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Experts, Conflicts of Interest, and Reputation for Ability

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achieve. Likewise, an improvement in the average quality of information that diminishes the ability differential between experts below a critical level reduces information transmission.

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1 Introduction

Individuals frequently rely on the information provided by experts when making economic decisions. This information can take either the form of a direct recommendation to follow a specific course of action or the form of a forecast that individuals use to inform their decisions. In all cases, the value of the expert's information relies on at least two components. First, the presumed ability of the expert to recover accurate information about an unobserved state of the world upon which the success of a specific action depends. Second, the presumption that the expert truthfully reports his information.

Experts often face incentives that are not fully compatible with truthful revelation of their information. In particular, there are situations where experts have a clear bias in favor of reporting over-optimistically (or over-pessimistically) on some unknown state of the world upon which receivers must base their decisions. In all these cases, experts face a conflict of interest with the party that eventually uses their information. On the other hand experts may be interested in correctly forecasting the state of the world in order to establish a reputation for having accurate information. Being identified as better informed often implies greater market rewards in terms of higher wages or fees.

We model a reporting environment where an expert faces conflicts of interest and is concerned about his reputation for having accurate information. The nature of the conflict of interest is such that, regardless of the initial belief of the decision maker, an expert receives some form of compensation whenever he manages to induce the decision maker to believe that the world is in one specific state. For example, even if public information regarding a particular state of the world (such as economic growth prospects) happens to be pessimistic, we assume that an expert always benefits from convincing those who rely on his advice that things are not as bad as they think.

A distinguishing feature of our model is that the decision maker is perfectly aware of this bias. Therefore, there is no uncertainty on the preferences of an expert. The literature on cheap talk has focused on situations where there is uncertainty on the preferences of experts, and where experts wish to be perceived as credible, i.e. to acquire a reputation for having preferences aligned with those of the decision maker (Sobel (1985), Benabou and Laroque (1992), Morris (2001)). We instead investigate whether the incentives to establish a reputation for ability may affect information revelation in the absence of uncertainty on preferences. These incentives to establish a reputation for ability stem from the fact that on the one hand the market rewards better experts, and on the other hand experts with higher reputation exert more influence on decision makers' choices. In order to acquire a higher reputation an expert must correctly forecast the state of the world. Thus, an expert trades off the reputational reward of providing correct forecasts against the benefit of using his credibility to sway the receiver's beliefs in the desired direction.

We propose a theoretical framework that captures these essential features of experts' incentives. Since these characteristics are common to several economic and political settings where decision makers rely on experts for making informed decisions, the model is well suited for analyzing different contexts that share these features. Financial analysts, for example, may have incentives to provide biased reports and thus may face a conflict of interest with investors. In many instances investors are perfectly aware of this bias.[1] On the other hand,

[1] There is a large body of literature showing evidence that affiliated analysts have an optimism bias resulting from their involvement in the investment banking activity of their brokerage house (Michaeli and Womack (1999), Barber et al. (2006, 2007)).

analysts are also concerned about their reputation for having accurate information, since this influences their future payoffs. An analyst who provides biased reports and possibly makes a mistake will be identified by the market as one who has less accurate information, thereby reducing his future wage and possibly jeopardizing his career.[2]

In the political sphere, some government agencies are responsible for providing macroeconomic or fiscal forecasts for the purpose of efficiently allocating scarce public resources and effective public and private sector planning. In this case, the conflict of interest stems from the fact that government agencies face incentives to bias their forecasts away from objective reports and towards those that favor politicians.[3] Also in this case, reputation costs can constrain such biased behavior in several ways.[4]

Our first result is that the desire to build a reputation for ability is effective in guaranteeing that some information is revealed, even when the decision maker is certain that an expert faces a conflict of interest. Reputational concerns fail to be an effective disciplining device only when public information is characterized by little uncertainty. Our second finding is that improvements in the quality of information may have negative effects on information revelation. We show that a variation in the share of experts with high quality information (i.e., a higher level of initial reputation) has a non-monotonic effect on the incentives to truthfully reveal information and eventually on the level of informational efficiency. In par-

[2]Stickel (1992), Mikhail, Walther, and Willis (1999), Hong and Kubik (2003), Fang and Yasuda (2009) all document that reputation has a disciplining effect on analyst behavior.

[3]The political science literature documents that incumbent governments generally prefer agencies that are more inclined to provide optimistic forecasts as a way to signal to the electorate that the politician is a competent public manager (Weatherford (1987), Alesina and Roubini (1997) Carlsen (1999)). The conflict of interest originates from the fact that the executive branch has the power to sanction agencies that fail to act in their interest by proposing budget cuts, disposing of political executives or even advocating termination of the agency.

[4]For instance if the electorate is to view the incumbent executive as a competent public manager the agencies issuing reports must be considered reliable sources of information (Heclo (1975), Rourke (1992), Carpenter (2001)). Government economists also value the esteem of their peers and act in order to maintain their professional reputation for career concerns (Wilson 1989). Finally, loss of reputation may also result in auditory sanctions that may pose a serious threat to the agency's existence (Bendor, Taylor, and Van Gaalen (1985), Banks and Weingast (1992)).

ticular, an increase in this share leads to less misreporting as long as the initial fraction of better-informed experts is not too high. However, beyond a certain threshold any increase in initial reputation results in a decrease in informational efficiency. Intuitively, when initial reputation is high, experts have less scope for reputation acquisition and at the same time face greater incentives to be over-optimistic, since decision makers attribute more weight to the advice of well informed experts. This is an effect that does not arise in the absence of conflicts of interest, where an increment in initial reputation for ability always has a positive effect on the amount of information revealed.

Similarly, we find that an improvement in the accuracy of information of less talented experts, that increases the average informativeness of signals, has a negative effect on informational efficiency. As the abilities of experts converge, the reputational gain of being recognized as a good expert tends to fade, reducing the disciplining role of reputation. At the same time, the improved quality of information generated by an increase in the accuracy of less talented experts enhances the credibility of advice, increasing the returns from biased reports.

The remainder of the paper is organized as follows. In Section 2, we review the relevant literature. Section 3 introduces the general setup of the model. Section 4 characterizes the most informative equilibrium and analyzes the conditions under which truthtelling is possible, highlighting the incentives that lead experts to deviate from truthtelling. Section 5 examines how informational efficiency is affected by variations in the institutional features that characterize the reporting environment. Section 6 concludes.

2 Literature Review

Our paper is closely related to two main strands of the literature on sender-receiver models of information transmission. The first deals with experts that do not have an explicit conflict of interest with decision makers, and are exclusively concerned about their reputation for having accurate information (Ottaviani and Sorensen (2001, 2006) and Trueman (1994)). The second strand considers information transmission where some senders face conflicts of interest and receivers are uncertain about the preferences of senders. Senders wish to be perceived as having the same preferences of receivers since this affects the credibility of their messages (Sobel (1985), Benabou and Laroque (1992), Morris (2001)). We combine these two approaches by introducing reputational concerns for ability in a context with conflicts of interest.

Ottaviani and Sorensen (2006) study information transmission by privately informed experts concerned about being perceived to have accurate information. They characterize experts' incentives to deviate from truthtelling, by analyzing different information structures. In particular, they consider information providers with known or unknown ability, and different signal structures, discrete versus continuous, in a setup in which the experts are solely concerned about the receivers' perceptions of their forecasting ability.

Trueman (1994) considers a model where analysts with different forecasting abilities are concerned about building a good reputation for their forecasting accuracy. He finds that analysts display herding behavior, whereby they disregard their private information and release forecasts similar to those previously announced by other analysts, in order to maximize their expected reputation. Trueman's findings are in line with Scharfstein and Stein (1990) where managers exhibit herd behavior in a framework in which the expert has to make an investment decision as opposed to reporting his private information to a third party. In both these papers, experts choose their actions sequentially.

