bias is not fully correlated, that is $\sigma_L < \sigma_H$ and we will show that non-monotonicity is not only a property of unanimity but, more generally, it can also be a property of less demanding majorities.

When biases are not fully correlated, even in the high state of the bias it can happen that some expert advises Reform. Given that having some expert advising Reform is not fully informative about the state of the bias anymore, all $\Pi_k$ change with respect to the neutral experts benchmark (recall that when bias was fully correlated, the only probability that changed was $\Pi_n$). In order to derive $\Pi_k$, we need to compute $Pr(\omega, b, k)$, that is the joint probability that the state of the world is $\omega$, the state of the bias is $b$ and $k$ experts advise Status Quo. Conditional on state of the world $\omega$ and state of the bias $b$, the probability that an expert $j$ advises Status Quo is:

$$\alpha(\omega, b) = \begin{cases} 
\sigma_b + (1 - \sigma_b)q & \text{if } \omega = S \\
\sigma_b + (1 - \sigma_b)(1 - q) & \text{if } \omega = R
\end{cases} \quad (2.10)$$

Thus the joint probability that $k$ experts advise Status Quo and state of the world is $\omega$ and state of the bias is $b$

$$Pr(\omega, b, k) = \frac{p_b}{2} Pr(k|\omega, b) = \frac{p_b}{2} \binom{n}{k} (\alpha(\omega, b))^k (1 - \alpha(\omega, b))^{n-k} \quad (2.11)$$

Once we have computed $Pr(\omega, b, k)$, we apply Bayesian updating and we obtain the probability that the state of the world is Status Quo conditional on the number of experts advising it:

$$\Pi_k = \frac{p_H Pr(S, H, k) + (1 - p_H) Pr(S, L, k)}{p_H Pr(S, H, k) + (1 - p_H) Pr(S, L, k) + p_H Pr(R, H, k) + (1 - p_H) Pr(R, L, k)} \quad (2.12)$$
In figure 2 we can observe what can happen when biases are partially correlated. In particular we see that the non-monotonicity is not only a problem of the extreme case $k = n$ but it is a property that can appear for all $k > \frac{n+1}{2}$.

The intuition is the following. If $k$ is close to unanimity, it means that there is a huge fraction of biased experts ($b = H$) and neutral agents receive Status Quo signals ($\omega = S$). If $k$ is slightly above the simple majority threshold, experts are neutral ($b = L$) and they receive Status Quo signals $\omega = S$. If $k$ is under the majority, experts are neutral $b = L$ and they receive Reform signals. Finally, when $k$ is above small majority and under unanimity, there is a huge fraction of biased experts $b = H$ and neutral experts receive Reform signals ($\omega = R$).

When $q$ is larger, that is, when neutral decision makers receive more precise signals, there is a compression of the distribution towards the right that can potentially erase the sink between simple majority and consensus.
2.6.2 Symmetric bias

In all the article we have assumed that experts could only be biased towards one of the options that we have labeled as Status Quo. The underlying idea is that experts, as an intellectual elite, may have some common interests that voters can ex-ante identify. In this section we relax this assumption allow experts to be biased to both directions.

That is we will extend the model such that the bias $\beta_j$ of expert $j$ can take values $\{S, 0, R\}$ and the state of the bias can also take values $S, 0, R$. Conditional on the state of the bias $S$ ($R$), the probability that an expert has bias $\beta_j = S$ ($\beta_j = R$) is $\sigma_S$ ($\sigma_R$) and the probability that he has bias 0 is $1 - \sigma_S$ ($1 - \sigma_R$). When $b = 0$ all experts are neutral. When the bias of experts can go on both directions, the non-monotonicity can also apply to the situations where $k < \frac{n}{2}$. The reason is that, when the bias was only towards Status Quo, consensus advice for Reform could only happen when all experts received a signal for Reform. This is not the case anymore if experts can also be biased towards Reform. Figure 4 shows this non-monotonicity when biases are fully correlated.
2.7 Discussion

Democracies require citizens to take a stand on many policy debates that are complex. Academics and experts can play a crucial role at shaping citizens positions on these policies. In the recent years, however, we have witnessed that voters do not always follow the advice of experts, in particular, when there is a strong consensus among them. This paper provides an explanation to this phenomenon. In particular, it shows that, the relationship between the number of experts endorsing an alternative and the electoral support to this alternative can be non-monotonic.

The explanation is that consensus among experts can be reached either because all experts share the same information or because experts ignore the information they have and provide their advice according to their own interests. Citizens can not distinguish between these two scenarios and when they expect experts to share common interests with high probability, they infer that consensus is not informative of the suitability of the policy they advise. On
the contrary, when there is no consensus, they discard that experts are motivated by their common interests and they infer that the majoritarian advice is informative of the suitability of the advised policy.
Chapter 3

Fake News, Media Competition and Political Accountability

3.1 Introduction

The news media play a fundamental role in providing political information to citizens and keeping candidates and elected officials accountable to public opinion (Strömberg, 2015). In order to fulfill their role, news media act as a filter between the information they receive from their sources and the information they transmit to the public. At the heart of this process lies what is often called fact-checking, which means verifying the claims of a source before publishing a report. A crucial question, therefore, is whether competition gives media outlets the incentive to undertake this very important task.

In this paper we show that this might not be the case: in our model, competition between media outlets crowds out fact-checking and leads to faster but more inaccurate reporting. In order to investigate what broader effects this might have on society, we introduce an electoral choice and describe how the less fact-checked information provided by the media to voters can distort it.

In our model, we consider a set of news outlets competing to break a news.

1This chapter is joint work with Giovanni Andreottola.
Each media receives some information on whether a politician in office is corrupt. Media outlets can decide whether to break the story immediately or wait and fact-check. The benefit of fact-checking is to allow a media outlet to be sure about the validity of the rumour. Since publishing a fake story is costly for the media outlet fact-checking therefore prevents fake scandals from making the news and affecting a reader’s electoral choice. The cost of fact-checking consists in having to put the publication of a story on hold, thus giving other firms the opportunity to break the news, leaving the firm that decided to fact check with nothing.

We show that as the number of competitors increases, each outlet becomes more likely to break the story without fact checking. This, in turn, makes incumbent politicians increasingly likely to be accused of corruption, hurting their chances of re-election. This does not only affect corrupt incumbents, but also honest incumbents which might be ousted from office and replaced with corrupt challengers.

Interestingly, we show that if there is a pecking order such that whenever some media outlet reports the scandal, readers are exposed to that news (for example because they preferably buy the newspaper whose headline mentions the scandal, or because they google search for scandals involving the politician) then increasing the number of media makes it less likely for an honest politician to win the election.

The changes in the media landscape that happened in recent years, especially due to the ever growing importance of the internet, seem to well fit the conditions implied by our model for a decrease in news quality (and the resulting

\[\text{\footnotesize \textsuperscript{2}}\text{The channel through which publishing a fake scandal is costly for a media outlet is not made endogenous in our model. Two explanations can be libel lawsuit and reputation. However, how these two channel interact with the dynamics of publication and with the number of outlets is left unanswered by our model and could be object of future research.}\]
First of all, the internet has dramatically decreased the entry barriers into the news media sector: setting up a blog does not require significant capital or expertise, but gives anybody access to a potentially vast market of readers.\(^3\) Secondly, the role of the internet and social media in the spread of news has transformed the way in which media outlets compete. In a world of around the clock news, being the first to cover an event is fundamental to increase traffic and earn through advertisements. Moreover, news of scandals travel very fast on social media. Since not reporting on a scandal does not go viral, readers are more likely to be exposed to the outlets that talk about a scandal rather than to those that don’t.

In light of this, the mechanism described in our model might help interpreting the consistent decrease in the level of trust in the accuracy and fairness of media that took place in the last two decades. According to a poll by Gallup in 2017 in the United States, confidence in printed newspapers stands at around 27%, whereas it is even lower for other media such as television news (24%) and internet news (16%).\(^4\)

Moreover, our work can pose a caveat on the idea that pluralism should bolster the quality of news, which is the backbone of theories such as the *marketplace for ideas* and that is also predicted by models such as Besley and Prat (2006). In other words, whilst pluralism and competition might insure against the risk of capture by interest groups, the decrease in fact-checking might act as a countervailing effect.

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\(^3\)The trend towards an increased number of media outlets is not limited to the internet: see for example Cagé (2016).

3.1.1 Historical Evidence: Yellow Journalism

Looking at the history of journalism there are several examples of how competition can lead to a lowering of publication standards: an interesting case in point is the so called Yellow Journalism period in the United States towards the end of the nineteenth century. As the number of media outlets increased, prices decreased and competition started to be centred on circulation, especially in large cities such as New York, where entrepreneurial and ambitious media owners such as Joseph Pulitzer and William Randolph Hearst led the industry. Competition was fierce and newspapers battled to attract potential buyers on the streets with enlarged headlines mentioning sensational, scandal-ripe and often completely unsubstantiated stories.

Consistently with this view, Zaller (1999) underlines how the first half of the twentieth century saw both a toning down from the sensationalism and muckraking of the yellow journalism era and a dramatic fall in competition.

One of the consequences of the aggressive reporting style of the yellow journalism era can be found in the Spanish-American war of 1898. The newspapers led by Pulitzer and Hearst, as a matter of fact, played a decisive role in making public opinion call for a war. One of the highlights of the media campaign against Spain was the stream of accusations (mostly not backed up by evidence) following the sinking of the USS Maine ship in the Havana Harbour. As the historian Allan Keller wrote: “Had these publishing titans not decided to slug it out toe to toe, the efforts of the downtrodden Cubans to throw off the yoke of Spanish oppression might never have burgeoned into a war between Spain and the United States”.

For an account of yellow journalism and circulation war, refer for example to https://publicdomainreview.org/collections/yellow-journalism-the-fake-news-of-the-19th-century/
The story of the Spanish-American war also brings to mind the much more recent case of Iraq and the alleged weapons of mass destruction possessed by Saddam Hussein’s regime; that is another important example of a competitive and pluralistic media failing to debunk a fake story, which then led to a tragic and costly war.