Sobel (1985) first modeled the role of reputation acquisition in a cheap-talk framework where the sender may have opposing interests with respect to the receiver. He shows that reputation plays a role in aligning the interests of the sender with those of the receiver. However, since experts are assumed to have completely informative signals, providing an incorrect report unambiguously leads a dishonest expert to be discovered. Benabou and Laroque (1992) introduce noisy signals in Sobel's (1985) framework allowing for reputation to fluctuate and for information manipulation to become possible, since an incorrect prediction may always be attributed to an honest mistake. Both in Sobel (1985) and Benabou and Laroque (1992), some types of senders are exogenously constrained to provide truthful reports. Morris (2001) endogenizes the expert's behavior and shows that even unbiased experts may have an incentive to distort information in order to build reputation. Ely and Valimaki (2003) obtain a result in the spirit of Morris (2001) in a traditional infinite horizon model of reputation. We study a setting where there is no uncertainty on preferences (all experts are biased), experts are characterized by heterogeneous forecasting abilities, and are concerned about reputation for ability rather than for "integrity" or "objectivity".

Our results on the non-monotonic effect of reputation on informational efficiency are reminiscent of Holmström (1999) which shows that managers exert more effort in the initial stages of their career, when uncertainty on their ability is higher and the scope for reputation acquisition is greater. While Holmström (1999) analyses reputational concerns in a dynamic setting with hidden information and hidden actions, we consider a static setting with hidden information. It is worth noticing that in our model, the non monotonicity effect is also driven by the fact that the expert's bias increases with the expert's reputation, since decision makers attribute more weight to the advice of well established experts. Thus, our model highlights that reputation can have a perverse effect not only because the scope for reputation acquisition is low when there is little uncertainty on reputation, but also because the temptation to cash in on reputation is much higher exactly when reputation is high.

Finally, our paper is related to the literature that considers experts that have conflicting interests with receivers but where reputational concerns do not play a role (Brandenburger and Polak (1996), Morgan and Stocken (2003)). In Brandenburger and Polak (1996), managers that are more informed with respect to the market on the true state of the world, must take an action whose effect on expected profits is conditional on the state of the world. The price of the firm, determined by public beliefs about the true state of the world, is updated based on the decision of the manager. They find that managers will tend to take an action that goes in the direction of prior market beliefs, in order to maximize the firm's share price. This bias does not disappear, even when the payoff function of managers is a convex combination of the short term objective of maximizing current share price, and the long term objective of maximizing future profits. As in our model, biased actions are driven by the incentives to influence the beliefs of receivers (prices) before the true state of the world is revealed. However, unlike our model there is no scope for reputation acquisition, since managers do not differ in terms of the quality of their private information.

Morgan and Stocken (2003) present a theoretical model that analyzes the informational content of stock reports when investors are uncertain about the analyst's incentives. These incentives may either be aligned or misaligned with those of investors. They find that any investor uncertainty about incentives makes full revelation of information impossible. Under certain conditions, analysts with aligned incentives can credibly convey unfavorable information, but can never credibly convey favorable information. In their model, analysts do not differ in the degree of informativeness of their signals (as they do in our work), but in the degree of divergence of their preferences with respect to those of investors. As in Benabou and Laroque (1992), analysts are not concerned about being perceived as having accurate information, but about being perceived as credible.

3 The Model

An expert is called upon to provide information to a pool of individuals who have to make a forecast about the state of world. The state of the world w is either high or low, i.e., $w \in \{h, l\}$, and all players hold the same prior belief θ that the state is h. At the beginning of the game, the expert observes a private and non-verifiable signal $s_i \in \{s_h, s_l\}$ about the true state, whose accuracy depends on the expert's ability t. We assume that the expert is either good or bad, i.e., $t \in \{g, b\}$, and that ability affects the accuracy of the signal as follows:

$$\Pr(s_h|t = g, w = h) = \Pr(s_l|t = g, w = l) = p, \ p \in (1/2, 1) \quad (1)$$

$$\Pr(s_h|t = b, w = h) = \Pr(s_l|t = b, w = l) = z, \ z \in (1/2, p] \quad (2)$$

Therefore, both types of experts can count on an informative (yet imperfect) signal, with the good type having a more accurate signal than a bad type.[5] We assume that neither the expert nor the receivers know the expert's type, and all players hold the same prior belief α that the expert is good.[6] We interpret α as the prior reputation for ability of the expert.

After observing the signal, the expert chooses a report that is publicly released in the form of a costless binary message $m_j \in \{m_h, m_l\}$. Receivers observe message m_j and revise their beliefs about the true state of the world. We denote with $\widehat{\theta}_{\alpha,m_j} \equiv \Pr(w = h|m_j)$, the receivers' posterior belief that the state of the world is h, given that message m_j was sent by an expert with prior reputation α. As we will see, in an equilibrium where some information is transmitted, the higher the reputation of the expert, the more the receivers trust the message sent. The subscript α highlights this relationship.

At the end of the game, the true state of the world is revealed and together with the message of the expert is used by the receivers to revise their beliefs about the expert's ability.[7] We denote with $\widehat{\alpha}_{w,m_j} \equiv \Pr(t = g|w, m_j)$, the receivers' posterior belief that the expert is good upon observing state w and message m_j. We interpret $\widehat{\alpha}_{w,m_j}$ as the new level of reputation for ability acquired by the expert at the end of the game.

[5] All the results hold also for $z = \frac{1}{2}$.We make use of informative signals of bad types of experts, $z \in (1/2, p]$ because in section (5.3) we analyze variations z .

[6] This assumption is without loss of generality as far as the key results of paper are concerned, and makes the analysis more tractable. Assuming that the expert knows his own type does not affect the nature of the results.

[7] In fact, in our model the receivers perform the task of forecasting the state of the world and the expert's ability. Notice that we do not explicitly model the payoff of the receivers. Instead, we follow the approach of Ottaviani and Sorensen (2006) and implicitly assume that receivers are rewarded for accurately forcasting both the state of the world and the ability of the expert.

To model the expert's concern about establishing a reputation for being a valuable provider of information and the contemporaneous existence of conflicts of interest, we construct a game where the payoff of the expert depends positively on the receivers' posterior beliefs $\widehat{\theta}_{\alpha,m_j}$ and $\widehat{\alpha}_{w,m_j}$, as follows:

$$\pi(m_j) = k\widehat{\theta}_{\alpha,m_j} + (1-k)\widehat{\alpha}_{w,m_j},\ k \in [0,1] \tag{3}$$

The component $\widehat{\alpha}_{w,m_j}$ captures the concern of the expert to be perceived as having accurate information.[8] The component $\widehat{\theta}_{\alpha,m_j}$ gives the expert an incentive to inflate the receivers' belief that the state is h, and thus creates a conflict of interest with the receivers, since the expert now has a bias in favor of information that increases the receivers' perception that the state is h.[9] Finally, the parameter $k \in [0,1]$ weighs these two components and can be seen as a measure of the severity of conflicts of interest. The structure and the parameters of the game (with the sole exception of the expert's signal) are common knowledge.[10]

Notice that interpreting h and l respectively as favorable and unfavorable states for the receivers, the model represents the over-optimism bias that has been discussed both in the finance literature on sell side analysts and in the political science literature on government agencies' forecasts.[11] For the sake of exposition, in the remainder of the paper we will adopt this interpretation and refer to the expert's bias as to the over-optimism bias.

[8] This reduced form to account for reputational concerns is widely adopted in studies that model the reputation of experts and managers (see for example Sharfstein and Stein (1990), Ottaviani and Sorensen (2006) and Gentzkow and Shapiro (2006)).

[9] Formally this game falls in the class of psychological games since the sender's payoff depends on the receiver's belief (see Battigalli and Dufwenberg (2009)).

[10] It is worth noticing that since also k is common knowledge, we do not address the case when receivers are uncertain about the incentives of the expert (see Sobel (1985), Benabou and Laroque (1992), Morgan and Stocken (2003) for a formal analysis of the case when there is uncertainty about the expert's incentives).

[11] Assuming that the expert has an interest in inflating the receivers' belief about the state being h, is without loss of generality. Our setup is well suited for analyzing a more general setting, where the expert has an incentive to manipulate the receivers' beliefs in a desired direction.

4 Equilibrium Analysis

In this section, we analyze the incentives of an expert to truthfully report his information and characterize the most informative equilibrium.[12]

At the moment of sending message m_j, the true state of the world is unknown to the expert. The expert uses his signal s_i to compute the expected impact of message m_j on his reputation, as follows:

$$E\left(\widehat{\alpha}_{w,m_j}|s_i\right) = \Pr(w = h|s_i)\widehat{\alpha}_{h,m_j} + \Pr(w = l|s_i)\widehat{\alpha}_{l,m_j}$$

Therefore, the expected payoff of the expert from sending message m_j reads:

$$E\left(\pi(m_j)|s_i\right) = k\widehat{\theta}_{\alpha,m_j} + (1-k)E\left(\widehat{\alpha}_{w,m_j}|s_i\right)$$

Before analyzing the incentives of an expert to truthfully report his information, it is convenient to gain an intuition of the tensions involved in the reporting decision of the expert. In any equilibrium where some information is transmitted we have that $\widehat{\theta}_{\alpha,m_h} > \widehat{\theta}_{\alpha,m_l}$.[13] This introduces an incentive to report message m_h and represents a threat to truthtelling whenever signal s_l is received. In fact, the presence of reputational concerns counterbalances this over-optimism bias. As long as $k \in (0,1)$, the expert has to trade off the temptation of sending m_h with the negative effects that this message might have on his reputation in case the message turns out to be incorrect.

The equilibrium concept we use is that of Perfect Bayesian Equilibrium (PBE). The expert will truthtfully report signal s_i if and only if the expected payoff of truthtelling is greater than the payoff of reporting a message that is different from the signal received.

[12] Our model presents the well-known problem of equilibrium multiplicity that is common to any cheap-talk game. A babbling equilibrium where all messages are taken to be meaningless and ignored always exists.

[13] Since the expert's signals are informative, in any equilibrium where signals are truthfully reported with some positive probability, the messages of the expert contain some information.

Thus, a truthtelling equilibrium exists if and only if for every $i, j \in \{h, l\}$, $E(\pi(m_i)|s_i) \geq E(\pi(m_i)|s_j)$, or equivalently:

$$k\widehat{\theta}_{\alpha,m_l} + (1-k)E(\widehat{\alpha}_{w,m_l}|s_l) \geq k\widehat{\theta}_{\alpha,m_h} + (1-k)E(\widehat{\alpha}_{w,m_h}|s_l) \quad (4)$$

$$k\widehat{\theta}_{\alpha,m_h} + (1-k)E(\widehat{\alpha}_{w,m_h}|s_h) \geq k\widehat{\theta}_{\alpha,m_l} + (1-k)E(\widehat{\alpha}_{w,m_l}|s_h) \quad (5)$$

In a truthtelling equilibrium, posterior reputation takes on only two possible values, which we denote with $\underline{\alpha}$ and $\overline{\alpha}$, where:

$$\underline{\alpha} \equiv \widehat{\alpha}_{l,m_h} = \widehat{\alpha}_{h,m_l}$$

$$\overline{\alpha} \equiv \widehat{\alpha}_{h,m_h} = \widehat{\alpha}_{l,m_l}$$

with $\overline{\alpha} > \alpha > \underline{\alpha}$.[14] Making a correct evaluation increases the expert's reputation from its initial level α to the higher level $\overline{\alpha}$. Making a wrong evaluation decreases the expert's reputation from α to the lower level $\underline{\alpha}$. In the rest of the paper we denote $(\overline{\alpha} - \underline{\alpha})$ as the reputational reward of being recognized as a good expert. This allows us to write conditions (4) and (5) in the following way:

$$k\left(\widehat{\theta}_{\alpha,m_h} - \widehat{\theta}_{\alpha,m_l}\right) \leq (1-k)(\overline{\alpha} - \underline{\alpha})(1 - 2\Pr(w = h|s_l)) \quad (6)$$

$$k\left(\widehat{\theta}_{\alpha,m_h} - \widehat{\theta}_{\alpha,m_l}\right) \geq (1-k)(\overline{\alpha} - \underline{\alpha})(1 - 2\Pr(w = h|s_h)) \quad (7)$$

For each of the above conditions, we refer to the left hand side as the benefit of providing a high message, and to the right hand side as the expected reputational gain of sending a low message. Notice that the right hand side of (6) represents the expected reputational gain of truthtelling when receiving a low signal, while the right hand side of (7) represents the expected reputational gain of misreporting when receiving a high signal.

[14] We show this result in the Appendix.

Lemma 1 *In a truthtelling equilibrium, the benefit of sending a high message,* $k\left(\widehat{\theta}_{\alpha,m_h}-\widehat{\theta}_{\alpha,m_l}\right)$ *satisfies the following properties: a) it is strictly positive for* $\theta \in (0,1)$ *and equal to zero for* $\theta = 0,1$*; b) it is strictly concave in* θ *with a maximum at* $\theta = \frac{1}{2}$.

(Proof: see Appendix)

The benefit of sending a high report is therefore increasing up until a threshold value of the prior on the state of the world, and decreasing from that point onwards. Notice also that when there is little uncertainty on the state of the world (i.e., when θ is close to 0 or 1), this benefit tends to zero.

The previous lemma immediately implies that in the limit case, when reputation does not play any role (i.e., when $k = 1$), condition (6) is never satisfied and a truthtelling equilibrium never exists.[15] In this case, the incentive of the expert to report m_h destroys any putative equilibrium where some information is transmitted and the expert plays no role in reducing information asymmetries. This is a standard result in the cheap talk literature. In our context, where there is no uncertainty on the preferences of the expert, the previous finding suggests that reputation for ability may be a device to elicit information.

Lemma 2 *The expected reputational gain of sending the low message,* $(1-k)(\overline{\alpha}-\underline{\alpha})\left(1-2\Pr\left(w=h|s_i\right)\right)$ *satisfies the following properties: a) it is positive at* $\theta = 0$ *and negative at* $\theta = 1$ *for* $i = h, l$*; b) it is strictly decreasing in* θ *for* $i = h, l$*; it is strictly concave in* θ *for* $i = l$ *and strictly convex in* θ *for* $i = h$.

It is important to notice that the reputational reward of being recognized as a good expert, $(\overline{\alpha}-\underline{\alpha})$ is not affected by variations in the prior on the state of the world. Variations in θ simply affect the expected reputational gains.

We now establish that when experts have reputational concerns some information can be transmitted:

[15] This case resembles Branderburger and Polak (1996), the only difference being that the absence of an over optimism bias in their model allows for the existence of partially informative mixed strategy equilibria.

Proposition 1 *For $k \in [0,1)$, the most informative equilibrium is separating (i.e., fully revealing) for $\theta \in [\underline{\theta}, \overline{\theta}]$ and pooling (i.e., uninformative) for $\theta \notin [\underline{\theta}, \underline{\theta}]$.*

(Proof: see Appendix)

For an intuition of Proposition 1, first notice that Lemma 1 implies that when θ is very low (high), receivers expect the economy to be in state l (h) regardless of the message sent by the expert. As a result, the net gain from inflating the beliefs of the receivers by sending m_h instead of a m_l, is very small and the choice of the expert is mainly driven by reputational concerns. However, reputational concerns make truthtelling impossible when the prior is relatively extreme. In these cases, the expert may believe that any contrarian signal he receives is probably incorrect. Being worried about the adverse impact of ex-post incorrect messages on his reputation, he disregards his private information and reports the signal that is more likely to be correct ex-post. This is illustrated in Lemma 2, that shows how as the ex-ante probability that the true state is h increases, the expected reputational gain of reporting the low message decreases independently from the signal received. This conservative behavior on the part of the expert exists as long as the expert has some concerns about his reputation (i.e., for $k < 1$).