3.1.2 Selection of Related Literature

The potentially negative effects of media competition have been picked up by media scholars. This is a quote from a book by Thompson (2013): “The pressure to run a story before one’s competitors acts as an incentive to disclose information that could spark off a scandal, or which could fuel a scandal which is already underway”.

From an empirical point of view, the question of what are the consequences of a more pluralistic media market has been addressed by several scholars. For example, Gentzkow et al. (2011) use a long time series of newspaper entry and exit to study its effects on political participation and electoral competition, focussing on the years 1869-1928. They find that newspaper entry increases turnout but they find it has no significant effects on incumbency advantage. Despite not being statistically significant, their point estimates of the effect of an additional newspaper on incumbency advantage are negative, i.e. in the direction predicted by our model. Drago et al. (2014) carry out a similar exercise with data on Italian local newspapers. They find, in line with Gentzkow et al. (2011), a positive effect of the number of newspapers on voters’ participation.

In a similar way, Garrard and Newell (2006) claim that: “[...] modern scandals are mediated, shaped to varying degrees by the priorities of those reporting them. This has rightly led some commentators to wonder whether the priorities of capitalist (even public-service) media competition have produced behaviour disfunctional for the liberal democracies that modern industrial capitalism tends to produce. [...] Whilst the latter require the spread of serious information and debate, the competitive priorities of the former, particularly mass-circulation tabloids, point increasingly to sensationalism, titillation, entertainment and trivialisation.”
in elections. In terms of incumbency advantage, they find an increase in the re-election probability of mayors who decide to rerun (they find no significant difference in the probability for incumbents to run for re-election). The authors claim that the positive effect on incumbency advantage is mostly due to increased incentives rather than selection: in fact, they find that an increase in the number of newspapers has no effect on the characteristics of elected officials, but it positively affects the efficiency of public policy.

Another paper addressing the effects of an increase in the number of media outlets is the above-mentioned Besley and Prat (2006). Their model shows that media pluralism decreases the risk of capture by corrupt politicians. The main idea is that as the number of media increases, a corrupt politician or interest group would have to pay monopolist profits to each outlet in order to prevent the publication of a scandal: therefore, the larger the number of media, the more expensive it is for interest groups to prevent the publication of a corruption scandal and the better for voters. Our model shows that if the concern is not capture but reporting accuracy, competition can instead be detrimental for voters welfare.

Our work is also related to Cage (2017). Her model is based on vertical product differentiation and it shows that the effect of entry on quality depends on the heterogeneity of readers: with no heterogeneity, there is no change in quality but simply a splitting of the market, whereas with heterogeneous readers newspapers differentiate on quality in order to soften price competition. Moreover, with heterogeneity on more dimensions, duopolists reduce quality on the less heterogeneous dimension. In our model, on the other hand, readers are homogeneous, but nonetheless we get that an increase in the number of firms leads to news of lower quality. Whereas we abstract from price competition,
firms compete on breaking the news, and the cost of quality is represented by increased time to publication: the increased competition on being first on a news is what leads to a decrease in quality as the number of firms increases. Finally, compared to Cage’s model, our model can deal with any number of firms and not just monopoly versus duopoly.

Finally, Gratton et al. (2016) present a model of strategic leak timing which is also connected with our work. In their model, good and bad leakers (who respectively have a true or a fake piece of information on a political scandal), try to influence the outcome of an election. In their model, the media is not specifically modeled, but once a leak is released, a learning process takes place, which can uncover the truth. In our model, instead, the initial leak reaches all media at the same time and we focus on the gatekeeping role of profit maximizing media outlets in deciding whether to release the information, with the objective of media being profit.

3.2 The Model

Consider a media market composed by $N$ media outlets playing across 2 periods. In each period, a state of the world $\omega \in \{0, 1\}$ is independently drawn such that $Pr(\omega = 1) = p$. When the realization of the state is $\omega = 1$ there is a political scandal, whereas $\omega = 0$ means that there is no scandal. We will later addition this simple model of media competition without politicians with an electoral choice between an incumbent and a challenger in order to evaluate the effects of news reporting on elections.

Each media $i$ receives a signal $s_i$ about $\omega$, distributed according to some full support density function $f_\omega(s)$ for each state of the world $\omega$, with cumulative distribution function $F_\omega(s)$. Let $\psi(s) = \frac{f_1(s)}{f_0(s)}$ denote the likelihood ratio at $s$. 

We will assume that $\psi(s)$ is increasing in $s$ which implies $F_1(s) > F_0(s)$ for all $s$ (first order stochastic dominance). Notice that this assumption means that higher values of the signal are more likely in case of scandal. Furthermore, we will also assume that $\lim_{s \to +\infty} \psi(s) = +\infty$ and $\lim_{s \to -\infty} \psi(s) = 0$, so that posterior beliefs converge to 0 and 1 when $s$ goes to $-\infty$ and $+\infty$ respectively.

After observing $s_i$, each media company simultaneously decides whether to publish announcing a scandal or whether to fact-check the information received with a new signal. We assume that fact-checking allows the media to receive a fully informative signal of the state of the world before deciding whether to publish the scandal or not.

The size of the media market is normalized to 1 and we assume that the revenues from publishing a scandal are equally split among the media outlets who published the scandal first. In particular, this means that the revenue from publishing a fact-checked scandal that was already published by another media outlet without fact-checking is 0.

Publishing fake scandals is costly for media because at the end of the first period, the state of the world is exogenously revealed and the media outlets that published a fake scandal are replaced by an equal number of identical ones.

In the second period, the game is repeated. We assume that the value of the market in the second period is $R > 1$. The reason for this assumption is that we think of the second period as a reduced form for all future periods in an infinitely repeated game.
3.3 Analysis

Let’s analyze the model starting from the second period. In the second period there is no disciplining effect from the possibility of being replaced. Therefore, all media publish, no matter what the state of the world is. It follows that the utility from staying in the market in period 2, or the opportunity cost of publishing a fake scandal, is \( c = \frac{R}{N} \).

Let’s now move to period 1: each media infers the state of the world conditional on the signal they received using Bayesian updating. Given the prior \( p \) that there is a scandal, each media updates according to the posterior:

\[
\hat{p}(s) = \frac{pf_1(s)}{pf_1(s) + (1 - p)f_0(s)},
\]

(3.1)

Lemma 1. \( \hat{p}(s) \) is increasing in \( s \) and the image of \( \hat{p} \) is \((0, 1)\).

Proof. All proofs can be found in the appendix. \( \square \)

Let’s for a moment focus on a single media company. Denote by \( r_j \) the revenue from publishing without fact-checking conditional on the state \( \omega = j \) for \( j \in \{0, 1\} \). Finally, let’s define by \( \gamma \in [0, 1] \) the probability that none of the other media publish a scandal without fact-checking conditional on the scandal being true. Notice that these quantities depend on the equilibrium behaviour of the media firms and will be made endogenous in the following pages. For now, assume that \( R > N \), meaning that \( c \) is large enough such that \( c > 1 \): in other words, publishing a certainly fake news is worse than not publishing; moreover, notice that by construction \( r_1 \geq \frac{1}{N} \), since at worst all media publish without fact-checking and the revenue is \( \frac{1}{N} \).

Lemma 2. When \( N = 1 \), the monopolist media always fact-checks the scandal.
When \( N > 1 \), in any equilibrium a media outlet uses a strategy characterized by a cut-off point \( s^* \), such that the media outlet publishes if \( s > s^* \) and fact-checks otherwise.

From the perspective of the monopolist, fact checking is always better than publishing directly, because she does not face the risk that another media publishes without fact-checking, leaving her without market revenues. On the contrary, when there are more than two firms, they have to trade-off the informational gain of fact-checking with the probability of having less revenues either because another media published without fact-checking or because if they publish after fact-checking the revenues are always split with all other media.

We still need to prove the existence of the equilibrium. In particular, let’s consider a symmetric equilibrium. From the previous lemma we know that if \( s^* \) is the threshold that characterizes the equilibrium strategy of a media outlet, it has to be that \( \gamma = F_1(s^*)^{N-1} \). Moreover, in a symmetric equilibrium, we can also rewrite the expressions of \( r_j \) as functions of \( s^* \). In particular:

\[
  r_j = \sum_{k=0}^{N-1} \frac{1}{k+1} \binom{N-1}{k} (1 - F_j(s^*))^k F_j(s^*)^{N-1-k}
\]

First of all, we will prove that the expected revenues of publishing increase in the threshold \( s^* \) used by the opponents. In other words, \( r_j \) is an increasing function of \( s^* \).

**Lemma 3.** \( r_j = \frac{1}{N} \frac{1 - F_j(s^*)^N}{1 - F_j(s^*)} \) and \( r_j \) is strictly increasing in \( s^* \).

The fact that \( r_j \) is strictly increasing in \( s^* \) means that the revenue from publishing without fact-checking is higher if the other media require a higher threshold for publishing. This gives the media outlet an incentive to publish without fact
checking. However, a larger $s^*$ also translates into a lower probability of direct publishing for the other media. Therefore, also fact checking becomes more profitable, since it becomes less likely that one of the competitors published without fact-checking.

Having characterized the revenues from publishing, we can go back to our equilibrium in cutoff strategies. A symmetric equilibrium requires the following fixed-point equation to hold:

$$s^* = \hat{p}^{-1} \left( \frac{c - r_0}{c - r_0 + r_1 - \frac{F_1(s^*)^{N-1}}{N}} \right).$$

**Theorem 4.** The game has a unique symmetric equilibrium, in which all media outlets publish the news without fact-checking if $s > s^*$ and fact-check if $s \leq s^*$.

The fact that $\frac{c - r_0}{c - r_0 + r_1 - \frac{F_1(s^*)^{N-1}}{N}}$ is decreasing in $s^*$ means that from the perspective of an individual media outlet, higher standards in the industry (i.e. a higher $s^*$) mean a lower indifference point in terms $\hat{p}(s)$ to publish without fact checking. In other words, this model describes an environment in which there is an incentive to free ride on the high fact-checking standards of the media industry.