On the other hand, Proposition 1 also highlights how truthful revelation occurs for interior values of θ. As illustrated in Lemma 1, in these cases conflicts of interest play a greater role with respect to the limit cases when θ approaches 0 or 1. Therefore, reputational concerns for ability allow truthtelling behavior to emerge, even in the presence of conflicts of interest.

It is worth noting that the nature of the most informative equilibrium in the presence of over-optimism bias ($k \in (0,1)$) is not qualitatively different from the case where conflicts of interest are absent and the expert is solely concerned about his reputation ($k = 0$).[16] Despite this similarity, there are significant differences between these two cases which we highlight in the following section.

[16]The case where experts are solely concerned about reputation for ability is analyzed by Ottaviani and Sorensen (2001,2006).

5 Discussion

In this section, we examine how variations in the severity of conflicts of interest, in the level of prior reputation, and in the difference between the signal informativeness of good and bad types affect the most informative equilibrium of Proposition 1. What we are interested in is how changes in the parameters k, α and $(p-z)$ affect the truthtelling region $\left[\underline{\theta}, \overline{\theta}\right]$, as measured by the difference $\overline{\theta} - \underline{\theta}$. With a slight abuse of terminology, we refer to any increase (decrease) in $\overline{\theta} - \underline{\theta}$ as to an increase (decrease) in informational efficiency. To gain further insight into our results, we carry out numerical analysis which we refer to in presenting the results.

The key finding is that significantly different results arise when conflicts of interest are present ($k \in (0,1)$), as opposed to the case when conflicts of interest are absent ($k = 0$). For the sake of exposition, it is convenient to define some properties of the truthtelling equilibrium in the case when $k = 0$:

Remark 1 *Let $\underline{\theta}^*$ and $\overline{\theta}^*$ denote the threshold values for an expert with no conflicts of interest (i.e., $k = 0$). Then, $\underline{\theta}^* = 1 - [\alpha p + (1-\alpha)z]$ and $\overline{\theta}^* = \alpha p + (1-\alpha)z$.*

(Proof: see Appendix)

The previous remark suggests that in the absence of conflicts of interest, the truthtelling region is symmetrically centered around $\theta = \frac{1}{2}$, and expands as α, p and z increase. In particular, $\underline{\theta}^*$ ($\overline{\theta}^*$) is decreasing (increasing) in α, p and z.

5.1 Variations in the Severity of Conflicts of Interest

We start by analyzing how variations in k affect the truthtelling thresholds $\underline{\theta}$ and $\overline{\theta}$ as described by the following proposition:

Proposition 2 *Both $\underline{\theta}$ and $\overline{\theta}$ are decreasing in k.*

(*Proof: see Appendix)*

In the case of no conflicts of interest ($k = 0$), the truthtelling region is centered around $\theta = \frac{1}{2}$. Proposition 2 suggests that as conflicts of interest become more severe, the truthtelling region progressively shifts toward values of the prior on the state of the world that are closer to zero. Indeed, as k increases the bias in favor of the high message increases. As a consequence, the expert is willing to send the high message for lower values of the prior θ. Truthful revelation becomes possible only when public information is rather contrary to the state towards which the expert wishes to sway public opinion (i.e., state h).

As conflicts of interest become fiercer, not only does the bias to report m_h become stronger, but informational efficiency progressively declines. This occurs because as k increases, the expert's interest to sway the beliefs of decision makers in favor of state h progressively dominates the expert's concern for his reputation (i.e., we approach the limit case when $k = 1$). The following proposition summarizes this result:

Proposition 3 *There always exists a level of k above which informational efficiency (i.e., $(\overline{\theta} - \underline{\theta})$) is decreasing in k.*

(*Proof: see Appendix)*

Numerical analysis suggests that informational efficiency is in fact strictly decreasing in k for all values of k, supporting the intuition that informational efficiency always suffers as conflicts of interest gets stronger (Figure 1). It is worth noticing that the decline in efficiency is quite sharp for relatively low values of k.

5.2 Variations in prior reputation (α)

We next analyze how variations in prior reputation affect informational efficiency. As a first step, we focus on the relationship between α and the different components of the expert's payoff, as described in the following remark:

Remark 2 *(i) The benefit of sending a high report,* $\widehat{\theta}_{\alpha,m_h} - \widehat{\theta}_{\alpha,m_l}$ *is increasing in prior reputation* α*; (ii) The reputational reward of being recognized as a good expert,* $\overline{\alpha} - \underline{\alpha}$ *is strictly concave in* α*, with* $\overline{\alpha} - \underline{\alpha} = 0$ *for* $\alpha = 0, 1$*.*

(Proofs: see Appendix)

The benefit of sending a high report increases with the level of reputation. An expert with higher reputation receives a more accurate signal. Therefore, his message has a greater impact on the beliefs of decision makers. The way $\overline{\alpha} - \underline{\alpha}$ changes in response to variations in the initial level of reputation reflects the common idea that individuals sluggishly change their mind in response to new evidence when they already hold a strong prior belief about something or somebody. On the contrary, new information typically leads to larger swings in beliefs when the level of uncertainty is high.

The previous remark suggests that above a certain level of α, the reputational reward of being recognized as a good expert, becomes negligible with respect to the benefit of sending a high report (indeed, the difference between these two components grows larger as α increases). As a result, above a threshold level of α, the expert's bias in favor of the high message becomes stronger and actually increases with α. This makes both truthtelling thresholds $\overline{\theta}$ and $\underline{\theta}$ decrease with α, reflecting the idea that, as α grows larger, the expert has a stronger incentive to report a high message for any level of θ.[17] A similar argument reveals that an increase in α, when α is below a certain threshold, determines an increment in $\underline{\theta}$ and $\overline{\theta}$. This leads us to the following proposition:

Proposition 4 *There always exist: (i) a level of prior reputation* α *above which an increase*

[17] At $\theta = \underline{\theta}$ an expert that has received a *high signal* is indifferent between reporting a high message and reporting a low message. Ceteris paribus, an increase in α breaks this indifference in favour of the high message, which in fact implies that at $\theta = \underline{\theta}$ the expert is now truthfully reporting the high signal (i.e. the new truthtelling threshold, say $\underline{\theta}$', is lower than the initial one, $\underline{\theta}$). On the other hand, at $\theta = \overline{\theta}$ an expert that has received a *low signal* is indifferent between reporting a high message and reporting a low message. Again, ceteris paribus, an increase in α breaks this indifference in favour of the high message, implying that at $\theta = \overline{\theta}$ the expert is now pooling on the high signal (i.e. the new truthtelling threshold, say $\overline{\theta}$', is lower than the initial one, $\overline{\theta}$).

in α reduces $\overline{\theta}$ and $\underline{\theta}$; (ii) a level of prior reputation α below which an increase in α increases $\overline{\theta}$ and $\underline{\theta}$

(Proof: see Appendix)

Remark 2 bears a deeper consequence as far as the impact of reputation on informational efficiency in concerned. As α increases above a certain threshold, the difference between $\overline{\alpha}-\underline{\alpha}$ and $\widehat{\theta}_{\alpha,m_h}-\widehat{\theta}_{\alpha,m_l}$ grows larger (with the former in fact progressively shrinking to zero), meaning that the reporting incentives of the expert are increasingly dominated by his interest to sway the beliefs of decision makers in favor of state h. As a result, for relatively large values of α, the benefit of sending the high message, irrespectively of the signal observed, dominates the expected reputational gain of making a correct evaluation, thus reducing informational efficiency. This effect clearly intensifies as α approaches to 1 (in this limit case, the truthtelling region becomes an empty set).