What can we say about the threshold $s^*$ that media outlets use to decide whether to fact check or publish? A natural questions concerns the amount of information that will make media indifferent between the two options. The following lemma finds sufficient conditions for $\hat{p}(s^*)$ to be larger or smaller than $p$. In the case of $\hat{p}(s^*) > p$, media outlets only ever report a scandal when the information they receive makes them more confident than the prior about the existence of the scandal. In other words, the bar for publication is higher than the prior. If instead $\hat{p}(s^*) < p$, there are situations in which the evidence
is against the scandal but the outlet nonetheless decides to publish. Whereas we rule out fully fake news with the assumption that \( R < N \), publishing a scandal despite evidence going against it might also be considered a (slightly milder) version of fake news.

**Lemma 5.** In equilibrium, if \( N < (1 - p)R + p \), then \( \hat{p}(s^*) > p \). If \( p > \frac{R - 1}{R} \), then \( \hat{p}(s^*) < p \).

We will see in the next section that this property is important for the welfare implications of the model.

### 3.3.1 Fact-checking and competition

So far we have proved that there is more fact checking under monopoly than when there are two or more firms competing. In the next proposition we generalize this result to an arbitrary increase in the number of firms:

**Proposition 6.** Increasing the number of firms decreases fact-checking, i.e. \( s^* \) decreases in \( N \).

The intuition of the result is the following: an increase in the number of firms makes fact-checking less profitable because it increases the probability that another firm publishes without fact-checking and it also increases the number of firms to share the revenues with in case no other media publishes without fact-checking. Moreover, sharing the market with a larger number of firms decreases the value of being in the market in the second period. As a result, increasing \( N \) leads media outlets to have lower standards for publishing a scandal. This result can be seen as a caveat to the reliability of competitive markets to deliver informative and fact-based media commentary, as maintained by the proponents of the theory of the marketplace of ideas.
3.3.2 Large $N$ scenarios

The analysis above rests on the assumption that $N < R$. This assumption makes sure that the profits from publishing a fake news as a monopolist, given by $1$, are smaller than the value of remaining in the market, given by $\frac{R}{N}$. Therefore, when $R < N$ no fake news in the most strict sense are published: conditional on being certain about the scandal, media outlets only publish true scandals. In other words, once fact-checking has taken place, only true news are published.

What happens if $N > R$? If nobody published fake news after the fact-checking stage, since $N > R$ any firm would have an incentive to unilaterally deviate and publish independently of the results of fact checking. Similarly, it cannot be the case that all firms publish with probability one independently of the fact-checking outcome. If that were the case, in fact, it would always be optimal to publish after receiving the leak rather than waiting. It follows that in any equilibrium with $N > R$, media outlets must mix when fact-checking reveals the scandal to be fake: this in turn means that in equilibrium, the expected return from publishing a fake news has to be equal to the cost $\frac{R}{N}$. Other than that, the main features of the equilibrium remain the same as in the $N < R$ case, and in particular the characterization of the strategy in the first stage does not change. We can summarize this in the following proposition:

**Proposition 7.** When $N > R$, media outlets follow a cutoff strategy in the first stage, with $s^*$ being described by the same condition as in the game with $N < R$. Conditional on fact-checking, media outlets always publish true scandals whereas they publish fake scandals with probability $1 - \sigma$ increasing in $N$.

Notice that as $N$ goes to infinity, $\sigma$ converges to zero, meaning that fake scandals are published with higher and higher probability even after fact-checking.
Moreover, notice that independently of the mixing, even in the $N > R$ game news published at the fact checking stage are more informative of a scandal than news published without fact checking, since true scandals are always published and fake scandals are always published with lower probability after fact checking compared to before fact checking. The reason for this is that, in equilibrium, 
\[ \frac{1-F_0(s^*)^N}{1-F_0(s^*)} = R - \frac{1-F_1(s^*)^{N-1}}{1-F_1(s^*)} \hat{p} < R. \]
As a result, it has to be the case that $\sigma > F_0(s^*)$, meaning that publication when the news is fake is more likely in the first stage.

### 3.4 Fact-checking and Political Accountability

This section adds an electoral choice to our model of media competition in order to evaluate how media behaviour influences the choices of voters, therefore influencing whether politicians are re-elected or ousted from office.

There are two candidates. Each of them can be corrupt or honest, depending on whether he is involved in a scandal or not. The utility from electing a clean candidate is 1, that from electing a dirty one is normalized at zero. Assume that both candidates have the same ex ante quality, meaning that they have the same unconditional probability of being dirty, and for the time being let’s assume that voters and media outlets assign the same prior probability to the candidate being dirty, denoted by $p$ as in the above analysis. Moreover, let’s assume that only the incumbent can be involved in a scandal newspapers can write about (for example because scandals involve their behaviour in office, or because the scandal of the incumbent will only be realized if he or she are elected). We will assume that voters are fully rational and update their prior by both reading about a scandal and not reading about a scandal (in other words, no news is good news).
In this section we will assume that readers only consult one media outlet. Since politicians are characterized by the same prior $p$, all that matters for the electoral choice is the direction of the update and not the size. Therefore, the electoral decision is the same independent of whether the reader consumes a fact-checked or a non-fact checked piece of news: any informative news of a scandal will lead to the dismissal of the incumbent in favour of the challenger.

One explanation for that might be that readers do not know the timing of the leak and therefore cannot infer from the timing of publication whether the news is fact-checked or not.

For maximum simplicity, let’s first assume that the economy is composed of only one reader. The first scenario we are going to analyze is one in which the reader picks randomly one of the media outlets. The outlet can be the same or change across the two stages of the game. The question we would like to answer is whether, in this economy, more media lead to a higher or lower probability of electing an honest politician (which we sometimes denote as welfare).

As we know from the analysis in the previous section, increasing $N$ decreases the threshold $s^*$ that each media uses to decide whether to publish without fact checking. As a result, the reader is more likely to encounter a scandal when consulting the news media and therefore she is less likely to vote for the incumbent. This means that dirty incumbents are less likely to be re-elected, but at the same time also clean incumbents are less likely to be re-elected. The following proposition proves that the trade-off can be resolved in both ways.

---

7. An extension of the model with different priors $p$ for challenger and incumbent would make the intensity of information important.

8. A model exploring the dynamics connected to the timing of leaks is Gratton (2016), in which the credibility of news depends on the timing of the release.

9. With multiple readers, the results of this section would have to account for the probability that a majority of readers read a media publishing or not publishing the scandal in the first period. However, the intuition of the results would remain very similar.
Proposition 8. When the reader selects one outlet randomly, the probability of having a clean politician in office can increase or decrease with $N$.

A necessary (but not sufficient) condition for an increase in $N$ to be welfare improving is therefore that $f_1(s^*) > f_0(s^*) + N f_1(s^*) F_1(s^*)^{N-1}$. In other words, the equilibrium threshold for publication $\hat{p}(s^*)$ has to be sufficiently larger than $p$, meaning that media outlets switch from fact-checking to publishing only when sufficiently bad news about the scandal arrives. From Lemma 5 we know that this can only happen if $N < (1 - p) R + p$. Notice that if fact checking were not possible, the optimal threshold for publication would be exactly the one distinguishing bad news from good news, i.e. $\hat{p}(s^*) = p$. As a result, as we increase $N$, the probability of having fact-checking decreases (both mechanically by the increase in $N$ and indirectly through the decrease in $s^*$), but at the same time the decrease in $s^*$ might be welfare improving given the decreased probability of having fact checking.

In order to consider a case in which fact-checking is not relevant for welfare except that through $s^*$, let’s now assume that elections are imminent and that any fact checked news will therefore necessarily arrive after the new leader has been elected. In this situation, non-fact checked news actually might serve a socially beneficial purpose, i.e. that of providing information on a scandal in time for the electoral choice, and in fact we show that increasing $N$ always increases welfare:

Proposition 9. With imminent elections, increasing $N$ increases welfare if and only if $\hat{p}(s^*) > p$.

The intuition of this result is that if fact checking is not useful for electoral purposes, the optimal publication threshold $s^*$ is finite. In particular, given the symmetry of the problem, a media outlet trying to maximize the voter’s
welfare would report the scandal if \( \hat{p}(s^*) > p \) and withhold it if \( \hat{p}(s^*) < p \). As we have seen from Lemma 5, market competition can make \( s^* \) lie both above and below this threshold. Therefore, when elections are imminent increasing the number of media is welfare improving if the market equilibrium makes media too reluctant to report news of a scandal.

Let’s now consider a different case, in which the reader, instead of selecting a newspaper at random independently of whether it mentions the scandal or not, reads one among the outlets (if any) which published the news of the scandal. In this case, compared to the previous one, the reader never misses a non-fact checked news. This means that if the politician is corrupt, the reader always ends up knowing it, either through a non-fact checked or through a fact checked news. As a result, all corrupt leaders are voted out of office, but some clean ones are, too. The expression for welfare becomes the following:

\[
1 - p^2 - p(1 - p)(1 - F_0(s^*))^N
\]

From this expression, it is immediate to see that as \( N \) increases, welfare decreases, since \( F_0(s^*) \) decreases.

**Proposition 10.** If readers read one outlet among those (if any) which talk about the corruption scandal, then welfare decreases as \( N \) increases.

This results tells us that as \( N \) increases, welfare increases only if the standards for publication of a scandal become stricter, i.e. \( s^* \) increases. However, we showed that what happens is exactly the opposite. The intuition for the welfare decrease is that with many media, it is more likely that one will get a high enough signal for publication. As a result, a reader will be very likely to find a scandal in the news and therefore to vote for the challenger even if the incumbent is clean.
Notice that both our welfare results point out that in the internet age, in which decreased entry barriers for media led to an increase in the number of outlets $N$, the resulting competitive pressure might be detrimental for welfare. The reason is that fact-checking is more likely to be election-relevant and that, at the same time, readers are more easily exposed to media mentioning a scandal (for example through social media). As a result, when evaluating the effect of the number of media on welfare, details such as the electoral relevance of fact checks and readers selection of the outlet to consult play a fundamental role.

3.5 Discussion

In this section we will discuss some key elements of the model and possible future extensions.

The first fundamental ingredient is the initial signal, that we assume all media receive at the same time. A particularly interesting extension of our model would be to have leaks being spread by interest groups acting strategically. For example, an interest group siding with the challenger might have the interest to spread scandals concerning the incumbent. In this extended game, leakers could choose either the timing of the information (in a similar fashion as in Gratton et al. (2016)), or the number of outlets receiving the leak, or even the realization of the signal $s$.

Another possible extension would be to allow media outlets to invest in fact-checking (for example by employing investigative journalists). This would be reminiscent of industrial organization models of investment in the quality of products with varying degrees of competition.

The other key element of our model is the cost for publishing a fake scandal, which we consider exogenous (it might represent for example libel lawsuits).
In real journalism, however, it is often up to competitors to expose as fake the scandal raised by another media outlet. Allowing for similar dynamics could be a significant addition to our model.

Finally, our political accountability results rest on the assumption that politicians have a fixed type, either honest or corrupt. However, it would be interesting to model corruption as an endogenous choice of politicians. In an environment where many fake scandals make the news, politicians might have a stronger incentive to become corrupt, as in a self-fulfilling prophecy.

3.6 Conclusion

This paper shows that increasing the competitive pressure to break a news can lead media outlets to be less demanding in the amount of evidence required to publish a story. In particular, we consider a case in which media outlets can accuse a politician of being involved in a scandal prior to an election: we show that when readers consult with priority one (if any) of the media talking about a scandal, then increasing the number of competitors decreases the probability of having a clean politician in office. Our results aim to pose a caveat to the claim that media pluralism always benefits democracy, suggesting that an increase in competition in the media sector might be socially damaging.
Appendices

A Proofs of chapter 1

Proof of Proposition 1

Proof. (i) Suppose good types follow their signal and bad types follow their private interest. Consistency of the beliefs requires:

\[
R(w, w) = \frac{\mu q}{\mu q + (1 - \mu) \frac{1}{2}}, \quad R(w, w^c) = \frac{\mu (1 - q)}{\mu (1 - q) + (1 - \mu) \frac{1}{2}}
\]  

(1)

Subtracting both reputations we have that taking the appropriate decision leads to higher reputation than taking the wrong one:

\[
R(w, w) - R(w, w^c) = \frac{2(2q - 1)(1 - \mu)}{1 - (2q - 1)^2 \mu^2} > 0
\]  

(2)

For good types, the expected utility of following the signal is given by \(q + \phi(q R(s, s) + (1 - q) R(s^c, s))\) and the expected utility from contradicting the signal is \((1 - q) + \phi((1 - q) R(s^c, s^c) + q R(s, s^c))\). Therefore good decision makers follow their signal if and only if:

\[
q + \phi(q R(s, s) + (1 - q) R(s^c, s)) > (1 - q) + \phi((1 - q) R(s^c, s^c) + q R(s, s^c))
\]  

(3)

And rearranging we get

\[
2q - 1 > \phi(1 - 2q)(R(s^c, s^c) - R(s, s^c))
\]  

(4)

and, from \(q > \frac{1}{2}\) we have that the left-hand-side is positive and the right-hand-side is negative. Thus \(R(w, w) > R(w, w^c)\) and good decision makers always follow their signal.

Regarding bad types, when the signal is aligned with their private interest it is immediate to see that they prefer to follow the signal. However,
when the signal contradicts the private interest, the utility of following the private interest is 
\[ 1 + \phi((1 - q)R(s^c, s^c) + qR(s, s^c)) \]
and the utility of contradicting the private interest is 
\[ \phi((1 - q)R(s^c, s) + qR(s, s)) \]
and bad decision makers follow their private interest if and only if
\[ 1 + \phi((1 - q)R(s^c, s^c) + qR(s, s^c)) > \phi((1 - q)R(s^c, s) + qR(s, s)) \] (5)

And rearranging we get:
\[ \phi < \frac{1}{(2q - 1)(R(s, s) - R(s^c, s))} \] (6)

Finally, plugging in the expression of the reputation functions, we obtain:
\[ \phi < \bar{\phi}_S(q, \mu) = \frac{1 - (2q - 1)^2 \mu^2}{2(2q - 1)^2(1 - \mu) \mu} \] (7)

Thus, when \( \phi < \bar{\phi}_S(q, \mu) \), there exists an equilibrium such that good types follow their signal and bad types follow their private interest.

(ii) Now, suppose good types follow their signals and bad types mix between following their signal and their private interest. In particular, let \( \alpha(0, \beta, \beta) = \beta \) and \( Pr(\alpha(0, \beta, \beta^c) = \beta) = x \in (0, 1] \). Notice that, in equilibrium \( x < 1 \) because for \( x = 1 \), we have that \( R(w, l) = \mu \) and without reputational incentives, bad types strictly prefer to follow their private interest than following the signal. But \( x \in (0, 1) \) requires bad types to be indifferent between following the signal and the private interest when \( s = \beta^c \). Consistency of the beliefs requires: 
\[ R(w, w) = \frac{\mu q}{\mu q + (1 - \mu) \frac{1}{2} q + xq + (1 - x)(1 - q)} \]
and 
\[ R(w, w^c) = \frac{\mu (1 - q)}{\mu (1 - q) + (1 - \mu) \frac{1}{2} (1 - q) + x(1 - q) + (1 - x)q} \].

And the \( x \) that makes a bad type indifferent between following the signal
and following the private interest when \( s = \beta^c \) is:

\[
x = \mu (2q - 1)(\phi - 1) - \sqrt{1 - \mu \phi (1 - 2q)^2 (2 - \mu \phi)} \over (1 - \mu) (2q - 1)
\]  \hspace{1cm} (8)

And \( x \in (0,1) \) if and only if \( \phi < \phi_S(q, \mu) \).

Finally notice that \( \phi_S(q, \mu) > 1 \):

\[
\phi_S(q, \mu) = \frac{1 - (2q - 1)^2 \mu^2}{2 (2q - 1)^2 (1 - \mu) \mu} > 1 \leftrightarrow \frac{1}{\mu (2 - \mu)} > (2q - 1)^2 \]  \hspace{1cm} (9)

Now, from \( \mu \in (0,1) \) we have that the left-hand-side is larger than one and from \( q \in (.5,1) \) the right-hand-side is smaller than one.

\[\square\]

**Proof of Corollary 2**

*Proof.* Good types always follow the signal independently of \( \phi \). When \( \phi \leq \phi_S \), bad types follow always their private interest and the probability of taking a correct decision is constant for all \( \phi \leq \phi_S \). When \( \phi > \phi_S \), the probability that a bad type follows the signal is increasing in \( \phi \). Therefore the probability of taking a correct decision is also increasing in \( \phi \).

\[\square\]

**Proof of Lemma 3**

*Proof.* First we will prove that for every \((\beta, s)\), \( Pr(\alpha(0, \beta, s) = \beta) \geq Pr(\alpha(1, \beta, s) = \beta) \). Let \( u(\theta, s, d) \) be the expected utility of a decision maker of type \( \theta \) and private interest \( \beta \) when he observes a signal \( s \) and takes a decision \( d \).
\[ u(1, \beta, \beta) - u(1, \beta, \beta^c) = 2q - 1 + \phi (q(R(\beta, \beta) - R(\beta, \beta^c)) + (1 - q)(R(\beta^c, \beta) - R(\beta^c, \beta^c)) \]
\[ < 1 + \phi (q(R(\beta, \beta) - R(\beta, \beta^c)) + (1 - q)(R(\beta^c, \beta) - R(\beta^c, \beta^c)) \]
\[ = u(0, \beta, \beta) - u(0, \beta, \beta^c) \tag{10} \]

\[ u(1, \beta^c, \beta) - u(1, \beta^c, \beta^c) = 1 - 2q + \phi ((1 - q)(R(\beta, \beta) - R(\beta, \beta^c)) + q(R(\beta^c, \beta) - R(\beta^c, \beta^c)) \]
\[ < 1 + \phi ((1 - q)(R(\beta, \beta) - R(\beta, \beta^c)) + q(R(\beta^c, \beta) - R(\beta^c, \beta^c)) \]
\[ = u(0, \beta^c, \beta) - u(0, \beta^c, \beta^c) \tag{11} \]

Thus, since low types always find more profitable than high types to follow the private interest than high types, if high types follow the private interest, low types to. In particular if \( x_\theta^s = Pr(\alpha(\theta, \beta, s) = \beta) \), then \( x_1^s \leq x_0^s \).

\[ R(\beta, \beta) = \frac{\mu(qx_1^\beta + (1 - q)x_1^\beta^c)}{\mu(qx_1^\beta + (1 - q)x_1^\beta^c) + (1 - \mu)(qx_0^\beta + (1 - q)x_0^\beta^c)} \tag{12} \]

\[ R(\beta, \beta^c) = \frac{\mu(q(1 - x_1^\beta) + (1 - q)(1 - x_1^\beta^c))}{\mu(q(1 - x_1^\beta) + (1 - q)(1 - x_1^\beta^c)) + (1 - \mu)(q(1 - x_0^\beta) + (1 - q)(1 - x_0^\beta^c))} \tag{13} \]

And, rearranging we get that \( R(\beta, \beta) > R(\beta, \beta^c) \) if and only if

\[ \frac{qx_1^\beta + (1 - q)x_1^\beta^c}{qx_0^\beta + (1 - q)x_0^\beta^c} > \frac{q(1 - x_1^\beta) + (1 - q)(1 - x_1^\beta^c)}{q(1 - x_0^\beta) + (1 - q)(1 - x_0^\beta^c)} \tag{14} \]

The left-hand-side is smaller than 1 and the right-hand-side is larger. Therefore, it has to be that \( R(\beta, \beta) \leq R(\beta, \beta^c) \). Analogously, we get \( R(\beta^c, \beta) \leq R(\beta^c, \beta^c) \). Finally notice that \( R(\beta^c, \beta) \leq \mu \leq R(\beta^c, \beta^c) \)

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Proof of Lemma 4

Proof. From the previous lemma we know that, in equilibrium, for every realization of the state of the world, reputation is higher when the decision maker contradicts the private interest than when he follows it. Given that when \( s = \beta^c \), \( w = \beta^c \) is more likely than \( w = \beta \), good decision makers always choose \( \beta^c \). \( \square \)

Proof of Proposition 5

Proof. Suppose \( \alpha(1, s) = 1_{s=\beta} \) and \( \alpha(0, s) = 1 \). Consistency of the beliefs requires \( R(w, \beta, \beta^c) = 1 \), \( R(\beta, \beta, \beta) = \frac{\mu q}{\mu q + (1 - \mu)} \) and \( R(\beta, \beta, \beta) = \frac{\mu (1 - q)}{\mu (1 - q) + (1 - \mu)} \).