A similar reasoning applied to the case when initial reputation is below a certain threshold suggests that an increase in α leads to an expansion of the truthtelling region when α is indeed below a certain threshold. The following proposition summarizes the previous reasoning:

Proposition 5 *There always exist: (i) a level of prior reputation α above which an increase in α reduces informational efficiency (i.e., $(\overline{\theta}-\underline{\theta})$); (ii) a level of prior reputation α below which an increase in α increases informational efficiency (i.e., $(\overline{\theta}-\underline{\theta})$ increases).*

(Proof: see Appendix)

The result in Proposition 5 contrasts with the case of no conflicts of interest ($k=0$), where an increase in reputation always translates into an improvement of informational efficiency (see Remark 1). Now, a further increase in prior reputation above a certain threshold (i.e., a reduction of uncertainty on expert ability) makes the truthtelling space shrink.

Numerical analysis illustrates how both $\overline{\theta}$ and $\underline{\theta}$ are hump-shaped in α (figure 2). Furthermore, the threshold level of α above which an increase in prior reputation leads to a stronger bias towards h is a relatively intermediate value (i.e., close to $1/2$). Thus this effect cannot be considered as a limit case that sets in only for extreme values of initial reputation. Prior reputation therefore has a non-monotonic effect on informational efficiency when conflicts of interest are present. Notice that for extreme values of α informational efficiency tends to zero. In other words, a very high level of reputation is as bad as a very low level of initial reputation as far as informational efficiency is concerned.

5.3 Variations in Signals' Informativeness

In analyzing variations in the quality of information, we examine the impact of variations in the gap between expert abilities by fixing p and letting z vary. The following proposition summarizes the main findings:

Proposition 6 *Holding p fixed, there always exists a level of z above which an increase in z reduces informational efficiency (i.e., $\overline{\theta} - \underline{\theta}$ decreases).*

(*Proofs: see Appendix)*

Notice that an increment in z increases the average informativeness of the experts' signals. Thus, proposition 6 highlights a result whereby informational efficiency may suffer from an improvement in the accuracy of information. The intuition for this result is that as the ability of the worst expert improves, the spread $\widehat{\theta}_{\alpha,m_h} - \widehat{\theta}_{\alpha,m_l}$ increases since the decision maker expects the report of an expert to be more informative. At the same time, as z approaches p, the reputational reward of being recognized as a good expert decreases, since the difference between good and bad experts shrinks. Thus, as the abilities of experts converge, the information revealed tends to zero (figure 3).[18] This result implies that the coexistence of experts of different abilities guarantees a higher level of informational efficiency.[19]

[18] We also perform the exercise of fixing z and letting p vary. As expected, informational efficiency is increasing in p. Overall, these results are consistent with the idea that the gap in the abilities of the experts do play a key role along with the accuracy of the experts' information.

[19] In the absence of conflicts of interest ($k = 0$), an increase in z has an unambiguously positive effect on informational efficiency resulting in maximum efficiency when $z \to p$.

6 Conclusion

Conflicts of interest are relevant in many economic settings where experts with privileged information are called upon to provide information to uninformed receivers. In particular, in this paper we have focused on the trade-off that experts typically face, between the short term benefit of providing biased reports, versus the long term reward of acquiring a reputation for being accurate information providers.

We find that reputation plays an important role in shaping the incentives of experts that face conflicts of interest driven by an over-optimism bias. Reputation for ability allows for some information transmission even when decision makers know that experts are biased. However, reputation has a non-monotonic effect on information transmission, and greater uncertainty on expert ability is associated with more information revelation. In other words, those experts that have established a reputation for having accurate information, may have strong incentives to release biased reports, much like those that have a stable record of incorrect evaluations. It is precisely the uncertainty on ability, that creates greater incentives for experts to truthfully reveal their information, in order to distinguish themselves from the poorly informed and acquire a higher reputation. Once this standing has been attained, the over-optimism bias tends to prevail over the reputational losses that experts may incur, by erroneously forecasting a future state of the world.

These results suggest an empirical implication for the case of sell-side financial analysts. In a situation where the market for analysts is populated by a large share of well established analysts, less information will be contained in financial reports. If investors are rational, this should on average lead stock prices to exhibit a milder reaction to analyst reports, with respect to other market scenarios characterized by more uncertainty on analyst ability. Testing this empirical implication represents a step for future research.

Another suggested direction for future research is to gather a better understanding of the link between informational efficiency and the institutional framework in which experts operate. In particular, the characteristics of the market and institutions that govern the expert environment, may affect the degree of uncertainty on ability (or reputation) in different ways. Capturing how these institutional settings may influence the degree of informational efficiency, through the reputational channel, represents an open question.

Appendix

Expert's Posterior Beliefs.

$$\begin{aligned}
\Pr(w &= h|s_h) = \frac{\theta(\alpha p + (1-\alpha)z)}{\theta(\alpha p + (1-\alpha)z) + (1-\theta)(\alpha(1-p) + (1-\alpha)(1-z))} \\
\Pr(w &= l|s_h) = 1 - \Pr(w = h|s_h) \\
\Pr(w &= h|s_l) = \frac{\theta(\alpha(1-p) + (1-\alpha)(1-z))}{\theta(\alpha(1-p) + (1-\alpha)(1-z)) + (1-\theta)(\alpha p + (1-\alpha)z)} \\
\Pr(w &= l|s_l) = 1 - \Pr(w = h|s_l)
\end{aligned}$$

■

Posterior Reputations under Truthtelling. In a truthtelling equilibrium the expert reports the signal he has observed. Therefore:

$$\widehat{\alpha}_{w,m_j} \equiv \Pr(t = g|w, m_j) = \begin{cases} \frac{\alpha p}{\alpha p + (1-\alpha)z} & \text{for } (w = h,\ j = h), (w = l,\ j = l) \\ \frac{\alpha(1-p)}{\alpha(1-p)+(1-\alpha)(1-z)} & \text{for } (w = h,\ j = l), (w = l,\ j = h) \end{cases}$$

Let $\overline{\alpha} \equiv \frac{\alpha p}{\alpha p+(1-\alpha)z}$ and $\underline{\alpha} \equiv \frac{\alpha(1-p)}{\alpha(1-p)+(1-\alpha)(1-z)}$. Then for $\alpha \in (0,1)$, $p \in \left(\frac{1}{2}, 1\right)$ and $z \in \left[\frac{1}{2}, p\right)$:

$$\overline{\alpha} - \underline{\alpha} = \frac{\alpha p}{\alpha p + (1-\alpha)z} - \frac{\alpha(1-p)}{\alpha(1-p) + (1-\alpha)(1-z)} = \frac{\alpha(1-\alpha)(p-z)}{(1-\alpha(p-z)-z)(\alpha(p-z)+z)} > 0$$

■

Proof of Lemma 1. Since $k \in [0,1]$, we can analyze $f(\theta) \equiv \widehat{\theta}_{\alpha,m_h} - \widehat{\theta}_{\alpha,m_l}$. In a truthtelling equilibrium the expert reports the signal he has observed. Therefore:

$$\widehat{\theta}_{\alpha,m_j} \equiv \Pr(w = h|m_j) = \Pr(w = h \mid s_j) = \begin{cases} \frac{\theta(\alpha p+(1-\alpha)z)}{\theta(\alpha p+(1-\alpha)z)+(1-\theta)(\alpha(1-p)+(1-\alpha)(1-z))} & \text{for } j = h \\ \frac{\theta(\alpha(1-p)+(1-\alpha)(1-z))}{\theta(\alpha(1-p)+(1-\alpha)(1-z))+(1-\theta)(\alpha p+(1-\alpha)z)} & \text{for } j = l \end{cases}$$

With a bit of algebra we obtain:

$$\begin{aligned} f(\theta) &\equiv \widehat{\theta}_{\alpha,m_h} - \widehat{\theta}_{\alpha,m_l} = \\ &= \frac{\theta(-1+\theta)\left(-1+2\left(\alpha(p-z)+z\right)\right)}{\left(\theta\left(2\left(\alpha(p-z)+z\right)-1\right)-\left(\alpha(p-z)+z\right)\right)\left(1+\theta\left(2\left(\alpha(p-z)+z\right)-1\right)\right)-\left(\alpha(p-z)+z\right)} \end{aligned}$$

Let $q \equiv \alpha(p-z)+z$. Then, $f(\theta) = -\frac{\theta(1-\theta)(2q-1)}{(2q\theta-\theta-q)(1+2q\theta-\theta-q)}$. Notice that for $\alpha \in (0,1)$, $p \in \left(\frac{1}{2},1\right)$ and $z \in \left[\frac{1}{2},p\right)$, we have that $\frac{1}{2} < q < 1$. Then:

$$f(\theta) > 0 \text{ for } 0 < \theta < 1$$

$$f(\theta) = 0 \quad \text{for } \theta = 0,1$$

$$\frac{\partial f(\theta)}{\partial \theta} = -\frac{q(1-q)(2q-1)(2\theta-1)}{(2q\theta-\theta-q)^2\,(1+2q\theta-\theta-q)^2}\begin{cases} >0 & \text{for } 0<\theta<\frac{1}{2} \\ =0 & \text{for } \theta=\frac{1}{2} \\ <0 & \text{for } \frac{1}{2}<\theta<1 \end{cases}$$

$$\frac{\partial^2 f(\theta)}{\partial \theta^2} = 2q(1-q)(2q-1)\left(\frac{1}{(2q\theta-\theta-q)^3} - \frac{1}{(1+2q\theta-\theta-q)^3}\right) < 0 \quad \text{for } 0<\theta<1$$

■

Proof of Lemma 2. Let $g(\theta) \equiv (1-k)(\overline{\alpha}-\underline{\alpha})1 - 2\Pr(w=h|s_l)$ and $v(\theta) \equiv (1-k)(\overline{\alpha}-\underline{\alpha})\left(1-2\Pr(w=h|s_h)\right)$. Using the values of $\overline{\alpha}$, $\underline{\alpha}$, $\Pr(w=h|s_l)$ and $\Pr(w=h|s_h)$ we obtain:

$$\begin{aligned} g(\theta) &= \frac{(1-k)(1-\alpha)\alpha(p-z)(-\theta+\alpha(p-z)+z)}{(-1+\alpha(p-z)+z)(\alpha(p-z)+z)(\alpha(-1+2\theta)(p-z)-z+\theta(-1+2z))} \quad \text{(RHS of (6))} \\ v(\theta) &= \frac{(1-k)\alpha(1-\alpha)(p-z)(-1+\theta+\alpha(p-z)+z)}{(-1+\alpha(p-z)+z)(\alpha(p-z)+z)(1+\alpha(-1+2\theta)(p-z)-z+\theta(-1+2z))} \quad \text{(RHS of (7))} \end{aligned}$$

Let $q \equiv \alpha(p-z)+z$. Then, $g(\theta) = \frac{\alpha(p-q)(\theta-q)}{q(1-q)(2q\theta-\theta-q)}$ and $v(\theta) = \frac{\alpha(p-q)(1-\theta-q)}{q(1-q)(2\theta q-\theta-q+1))}$. Notice that for $\alpha \in (0,1)$, $p \in \left(\frac{1}{2},1\right)$ and $z \in \left[\frac{1}{2},p\right)$, we have that $\frac{1}{2} < z < q < p < 1$. Then:

$$g(\theta) \begin{cases} > 0 & \text{for } 0 < \theta < q \\ = 0 & \text{for } \theta = q \\ < 0 & \text{for } q < \theta < 1 \end{cases}$$

$$g(0) = \frac{\alpha(p-q)}{q(1-q)} > 0, \; g(1) = -\frac{\alpha(p-q)}{q(1-q)} < 0$$

$$\frac{\partial g(\theta)}{\partial \theta} = -\frac{2\alpha(p-q)}{(q+\theta-2q\theta)^2} < 0 \;\; \text{for } 0 < \theta < 1$$

$$\frac{\partial g^2(\theta)}{\partial \theta^2} = -\frac{4\alpha(p-q)(2q-1)}{(q+\theta-2q\theta)} < 0 \;\; \text{for } 0 < \theta < 1$$

$$v(\theta) \begin{cases} > 0 & \text{for } 0 < \theta < 1-q \\ = 0 & \text{for } \theta = 1-q \\ < 0 & \text{for } 1-q < \theta < 1 \end{cases}$$

$$v(0) = \frac{\alpha(p-q)}{q(1-q)} > 0, \; v(1) = -\frac{\alpha(p-q)}{q(1-q)} < 0$$

$$\frac{\partial v(\theta)}{\partial \theta} = -\frac{2\alpha(p-q)}{(-1+q+\theta-2q\theta)^2} < 0 \;\; \text{for } 0 < \theta < 1$$

$$\frac{\partial v^2(\theta)}{\partial \theta^2} = \frac{4\alpha(p-q)(2q-1)}{(1-q-\theta+2q\theta)^3} > 0 \;\; \text{for } 0 < \theta < 1$$

$$g(\theta) - v(\theta) = \frac{2\alpha(p-q)(2q-1)(1-\theta)\theta}{q(1-q)(1-q-\theta+2q\theta)(q+\theta-2q\theta))} > 0 \;\; \text{for } 0 < \theta < 1$$

■

Proof of Proposition 1. Consider the two conditions for truthtelling:

$$k[\widehat{\theta}_{\alpha,m_h} - \widehat{\theta}_{\alpha,m_l}] \leq (1-k)(\overline{\alpha} - \underline{\alpha})\left[1 - 2\Pr(w = h|s_l)\right] \tag{A1}$$

$$k[\widehat{\theta}_{\alpha,m_h} - \widehat{\theta}_{\alpha,m_l}] \geq (1-k)(\overline{\alpha} - \underline{\alpha})\left[1 - 2\Pr(w = h|s_h)\right] \tag{A2}$$

We first prove that for every value of $\alpha \in (0,1)$, $k \in [0,1)$, $p \in \left(\frac{1}{2},1\right)$ and $z \in \left[\frac{1}{2},p\right)$, there exist $\underline{\theta} \in [0,1]$ and $\overline{\theta} \in [0,1]$ such that for $\theta \in \left[\underline{\theta},\overline{\theta}\right]$ conditions (A1) and (A2) are satisfied simultaneously. Consider condition (A1) first. Using lemmas 1 and 2, we can write (A1) as follows:

$$-\frac{k\theta(1-\theta)(2q-1)}{(2q\theta-\theta-q)\,(1+2q\theta-\theta-q)} \leq \frac{(1-k)\alpha(p-q)(\theta-q)}{(1-q)q(2q\theta-\theta-q)}$$

Notice that $\frac{1}{2} \leq z < q < p < 1$. Thus, for $\theta \in (0,1)$, $2q\theta-\theta-q < 0$ and (A1) is equivalent to:

$$\frac{k\theta(1-\theta)(2q-1)}{1+2q\theta-\theta-q} \leq -\frac{(1-k)\alpha(p-q)(\theta-q)}{(1-q)q} \tag{A3}$$

Finally, let $h(\theta) = -\frac{k\theta(1-\theta)(2q-1)}{2q\theta-\theta-q}$ and $r(\theta) = \frac{(1-k)\alpha(p-q)(\theta-q)}{(1-q)q}$, and notice that:

a) $r(0) > h(0) = 0$, $r(1) < h(1) = 0$

b) $r(\theta)$ is a negatively sloped straight line.

c) $h(\theta)$ is non-negative, continuous, and strictly concave for $\theta \in (0,1)$.

Properties a), b) and c) imply that there exists a unique $\overline{\theta} \in (0,1)$ such that for any $\theta < \overline{\theta}$ (A3) (and therefore (A1)) are satisfied.