The incentive compatibility condition for good types is:

\[
\phi < \phi_1 = \frac{(2q - 1) (\mu + \mu^2(q - 1)q - 1)}{(1 - \mu)(\mu(2(q - 1)q + 1) - 1)} \tag{15}
\]

and the incentive compatibility condition for low types is:

\[
\phi < \phi_0 = \frac{1 - \frac{\mu^2(q - 1)q}{(1 - \mu)(2\mu(q - 1)q + 1)}}{(1 - \mu)(2\mu(q - 1)q + 1)} \tag{16}
\]

Let \( \bar{\phi}_D := \min(\phi_0, \phi_1) \). Therefore this equilibrium exists if and only if \( \phi < \bar{\phi}_D \).

Finally from \( \mu \in (0, 1) \) and \( q \in (.5, 1) \), it follows that both \( \phi_0 \) and \( \phi_1 \) are strictly positive. \( \square \)

Proof of Corollary 6

Proof. We will prove that \( \phi_0 < \bar{\phi} \).

\[
\text{sign} \ (\phi_0 - \bar{\phi}) = \text{sign} \left( \frac{\mu(\mu + 2(2\mu - 3)(q - 1)q - 2) + 1}{2(\mu - 1)\mu(1 - 2q)^2(2\mu(1 - q) + 1)} \right)
\]

\[
= -\text{sign} \ (\mu(\mu + 2(2\mu - 3)(q - 1)q - 2) + 1) \tag{17}
\]

\[
= -1 \square
\]
Proof of Lemma 7

Proof.

\[ \phi_1 - \phi_0 = \frac{(\mu + \mu^2(q - 1)q - 1)(\mu + 2q(2\mu(q - 1)q + 1) - 2)}{(\mu - 1)(2\mu(q - 1)q + 1)(\mu(2(q - 1)q + 1) - 1)} \quad (18) \]

And, rearranging we get that \( \phi_1 - \phi_0 > 0 \) if and only if

\[ \mu > \bar{\mu} = \frac{2 - 2q}{4(q - 1)q^2 + 1} \quad (19) \]

And \( \frac{\partial \bar{\mu}}{\partial q} < 0. \)

Proof of proposition 8

Proof. Suppose there exists an equilibrium such that good types follow the signal and the strategy of bad types is such that \( \alpha(0, \beta) = 1 \) and \( Pr(\alpha(0, \beta^e) = \beta) = x \in (0, 1) \). Let \( \Delta R(s) \) be the reputational gains from contradicting the private interest when the signal is \( s \). In particular,

\[ \Delta R(\beta) = q(R(\beta, \beta^e) - R(\beta, \beta)) + (1 - q)(R(\beta^c, \beta^e) - R(\beta^c, \beta)) \quad (20) \]

\[ \Delta R(\beta^e) = q(R(\beta^e, \beta^e) - R(\beta^e, \beta)) + (1 - q)(R(\beta^e, \beta^e) - R(\beta^e, \beta)) \quad (21) \]

Since in both signals, good types contradict their private interest with higher probability, \( R(w, \beta^e) > R(w, \beta) \) and \( \Delta R(s) > 0 \). Thus, when \( s = \beta^e \) good types follow the signal because it increases both their reputation and their present utility and for good types we only have to show that they follow the signal when \( s = \beta \). Regarding bad types, if good types follow the signal when \( s = \beta \), bad types will follow the signal too. Therefore we only have to check that when \( s = \beta^e \), there exists an \( x \) such that they are indifferent.

Regarding good types, notice that from \( \phi < \phi_1 \) we know that, when \( x = 0 \), good types strictly prefer to follow the private interest when \( s = \beta \). Now,
notice that $\frac{\partial}{\partial x} R(s, \beta) > 0$ and $\frac{\partial}{\partial x} R(s, \beta^c) < 0$. Therefore $\frac{\partial}{\partial x} \Delta R(s) < 0$, that is, the reputational gains of contradicting the private interest are decreasing on $x$ and, therefore good types strictly prefer to follow the private interest when $s = \beta$ for any $x \in (0, 1)$.

Finally, regarding bad types notice that when $x = 0$, $\phi R(\beta^c) > 1$ and when $x = 1$, $\phi R(\beta^c) = 0$. Therefore by Bolzano’s theorem there exists an $x \in (0, 1)$ such that $\phi R(\beta^c) - 1 = 0$.

Proof of Corollary 9

**Proof.** The expected reputation gain from following the signal when $s = \beta^c$ without disclosure is $\phi((2q - 1)(R(w, w) - R(w, w^c))$ and the expected reputation gain with disclosure is $\phi(q(R(\beta, \beta^c, \beta^c) - R(\beta, \beta^c, \beta)) + (1 - q)((R(\beta, \beta, \beta^c) - R(\beta, \beta, \beta)))$ and the second expression always exceeds the first one.

Proof of proposition 10

**Proof.** (i) Suppose $\alpha(1, s) = \beta^c$ and $\alpha(0, s) = \beta$. Consistency of the beliefs requires $R(w, \beta, d)$ to be such that $R(w, \beta, \beta) = 0$ and $R(w, \beta, \beta^c) = 1$.

With these reputational incentives, good types only experience a trade-off when the signal coincides with the private interest and the condition to sustain their strategy in equilibrium is $q < (1 - q + \phi \leftrightarrow 2q - 1 < \phi$. The problem of bad types does not depend on the signal they receive and the condition to sustain their strategy in equilibrium is $\phi < 1$. Therefore this equilibrium exists when $2q - 1 < \phi < 1$.

(ii) Suppose $\alpha(1, s) = \beta^c$, $Pr(\alpha(0, \beta) = \beta) = x$ and $Pr(\alpha(0, \beta^c) = \beta) = y$. 

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First of all notice that \( x = y \). Suppose without loss of generality that \( x < y \), then \( R(\beta, \beta^c) - R(\beta, \beta) < R(\beta^c, \beta^c) - R(\beta^c, \beta) \), and low types would have higher reputational incentives to contradict the private interest when \( s = \beta^c \) which is a contradiction with the indifferent condition in both signals. Then, when \( x = y \), Consistency of the beliefs requires \( R(w, \beta, \beta) = 0 \), \( R(w, \beta, \beta^c) = \frac{\mu}{\mu+(1-x)(1-%mu)} \), bad types are indifferent between following and contradicting the private interest if \( 1 = \phi \frac{\mu}{\mu+(1-x)(1-%mu)} \) and \( x = 1 - \frac{\mu(\phi-1)}{1-%mu} \). The reputation incentives of contradicting the private interest are \( R(w, \beta, \beta^c) = \frac{1}{\phi} \) and good types always contradict the private interest. This equilibrium exists if \( x \in (0,1) \) and this happens when \( 1 < \phi < 1 \frac{1}{\mu} \).

(iii) Suppose \( \alpha(1, s) = \beta^c \) and \( \alpha(0, s) = \beta^c \). Consistency of the beliefs requires \( R(w, \beta, \beta^c) = \mu \) and the less restrictive out of equilibrium belief is \( R(w, \beta, \beta) = 0 \). The binding incentive compatibility condition of good decision makers is \( 2q - 1 < \phi \mu \) and the incentive compatibility condition of bad decision makers is \( 1 < \phi \mu \). Therefore, this equilibrium exists when \( 1 < \frac{1}{\mu} < \phi \).

\[ \square \]

**Proof of corollary 11**

*Proof.* A Disciplining Effect Equilibrium exists if \( \phi \in [\phi_0, \phi_1] \) and a Pandering Equilibrium exists if \( \phi > 2q - 1 \). In order to prove that for any \((\mu, q)\), if a Disciplining Effect equilibrium exists, a Pandering Equilibrium exists too, it is sufficient to prove that for any \((\mu, q)\), \( 2q - 1 < \phi_j \) for \( j \in \{0,1\} \).

Notice that \( \phi_0 < 2q - 1 \) if and only if:
\[
\frac{\mu(2q - 1)(1 - \mu + (3\mu - 2)(1 - q)q)}{(1 - \mu)(1 - \mu(2(q - 1)q + 1))} > 0 \quad (22)
\]

Which always holds because the denominator is positive and the numerator too. And \(\phi_1 < 2q - 1\) if and only if:

\[
1 < \frac{(1 - \mu(1 - q))(1 - \mu q)}{(1 - \mu)(1 - \mu(1 - 2(1 - q)q))} \quad (23)
\]

Which is always satisfied for \(\mu \in (0, 1)\) and \(q \in (.5, 1)\). \(\square\)

**Proof of Proposition 12**

*Proof. (i) Follows from Proposition 5. (ii) follows from Proposition 8. (iii) follows from Proposition 10.* \(\square\)

**Proof of Lemma 13**

*Proof. When \(\phi \leq \phi_S\), an increase in \(\phi\) does not change the behaviour of any of the types and the probability of having a good type in the second period is constant. However, when \(\phi > \phi_S\), the probability that a bad type follows the signal is increasing and \(R(w, w)\) decreases and \(R(w, w^c)\) increases, therefore, the probability that a good type is reelected decreases and the probability that a bad type is reelected increases. Thus, the probability of having a good type in the second period increases.* \(\square\)

**Proof of Lemma 14**

*Proof. When \(\phi < \phi_D\), good types follow the signal and bad types follow their private interest both with disclosure and without disclosure. is*
Without disclosure, the probability that a good type is reelected is:

\[
E[R|\theta = 1, ND] = qR(w, w) + (1 - q)R(w, w^c)
\]  \hspace{1cm} (24)