Focusing on condition (A2) and following the same steps above, we can prove the existence and uniqueness of a $\underline{\theta} \in (0,1)$ such that, for any $\theta > \underline{\theta}$, (A2) is satisfied. From lemma 2 we know that for $\theta \in (0,1)$ the RHS of condition (A1) is strictly greater than the RHS of condition (A2). This result, together with the uniqueness of $\underline{\theta}$ and $\overline{\theta}$ implies that $\overline{\theta} > \underline{\theta}$. Therefore, (A1) and (A2) are simultaneously satisfied for $\theta \in \left[\underline{\theta},\overline{\theta}\right]$.

Finally, notice that a babbling equilibrium where the expert sends m_h with probability π and m_l with probability $1-\pi$ irrespectively of the signal observed always exists. In this case all messages are taken to be meaningless and ignored: $\widehat{\theta}_{\alpha,m_j} = \theta$ for any $i = h,l$, and $\widehat{\alpha}_{w,m_j} = \alpha$ for any $w = h,l$ and $j = h,l$, making the expert indifferent between the two messages. ■

Corollary 1 *For condition (A1),* $\frac{\partial RHS}{\partial \theta}\Big|_{\theta=\overline{\theta}} > \frac{\partial LHS}{\partial \theta}\Big|_{\theta=\overline{\theta}}$. *For condition (A2),* $\frac{\partial RHS}{\partial \theta}\Big|_{\theta=\underline{\theta}} >$

$\frac{\partial LHS}{\partial \theta}\Big|_{\theta=\underline{\theta}}$.

Proof of Corollary 1. The result in Corollary 1 is an immediate consequence of uniqueness of $\overline{\theta}$ and $\underline{\theta}$, together with the properties in lemma 1 and lemma 2. In words, the RHS of (A1) always intersects the LHS from above. The same is true for condition (A2). ■

Proof of Remark 1. When $k=0$, condition (A3) boils down to $0 \leq \alpha(p-q)(\theta-q)$. The associated equation has solution $\theta = q = \alpha p + (1-\alpha)z \equiv \overline{\theta}^{*}$. The value of $\underline{\theta}^{*}$ is obtained in the same way from condition (A2) ■

Proof of Proposition 2. Consider condition (A1)**.** We know from lemma 1 that the LHS is strictly positive for any $\theta \in (0,1)$. This implies that at $\theta = \overline{\theta}$, $RHS = LHS > 0$. We know from Lemma 2 that: RHS is strictly decreasing in θ for any $\theta \in (0,1)$, being equal to zero at $\theta = q = \overline{\theta}^{*}$. Therefore, it must be that $\overline{\theta} < \overline{\theta}^{*}$. Having established this result, notice that for any $\theta \in \left(0, \overline{\theta}^{*}\right)$: $\frac{\partial LHS}{\partial k} = -\frac{\theta(1-\theta)(2q-1)}{(2q\theta-\theta-q)(1+2q\theta-\theta-q)} > 0$ and $\frac{\partial RHS}{\partial k} = -\frac{\alpha(p-q)(\theta-q)}{(1-q)q(2q\theta-\theta-q)} < 0$. This, together with the result from Corollary 1 implies that $\overline{\theta}$ is decreasing in k. The same reasoning applies to condition (A2) to show that $\underline{\theta}$ is decreasing in k. ■

Proof of Proposition 3. Consider condition (A1). Notice that for $k \to 1$, $LHS_1 \to -\frac{\theta(1-\theta)(2q-1)}{(2q\theta-\theta-q)(1+2q\theta-\theta-q)}$ and $RHS_1 \to 0$. Thus, for $k \to 1 : \overline{\theta} \to 0$. For $k=0$, $LHS_1 = 0$ and $RHS_1 = -\frac{\alpha(p-q)(\theta-q)}{(1-q)q(2q\theta-\theta-q)}$. Thus for $k=0$, $\overline{\theta} = \overline{\theta}^{*}$.

Consider condition (A2). Notice that for $k \to 1$, $LHS_2 \to -\frac{\theta(1-\theta)(2q-1)}{(2q\theta-\theta-q)(1+2q\theta-\theta-q)}$ and $RHS_2 \to 0$. Thus, for $k \to 1 : \underline{\theta} \to 0$. For $k=0$, $LHS_2 = 0$ and $RHS_2 = \frac{\alpha(p-q)(1-\theta-q)}{q(1-q)(2\theta q-\theta-q+1))}$. Thus for $k=0$, $\underline{\theta} = \underline{\theta}^{*}$.

The results above imply that: for $k=0$, $\overline{\theta} - \underline{\theta} = \overline{\theta}^{*} - \underline{\theta}^{*} > 0$; for $k \to 1$, $\overline{\theta} - \underline{\theta} = 0$. By continuity of $\overline{\theta}$ and $\underline{\theta}$, there must exists a $k' \in [0,1)$ such that for $k > k'$, $\frac{\partial\left(\overline{\theta}-\underline{\theta}\right)}{\partial k} < 0$. ■

Proof of Remark 2. Let $q = \alpha\,(p-z) + z$, where $z < q < p$. Notice that:

(i) $\frac{\partial\left(\widehat{\theta}_{\alpha,m_h}-\widehat{\theta}_{\alpha,m_l}\right)}{\partial \alpha} = \theta(1-\theta)\,(p-z)\left(\frac{1}{(q+\theta(1-2q))^2} + \frac{1}{(1-q-\theta(1-2q))^2}\right) > 0$ for any $\alpha \in (0,1)$.

(ii) $\frac{\partial(\overline{\alpha}-\underline{\alpha})}{\partial \alpha} = \frac{(p-z)\left(\alpha^2(p-1)p+(\alpha-1)^2 z-(\alpha-1)^2 z^2\right)}{(q-1)^2 q^2}$; Notice that: $\frac{\partial(\overline{\alpha}-\underline{\alpha})}{\partial \alpha} = 0 \Leftrightarrow \alpha_0 = \frac{z-z^2-\sqrt{pz-p^2z-pz^2+p^2z^2}}{p^2-p+z-z^2}$, $\alpha_1 = \frac{z-z^2+\sqrt{pz-p^2z-pz^2+p^2z^2}}{p^2-p+z-z^2}$, where $\alpha_1 < 0 < \alpha_0 < 1$.

(iii) $\frac{\partial^2(\overline{\alpha}-\underline{\alpha})}{\partial\alpha^2} = 2\,(p-z)\left(-\frac{(1-p)(1-z)}{(1-q)^3} - \frac{pz}{q^3}\right) < 0$ for $\alpha \in (0,1)$.

Therefore, for $\alpha \in (0,1)$, $\overline{\alpha} - \underline{\alpha}$ is strictly concave with a maximum at $\alpha = \alpha_0$. ■

Proof of Proposition 4. Consider condition (A1) and notice that: (i) For $\alpha \to 0$, $LHS_1 \to \frac{k\theta(2z-1)(1-\theta)}{(2z\theta-\theta-z)(2z\theta-\theta-z+1)}$ and $RHS_1 \to 0$; thus, for $\alpha \to 0$, $\overline{\theta} \to 0$; (ii) For $\alpha \to 1$, $LHS_1 \to \frac{k\theta(2p-1)(1-\theta)}{(2p\theta-\theta-p)(2p\theta-\theta-p+1)}$ and $RHS_1 \to 0$; thus, for $\alpha \to 1 : \overline{\theta} \to 0$.

Now notice that $\overline{\theta}$ is positive and continuous for $\alpha \in (0,1)$. This, together with (i), (ii) imply that : There exist an $\alpha' \in (0,1)$ such that for $\alpha \in (0,\alpha')$, $\frac{\partial\overline{\theta}}{\partial\alpha} > 0$; There exist an $\alpha'' \in (0,1)$ such that for $\alpha \in (\alpha',1)$, $\frac{\partial\overline{\theta}}{\partial\alpha} < 0$.