And the probability that a bad type is reelected is:

\[
E[R|\theta = 0, ND] = \frac{1}{2}(R(w, w) + R(w, w^c))
\]  \hspace{1cm} (25)

The probability of having a good type in period 2 is:

\[
Pr[\theta_2 = 1|ND] = \mu(E[R|\theta = 1, ND] + (1 - E[R|\theta = 1, ND])\mu) + (1 - \mu)(1 - E[R|\theta = 0, ND])\mu
\]  \hspace{1cm} (26)

And, plugging-in the reputation expression we get:

\[
Pr[\theta_2 = 1|ND] = \frac{\mu(-\mu((\mu - 3)\mu + 1)(1 - 2q)^2 - 1)}{\mu^2(1 - 2q)^2 - 1}
\]  \hspace{1cm} (27)

Now, with disclosure, the probability that a good type is reelected is:

\[
E[R|\theta = 1, D] = \frac{1}{2}(q(R(\beta, \beta, \beta) + R(\beta, \beta^c, \beta^c)) + (1 - q)(R(\beta, \beta, \beta^c) + R(\beta, \beta^c, \beta))
\]  \hspace{1cm} (28)

And the probability that a bad type is reelected is:

\[
E[R|\theta = 0, D] = \frac{1}{2}(R(\beta, \beta, \beta) + R(\beta, \beta^c, \beta))
\]  \hspace{1cm} (29)

The probability of having a good type in period 2 is:

\[
Pr[\theta_2 = 1|D] = \mu(E[R|\theta = 1, D] + (1 - E[R|\theta = 1, D])\mu) + (1 - \mu)(1 - E[R|\theta = 0, D])\mu
\]  \hspace{1cm} (30)

And, plugging-in the reputation expression we get:

\[
Pr[\theta_2 = 1|D] = \frac{\mu(\mu(\mu - 2((\mu - 3)\mu + 1)(q - 1)q + 4) - 3)}{2(\mu + \mu^2(q - 1)q - 1)}
\]  \hspace{1cm} (31)

Finally,
\[ Pr[\theta_2 = 1|D] - Pr[\theta_2 = 1|ND] = \frac{(\mu - 1)^2 \mu (\mu + 2(2\mu - 3)(q-1)q - 2) + 1}{2(\mu^2 (1-2q)^2 - 1)(\mu + \mu^2 (q-1)q - 1)} > 0 \] (32)

The proof of the rest of the cases is analogous.

\[ \square \]

**Proof of proposition 15**

*Proof.* Follows from Lemma 13 and 14.

\[ \square \]

**Proof of proposition 16**

*Proof.* Analogously to the case \( n = 2 \), we compute \( \phi_0 \) and \( \phi_1 \) and the condition such that \( \phi_0 < \phi_1 \) is given by \( \mu > \mu(q,n) \) where:

\[ \mu(q,n) := \frac{(n-1)^2 n(1-q)}{n(n(2(q-1)q + 1) + q((q-5)q + 3) - 2) + 2q + 1} - 1 \] (33)

Notice that \( \mu(q, 2) = \bar{\mu}(q) \) that we computed previously and \( \mu(q,n) \) is decreasing in \( q \) and in \( n \).

\[ \square \]

**Proof of lemma 17**

*Proof.* When contradicting the private interest, the probability of taking an appropriate decision is:

\[ \Pi(n) = \frac{1}{n} \left( (n-1)q + \frac{1-q}{n-1} \right) \] (34)

Notice that \( \Pi(2) = 2 \) which is the expression we already obtained in the model.

Finally, we compute the partial derivative of \( \Pi \) with respect to \( n \) and we obtain:

\[ \frac{\partial \Pi}{\partial n} = \frac{1 + n(-2 + nq)}{(n-1)^2 n^2} \] (35)
which is positive if and only if $\frac{2n-1}{n^2} < q$ which always hold because

$$\frac{2n-1}{n^2} = \frac{2 - \frac{1}{n}}{n} < \frac{1}{n} < q \quad (36)$$

\[ \square \]

**Proof of proposition 18**

**Proof.** First of all we will derive the equilibrium with secrecy for $n > 2$. Analogously to the case $n = 2$, it is always sustainable for good types to follow the signal. With this strategy, in equilibrium, bad types can either follow follow their private interest or mix between following the private interest and the signal. Any other action would be suboptimal because it would reduce the expected reputation with respect to following the signal without increasing the present utility. Now, notice that the equilibrium us such that, there exists a $\phi_S$ such that when $\phi < \phi_S$, bad types follow the private interest and when $\phi \geq \phi_S$, bad types follow the signal with probability $x$ and follow the private interest with probability $1 - x$.

It is immediate to see that:

$$\phi_S = \frac{(n - 1)(\mu(nq - 1) + 1)(n(\mu q - 1) + 1 - \mu)}{(1 - \mu)\mu n(nq - 1)^2} \quad (37)$$

$$x = \frac{n^2 - 3n + 2 + \mu(nq - 1)(n(\phi - 2) + 2) - n\sqrt{\mu^2 \phi^2(nq - 1)^2 - 2\mu(n - 1)(2q - 1)\phi(nq - 1) + (n - 1)^2}}{2(1 - \mu)(nq - 1)(n - 1)} \quad (38)$$

And, in terms of welfare, the probability that an appropriate decision is taken is:

$$W_S = \frac{n - 1 + \mu \phi(nq - 1) - \sqrt{\mu^2 \phi^2(nq - 1)^2 - 2\mu(n - 1)(2q - 1)\phi(nq - 1) + (n - 1)^2}}{2(n - 1)} \quad (39)$$
Now, regarding the Pandering equilibrium, let’s focus on the case such that all types follow the signal when it does not coincide with their private interest and they mix between the remaining actions when it does. We can impose the out of equilibrium belief \( R(w = W, d = \beta) = 0 \) and consistency of the beliefs requires \( R(w = W, d \neq \beta) = \mu \). Now, the only binding IC condition is for bad types and it is simply:

\[
\bar{\phi}_D := \frac{1}{\mu} < \phi
\]  

(40)

Now, in terms of welfare, the probability that an appropriate decision is taken is:

\[
W_D = \frac{(n - 2)qn + 1}{(n - 1)n}
\]  

(41)

Notice that \( \bar{\phi}_D < \bar{\phi}_S \), that is when there exists a mixed equilibrium with secrecy, there exists the disclosure Pandering equilibrium too. Finally, \( W_D > W_S \) if and only if:

\[
\phi > \hat{\phi} := \frac{(n^2(1 - q) + n(2q - 1) - 1)((n - 2)qn + 1)}{\mu n(qn - 1)^2}
\]  

(42)

Notice that \( \frac{\partial \hat{\phi}}{\partial n}, \frac{\partial \hat{\phi}}{\partial \mu} \) and \( \frac{\partial \hat{\phi}}{\partial q} < 0 \)

\[ \square \]

**Proof of proposition 19**

Proof. Since good types only maximize their reputation and do not care about the decision, they will simply take the decision that gives them higher reputation. We will distinguish between two situations. Suppose \( R \) is constant, when this is the case, bad types always follow the private interest. Now, in order to satisfy the beliefs, good types should also follow their private interest. However, this is PBE is not attractive. Therefore it has to be that the reputa-
tion from contradicting the private interest is larger than the reputation from following it and then, good types always contradict their private interest.
B Proofs of chapter 2

Proof of Lemma 1

Proof. When $\omega = -1$, a citizen $i$ prefers $S$ to $R$ if and only if $u_i(-1, S) > u_i(-1, R)$. Rearranging we get:

\[
\begin{align*}
    u_i(-1, S) - u_i(-1, R) &= (-1 + v_i - S)^2 + (-1 + v_i - R)^2 \\
    &= (1 - v_i - S)^2 + (1 + v_i - S)^2 \\
    &= -((-1 + v_i)^2 - 2(-1 + v_i)S + S^2) + ((1 - v_i)^2 + 2(-1 + v_i)S + S^2) \\
    &= 4(-1 + v_i)S > 0
\end{align*}
\]

Analogously when $\omega = 1$. \hfill \square

Proof of Lemma 2

Proof. Given $\pi_k$, the indifferent voter between Status Quo and the reform is $2\pi_k - 1$. Given that voter’s preferences follow a uniform distribution this is also the share of voters of Status Quo and is increasing in $\pi_k$. \hfill \square

Proof of Lemma 3

Proof.

\[
\Pi_k < \Pi_{k+1} \iff \frac{\pi(S,k)}{\pi(S,k+1)} < \frac{\pi(R,k)}{\pi(R,k+1)} \quad (1)
\]

Now we just have to plug the expressions of $\pi(\omega, k)$:

\[
\begin{align*}
\frac{\binom{n}{k}(\sigma + (1 - \sigma)q)^k(1 - (\sigma + (1 - \sigma)q))^{n-k}}{\binom{n}{k+1}(\sigma + (1 - \sigma)q)^{k+1}(1 - (\sigma + (1 - \sigma)q))^{n-k-1}} &< \\
\frac{\binom{n}{k}(\sigma + (1 - \sigma)(1 - q))^k(1 - (\sigma + (1 - \sigma)(1 - q)))^{n-k}}{\binom{n}{k+1}(\sigma + (1 - \sigma)(1 - q))^{k+1}(1 - (\sigma + (1 - \sigma)(1 - q)))^{n-k-1}} &\leftrightarrow \quad (2)
\end{align*}
\]
\[
\frac{(p + (1 - \sigma)q)k(1 - (\sigma + (1 - \sigma)q))^{n-k}}{(\sigma + (1 - \sigma)q)^{k+1}(1 - (\sigma + (1 - \sigma)q))^{n-k-1}} < \\
\frac{(\sigma + (1 - \sigma)(1 - q))^k(1 - (\sigma + (1 - \sigma)(1 - q)))^{n-k}}{(\sigma + (1 - \sigma)(1 - q))^{k+1}(1 - (\sigma + (1 - \sigma)(1 - q)))^{n-k-1}} \leftrightarrow (3)
\]

\[
\frac{(1 - (\sigma + (1 - \sigma)q))}{(\sigma + (1 - \sigma)q)} < \frac{(1 - (\sigma + (1 - \sigma)(1 - q)))}{(\sigma + (1 - \sigma)(1 - q))} \leftrightarrow (4)
\]

\[
\frac{(1 - \sigma)(1 - q)}{(\sigma + (1 - \sigma)q)} < \frac{(1 - \sigma)q}{(\sigma + (1 - \sigma)(1 - q))} \leftrightarrow (5)
\]

\[
(1 - q)(\sigma + (1 - \sigma)(1 - q)) < q(\sigma + (1 - \sigma)q) \leftrightarrow (6)
\]

\[
\sigma(1 - 2q) < (1 - \sigma)(q^2 - (1 - q)^2) \leftrightarrow (7)
\]

Which from \(\sigma \in [0, 1]\) and \(q \in (\frac{1}{2}, 1)\) always holds because the LHS is negative and the RHS is positive. \(\square\)

**Proof of Proposition 4**

Proof. (i) When \(k < n - 1\), the proof is analogous to the proof of Lemma 3 for \(\sigma = 0\).