A similar argument applies to condition (A2) to show that: (iii) For $\alpha \to 0$, $\underline{\theta} \to 0$; (iv) For $\alpha \to 1$, $\underline{\theta} \to 0$. Again, continuity and the fact that $\underline{\theta}$ is positive for any $\alpha \in (0,1)$ imply that: There exist an $\alpha^+ \in (0,1)$ such that for $\alpha \in (0,\alpha^+)$, $\frac{\partial\underline{\theta}}{\partial\alpha} > 0$; There exist an $\alpha^{++} \in (0,1)$ such that for $\alpha \in (\alpha^+,1)$, $\frac{\partial\underline{\theta}}{\partial\alpha} < 0$. ■

Proof of Proposition 5. From the results in the proof of proposition 4 we have that: (i) For $\alpha \to 0$, $\overline{\theta} - \underline{\theta} \to 0$; (ii) For $\alpha \to 1$, $\overline{\theta} - \underline{\theta} \to 0$. Since $\overline{\theta} - \underline{\theta}$ is positive for any value of $\alpha \in (0,1)$, by continuity there exist a value of $\alpha \in (0,1)$ below which $\overline{\theta} - \underline{\theta}$ is increasing in α, and a value of $\alpha \in (0,1)$ above which $\overline{\theta} - \underline{\theta}$ is decreasing in α. ■

Proof of Proposition 6. Consider conditions (A1) and (A2).Notice that for $z \to p$: (i) $LHS_1 \to \frac{k\theta(1-\theta)(2p-1)}{(2p\theta-\theta-p)(2p\theta-\theta-p+1)}$ and $RHS_1 \to 0$, which implies that $\overline{\theta} \to 0$; (ii) $LHS_2 \to \frac{k\theta(1-\theta)(2p-1)}{(2p\theta-\theta-p)(2p\theta-\theta-p+1)}$ and $RHS_2 \to 0$, which implies that $\underline{\theta} \to 0$. From (i) and (ii) it follows that for $z \to p$, $\overline{\theta} - \underline{\theta} \to 0$. Since $\overline{\theta} - \underline{\theta}$ is positive for any value of $z \in (0,p)$, by continuity there exist a value of $z \in (0,1)$ above which $\overline{\theta} - \underline{\theta}$ is decreasing in z. ■

References

[1] Alesina, Alberto, and Nouriel Roubini [with Gerald D. Cohen] (1997). "Political Cycles and the Macroeconomy", Cambridge, MA: MIT Press.

[2] Banks, Jeffrey S., and Barry R. Weingast (1989). "The Political Control of Bureaucracies under Asymmetric Information", *American Journal of Political Science*, vol. 36, pp 509–24.

[3] Barber, B., Lehavy, R., McNichols, M., Trueman, B. (2006). "Buys, holds, and sells: The distribution of investment banks' stock ratings and the implications for the profitability of analysts' recommendations", *Journal of Accounting and Economics*, vol. 41, pp. 87–117.

[4] Barber, B., Lehavy, R., Trueman, B. (2007). "Comparing the stock recommendation performance of investment banks and independent research firms", *Journal of Financial Economics*, vol. 85, pp. 490-517.

[5] Battigalli, Pierpaolo, and Martin Dufwenberg (2009). "Dynamic Psychological Games", *Journal of Economic Theory*, vol. 144, pp. 1-35.

[6] Benabou, Roland, and Guy Laroque (1992). "Using Privileged Information to Manipulate Markets: Insiders, Gurus and Credibility", *Quarterly Journal of Economics*, vol. 107, pp. 921-58.

[7] Bendor, Jonathan, Serge Taylor, and Roland Van Gaalen (1985). "Bureaucratic Expertise versus Legislative Authority: A Model of Deception and Monitoring in Budgeting", *American Political Science Review*, vol. 70, pp. 1041–1060.

[8] Brandenburger, A., and B. Polak (1996). "When managers cover their posteriors: making the decisions the market wants to see", *RAND Journal of Economics*, vol. 27, pp. 523–541.

[9] Carlsen, Fredrik (1999). "Inflation and Elections: Theory and Evidence for Six OECD Economies", *Economic Inquiry* (January), pp. 119–35.

[10] Carpenter, Daniel P. (2001). "The Forging of Bureaucratic Autonomy: Reputations, Networks, and Policy Innovation in Executive Agencies", 1862–1928. Princeton, NJ: Princeton University Press.

[11] Crawford, Vincent P., and John Sobel (1982). "Strategic Information Transmission", *Econometrica*, vol. 50, pp. 1431-51.

[12] Dasgupta, Amil, and Andrea Prat (2008). "Information Aggregation in Financial Markets with Career Concerns", *Journal of Economic Theory*, vol. 143, pp. 83-113.

[13] Ely, Jeffrey, and Juuso Valimaki (2003). "Bad Reputation", *Quarterly Journal of Economics*, vol. 118(3), pages 785-814.

[14] Fang, Lily, and Ayako Yasuda (2009). "The Effectiveness of Reputation as a Disciplinary Mechanism in Sell-side Research", forthcoming in *Review of Financial Studies*.

[15] Gentzkow, Matthew, and Jesse M. Shapiro (2006). "Media Bias and Reputation", *Journal of Political Economy*, vol. 114, pp. 280-316.

[16] Grossman, Sanford, and Joseph Stiglitz (1980). "On the Impossibility of Informationally Efficient Markets", *American Economic Review*, vol. 70, pp. 393-408.

[17] Heclo, Hugh (1975). "OMB and the Presidency - The Problem of 'Neutral Competence'", *The Public Interest*, vol. 38, pp. 80–99.

[18] Holmström, B. (1999). "Managerial Incentive Problems: A Dynamic Perspective", *Review of Economic Studies*, vol. 66, pp. 169–182.

[19] Hong, H., Kubik, J.D. (2003). "Analyzing the Analysts: Career Concerns and Biased Earnings Forecasts", *Journal of Finance*, vol. 58, pp. 313–351.

[20] Kreps, David M., and Robert Wilson, (1982). "Reputation and Imperfect Information", *Journal of Economic Theory*, vol. 27, pp. 253-79.

[21] Lizzeri, Alessandro (1999)."Information Revelation and Certification Intermediaries", *Rand Journal of Economics*, vol. 30, pp. 214-231.

[22] Michaely, Roni, and Kent L. Womak (1999). "Conflict of Interest and the Credibility of Underwriter Analyst Recommendations," *Review of Financial Studies*, vol. 12, pp. 653-686.

[23] Mikhail, M.B., Walther, B.R., Willis, R.H. (1999). "Does forecast accuracy matter to security analysts?", *Accounting Review*, vol. 74, pp. 185–200.

[24] Milgrom, Paul, and John Roberts (1982). "Predation, Reputation and Entry Deterrence", *Journal of Economic Theory*, vol. 27, pp. 280-312.

[25] Morgan, John, and Phillip C., Stocken (2003). "An Analysis of Stock Recommendations", *RAND Journal of Economics, vol.* 34, pp. 183-203.

[26] Morris, Stephen (2001). "Political Correctness", *Journal of Political Economy*, vol. 109, pp. 231-265.

[27] Ottaviani, Marco, and Peter N. Sorensen (2000). "Herd Behavior and Investment: Comment", *American Economic Review*, vol. 90, pp. 695-703.

[28] Ottaviani, Marco, and Peter N. Sorensen (2001). "Information aggregation in debate: who should speak first?", *Journal of Public Economics, vol.* 81, pp. 393-421.

[29] Ottaviani, Marco, and Peter N. Sorensen (2006). "Reputational Cheap Talk", *Rand Journal of Economics*, vol. 37, pp. 155-175.

[30] Rourke, Francis E. (1992). "Responsiveness and Neutral Competence in American Bureaucracy",.*Public Administration Review*, vol. 52, pp. 539–46.

[31] Scharfstein, David S., and Jeremy C. Stein (1990. "Herd Behavior and