(ii) When \(k = n\),

\[
\Pi_{n-1} < \Pi_n \leftrightarrow (8)
\]

\[
\Pi_{n-1} < \frac{(1 - p_H)\pi(S, n) + \frac{p_H}{2}}{(1 - p_H)(\pi(S, n) + \pi(R, n)) + p_H} \leftrightarrow (9)
\]

\[
\Pi_{n-1} ((1 - p_H)(\pi(S, n) + \pi(R, n)) + p_H) < (1 - p_H)\pi(S, n) + \frac{p_H}{2} \leftrightarrow (10)
\]
\[ \Pi_{n-1} ((\pi(S,n) + \pi(R,n)) + p_H (1 - (\pi(S,n) + \pi(R,n)))) < \pi(S,n) + p_H \left( \frac{1}{2} - \pi(S,n) \right) \leftrightarrow (11) \]

\[ p_H < \hat{p} = \frac{\pi(S,n) - \Pi_{n-1} ((\pi(S,n) + \pi(R,n)))}{(\Pi_{n-1} (1 - (\pi(S,n) + \pi(R,n))) - (\frac{1}{2} - \pi(S,n))} \leftrightarrow (12) \]

Finally we have to show that \( \hat{p} \in [0,1] \). But notice that \( \lim_{p \to 0} \Pi_n = \frac{\pi(S,n)}{\pi(S,n) + \pi(R,n)} > \Pi_{n-1} \) and \( \lim_{p \to 1} \Pi_n = \frac{1}{2} < \Pi_{n-1} \). Therefore, \( \hat{p} \in [0,1] \).

(iii) We want to show that \( \frac{1}{2} < \Pi_n \).

\[ \frac{1}{2} < \Pi_n \leftrightarrow (13) \]

\[ \frac{1}{2} < \frac{(1 - p_H)\pi(S,n) + \frac{p_H}{2}}{(1 - p_H)(\pi(S,n) + \pi(R,n)) + p_H} \leftrightarrow (14) \]

\[ (1 - p_H)(\pi(S,n) + \pi(R,n)) + p_H < 2(1 - p_H)\pi(S,n) + p_H \leftrightarrow (15) \]

\[ \pi(R,n) < \pi(S,n) \leftrightarrow (16) \]

Which always holds.

\[ \square \]

Proof of Lemma 5

Proof. Suppose that three experts advise the reform. Given that experts only advise the reform if they are unbiased and they received a signal in favour
of the reform, this means that two experts have received and the third has received a signal in favour of Status Quo.

\[
\pi'_0(s) = \frac{q'_c(1-q)^3}{q'_c(1-q)^3 + (1-q'_c)q^3}
\]  
(17)

And \(\pi'_0(s) < \frac{1}{2}\) if and only if:

\[
q'_c(1-q)^3 < (1-q'_c)q^3
\]  
(18)

\[
q'_c(1-q)^3 < (1-q'_c)q^3
\]  
(19)

From \(q'_c < q\), we have that \(1 - q'_c > 1 - q\) and, from both inequalities we have \(\frac{q'_c}{1-q'_c} < \frac{q}{1-q}\) and, therefore \(q'_c(1-q) < q(1-q'_c)\). Now, we multiply both sides by \((1-q)^2\) and we get \(q'_c(1-q)^3 < q(1-q)^2(1-q'_c)\) and the RHS is smaller than \(q^3(1-q'_c)\). Thus, \(\pi'_0(s) < \frac{1}{2}\) and, from the previous lemma, \(\pi'_0(r) < \pi'_0(s) \leq \frac{1}{2}\).

If only two experts advise the reform, we have that \(\pi'_1(s) < \frac{1}{2}\) if and only if \(q'_c(1-q) < (1-q'_c)q\) which always holds.

\[
\text{Proof of Proposition 6}
\]

\textit{Proof.} The first three statements are trivial and follow a proof similar to the one of the previous lemma. Regarding the third one,

\[
\pi'_3(r) = \frac{(1-q'_c)(p_H + (1-p_H)q)^3}{(1-q'_c)(p_H + (1-p_H)q^3) + q'_c(p_H + (1-p_H)(1-q)^3)}
\]  
(20)

And Status Quo is implemented if and only if \(\pi'_3(r) \geq \frac{1}{2}\) which happens if and only if:
\[(1-q_c')(p_H + (1-p_H)q^3) \geq q_c'(p_H + (1-p_H)(1-q_c)^3) \] (21)

\[p_H \leq p = \frac{(1-q_c')q^3 - q_c'(1-q)^3}{(1-(1-q)^3)q_c' - (1-q^3)(1-q_c')} \] (22)

Finally we have to prove that \(p \in (0, 1)\).

When \(p_H = 0\),
\[\pi'(r) = \frac{(1-q_c')q^3}{(1-q_c')q^3 + q_c'(1-q)^3} \] (23)
And \(\pi'(r) > \frac{1}{2}\) if and only if:
\[(1-q_c')q^3 > q_c'(1-q)^3 \] (24)
And, from the proof of the previous proposition, this is always satisfied.

When \(p_H = 1\),
\[\pi'(r) = \frac{(1-q_c')}{(1-q_c') + q_c'} \] (25)
And \(\pi'(r) < \frac{1}{2}\) if and only if \(q_c' > \frac{1}{2}\) which always holds.

Therefore, \(p \in (0, 1)\).

\[\square\]

**Proof of Corollary 7**

*Proof.* The proof is analogous to the proof of the previous proposition. \(\square\)
C Proofs of chapter 3

Proof of Lemma 1

Proof. 
\[ \hat{p}(s) = \frac{pf_1(s)}{pf_1(s) + (1-p)f_0(s)} = \frac{p}{p + \frac{1-p}{\psi(s)}} \]

And
\[ \hat{p}'(s) = \frac{p(1-p)}{(p\psi(s) + (1-p))^2} \psi'(s) > 0 \]

Finally, the image of \( \hat{p} \) is the set \((0,1)\) because \( \hat{p} \) is a continuous function and the \( \lim_{s \to +\infty} \hat{p}(s) = 1 \) and \( \lim_{s \to -\infty} \hat{p}(s) = 0 \). \( \square \)

Proof of Lemma 2

Proof. The pay-off from publishing the news is \( \Pi_1 = \hat{p}(s)r_1 + (1-\hat{p}(s))(r_0 - c) \). The pay-off from fact-checking is \( \Pi_0 = \hat{p}(s)\frac{\gamma}{N} \). The indifference point is such that \( \Pi_1 = \Pi_0 \) and it yields the following condition:
\[ \hat{p}(s^*) = \frac{c - r_0}{c - r_0 + r_1 - \frac{\gamma}{N}}. \] (1)

The right-hand-side is a constant and bounded by 0 and 1. To see that it is higher than 0 notice that both the numerator and the denominator are positive. The numerator because by definition \( r_0 \leq 1 \) and \( c > 1 \), the denominator because \( r_1 \geq \frac{1}{N} \geq \frac{\gamma}{N} \). It is lower than one because the numerator is always lower than the denominator (strictly if \( N > 1 \)).

The left-hand-side is increasing in \( s \) and the range is \((0,1)\). Therefore, there always exists a unique \( s^* \) that solves the indifference condition and, in any equilibrium, media publishes the scandal if \( s \geq s^* \) and fact checks otherwise. \( \square \)
Proof of Lemma 3

Proof. First notice that
\[ \frac{1}{k+1} \binom{N-1}{k} = \frac{1}{k+1} \frac{(N-1)!}{k!(N-1-k)!} = \frac{N!}{N(k+1)!(N-1-k)!} = \frac{1}{N} \binom{N}{k+1}. \]

Plugging-in this identity in \( r_j \) and multiplying and dividing by \( 1 - F_j(s^\ast) \) we get:

\[ r_j = \frac{1}{N} \frac{1}{1 - F_j(s^\ast)} \sum_{k=0}^{N-1} \binom{N}{k+1} (1 - F_j(s^\ast))^{k+1} F_j(s^\ast)^{N-1-k} \]

Let’s then add and subtract \( \frac{1}{N} \frac{F_j(s^\ast)^N}{1 - F_j(s^\ast)} \). We can now rewrite the expression as:

\[ r_j = \frac{1}{N} \frac{1}{1 - F_j(s^\ast)} \sum_{k=-1}^{N-1} \binom{N}{k+1} (1 - F_j(s^\ast))^{k+1} F_j(s^\ast)^{N-1-k} - \frac{1}{N} \frac{F_j(s^\ast)^N}{1 - F_j(s^\ast)}. \]

Now, substituting \( k = k' - 1 \), we have that the summation of the previous equation is simply the sum of the probabilities of all possible events of a discrete binomial distribution which have to sum 1. Therefore we are left with

\[ r_j = \frac{1}{N} \frac{1 - F_j(s^\ast)^N}{1 - F_j(s^\ast)} \]

In order to show that this expression is increasing in \( s^\ast \) we can use the well known formula for the summation of a geometric series to get:

\[ r_j = \frac{1}{N} \sum_{k=0}^{N-1} F_j(s^\ast)^k \]

and it is immediate to verify that this is increasing in \( s^\ast \), given that for any \( k \geq 0 \), \( F_j(s^\ast) \) is increasing in \( s^\ast \). 

\( \square \)
Proof of Theorem 4

Proof. In equilibrium, the following has to hold:

\[ \hat{p}(s^*) = \frac{c - r_0}{c - r_0 + r_1 - \frac{F_1(s^*)^{N-1}}{N}} \]

We know that \( \hat{p}(s^*) \) is strictly increasing in \( s^* \), approaching 0 as \( s^* \) goes to \( -\infty \) and approaching 1 as \( s^* \) goes to \( +\infty \). As far as the right hand side is concerned, we can rewrite it as:

\[ \frac{1}{1 + \frac{1-F_1(s^*)^{N-1}}{c-r_0}} \]

We know that as \( s^* \) goes to \( +\infty \), \( r_j \) and \( F_j(s^*) \) go to 1. If \( s^* \) goes to \( -\infty \), on the other hand, \( r_j \) goes to \( \frac{1}{N} \) and \( F_j(s^*) \) goes to 0. It follows that \( \lim_{s^* \to +\infty} \frac{c-r_0}{c-r_0 + r_1 - \frac{F_1(s^*)^{N-1}}{N}} = \frac{c-1}{c-1/N} < 1 \) and \( \lim_{s^* \to -\infty} \frac{c-r_0}{c-r_0 + r_1 - \frac{F_1(s^*)^{N-1}}{N}} = \frac{c-1/N}{c} > 0 \) and we can see that \( \forall N > 1 \frac{c-1}{c-1/N} < \frac{c-1/N}{c} \), since \( 1 + (N-2)cN > 0 \). This means that \( \lim_{s^* \to -\infty} \frac{c-r_0}{c-r_0 + r_1 - \frac{F_1(s^*)^{N-1}}{N}} > \lim_{s^* \to +\infty} \frac{c-r_0}{c-r_0 + r_1 - \frac{F_1(s^*)^{N-1}}{N}} \). Moreover, it is immediate to verify that \( \frac{c-r_0}{c-r_0 + r_1 - \frac{F_1(s^*)^{N-1}}{N}} \) is continuous. In order to show that it is strictly decreasing, let’s focus on the ratio \( \frac{r_1-F_1(s^*)^{N-1}/N}{c-r_0} \). It is immediate to verify that the denominator is decreasing in \( s^* \), since \( r_0 \) increases in \( s^* \). As far as the numerator is concerned, we can rewrite it as \( \frac{1}{N} \frac{1-F_1(s^*)^{N}}{1-F_1(s^*)} - \frac{1}{N}F_1(s^*)^{N-1} \). This can be rearranged into \( \frac{1}{N-1} \frac{1-F_1(s^*)^{N}}{1-F_1(s^*)} - \frac{1}{N}r_1(N-1) \), i.e. it is proportional to the revenue when the number of players is \( N - 1 \) instead of \( N \). Since \( r_1 \) is increasing in \( s^* \) for all \( N \), this is also increasing in \( s^* \). Therefore, \( \frac{c-r_0}{c-r_0 + r_1 - \frac{F_1(s^*)^{N-1}}{N}} \) is strictly decreasing in \( s^* \). However, since \( \hat{p} \) is strictly increasing in \( s^* \) and since \( \lim_{s^* \to +\infty} \hat{p}(s^*) < \lim_{s^* \to -\infty} \hat{p}(s^*) \) and \( \lim_{s^* \to -\infty} \hat{p}(s^*) > \lim_{s^* \to +\infty} \hat{p}(s^*) \), there exists a unique \( s^* \) solving the above equation. Hence the symmetric equilibrium exists and is unique. \( \square \)

Proof of Lemma 5

Proof. Consider the indifference condition \( \hat{p}(s^*) = \left( \frac{c-r_0}{c-r_0 + r_1 - \frac{F_1(s^*)^{N-1}}{N}} \right) \). The right-hand side takes values in \( (\frac{c-1}{c}, \frac{c-1/N}{c}) \) A sufficient condition for \( \hat{p}(s^*) > p \)
is therefore that \( p < \frac{c-1}{c-N} \). We can rewrite this as \( c > \frac{1-p}{1-p} \). On the other hand, a sufficient condition for \( \hat{p}(s^*) < p \) is that \( p > \frac{c-1/N}{c-N} \), which can be rewritten as \( p > \frac{R-1}{R} \).

\[ \square \]

**Proof of Proposition 6**

**Proof.** Let \( s^* \) be the equilibrium threshold. Thus \( s^* \) solves the indifference condition:

\[ \hat{p}(s^*) = \frac{c - r_0}{c - r_0 + r_1 - \frac{F_1(s^*)^{N-1}}{N}} \]

Now, let’s keep \( s^* \) fixed. Notice that the left-hand-side of the indifference condition does not depend on \( N \), which enters only on the right-hand side. The right-hand side of the expression can be rewritten as \( \left\{ 1 + \frac{\frac{1}{N} - \frac{1-F_1(s^*)^{N-1}}{N}}{\frac{N}{N-1} - \frac{1-F_1(s^*)^{N-1}}{N}} \right\}^{-1} \).

Let’s focus on the ratio contained in this term. We can cancel out \( \frac{1}{N} \) and it is straightforward to check that, increasing \( N \) and fixing \( s^* \), the numerator increases while the denominator decreases. Hence, the right hand side of the indifference condition decreases; therefore an increase in \( N \), has to decrease \( \hat{p}(s^*) \) and this happens only if \( s^* \) decreases. Thus, \( s^* \) is decreasing in \( N \) for all \( N \).

\[ \square \]

**Proof of Proposition 7**

**Proof.** The probability of having a clean politician in office is

\[ p((1 - F_1(s^*) + F_1(s^*)^N)(1 - p) + (1 - p)(1 - F_0(s^*))p + (1 - p)F_0(s^*) \]

This can be rearranged to yield:

\[ W = (1 - p)^2 + p(1 - p)[1 - F_1(s^*) + F_1(s^*)^N + F_0(s^*)] \]

Taking the derivative with respect to \( N \) results in the following expression:

\[ p(1 - p) \left[ -f_1(s^*) + f_0(s^*) + NF_1(s^*)F_1(s^*)^{N-1} \right] \frac{\partial s^*}{\partial N} + F_1(s^*)^N \ln F_1(s^*), \]
which is not unambiguously positive or negative.

Proof of Proposition 8

Proof. In this scenario, welfare can be expressed in the following way:

$$(1 - p)^2 + p(1 - p)(1 + F_0(s^*) - F_1(s^*))$$

Notice that since $F_0(s^*) \geq F_1(s^*)$ and $\lim_{s^* \to \infty} F_0(s^*) = \lim_{s^* \to \infty} F_1(s^*)$, in this case welfare is maximized when $f_0(s^*) = f_1(s^*)$. Notice that by definition of $\hat{p}$, $f_1(s^*) = f_0(s^*)$ implies that $\hat{p}(s^*) = p$. Therefore, we can use Lemma 5 to characterize sufficient conditions for $\hat{p}(s^*)$ to lie above or below $p$. 

Proposition 1. If readers read one outlet among those (if any) which talk about the corruption scandal, then welfare decreases as $N$ increases.

Proposition 2. When $N > R$, media outlets follow a cutoff strategy in the first stage, with $s^*$ being the same as in the game with $N < R$. Conditional on fact-checking, media outlets always publish true scandals whereas they publish fake scandals with probability $1 - \sigma$.

Proof. Let’s start from the second stage, i.e. after fact-checking has taken place. If the scandal is true, all firms publish it. If the scandal is wrong and no firm publishes it, then each firm as the incentive to unilaterally deviate and publish it, since the monopolistic revenue 1 is larger than $\frac{R}{N}$. At the same time, if all firms were to publish the fake scandal, then it would be optimal to always publish the scandal in the first without fact-checking. It follows that media outlets must mix when the scandal is proved to be fake. Using an analogous formula to (1), where $\sigma$ denotes the probability of not publishing the fake news after fact-checking, the expected revenue from publishing a fake news, given
that all other media outlets use the same strategy, is \( \frac{1}{N} \frac{1-\sigma^N}{1-\sigma} \). In equilibrium, this expected revenue has to equal the cost \( \frac{R}{N} \). Notice that if \( N > R \), there always exists a \( \sigma < 1 \) such that \( \frac{1}{N} \frac{1-\sigma^N}{1-\sigma} = \frac{R}{N} \). To see this, rearrange the condition to get \( \frac{1-\sigma^N}{1-\sigma} = R \). The left-hand side is a strictly increasing function of \( \sigma \) with image in \([1, N]\). As a result, there is a unique \( \sigma \in (0, 1) \) such that the condition is satisfied. Let’s now move to the analysis of the first stage, i.e. the decision to fact check. The only change compared to the case of \( N < R \) is in the case of the news being fake. However, we just proved that the expected revenue from publishing conditional on fact-checking indicating that the scandal is fake is equal to zero. Therefore, the payoff for the media outlet conditional on fact-checking and the scandal being fake is the same as before. This means that the indifference condition determining \( s^* \) remains the same. In terms of existence of the equilibrium, since the indifference condition is the same, the only change concerns the limit of the right hand side \( \frac{c-r_0}{c-r_0+r_1-p_1(s^*)^N-1} \) as \( s^* \) goes to infinity, represented by \( \frac{c-1}{c-N} \). Whereas with \( N < R \) this limit is strictly positive, since \( c > 1 \), as \( N \) grows larger \( c \) becomes smaller than 1 and \( \frac{c-1}{c-N} \) tends to \(-\infty\). In other words, compared to the case of \( N < R \), \( \hat{p} \) at the equilibrium \( s^* \) is no longer bounded below, meaning that as \( N \) grows, the cutoff \( s^* \) grows smaller and smaller. \( \square \)
Bibliography


Melis Kartal and James Tremewan. An offer you can refuse: the effect of transparency with endogenous conflict of interest. 2016.


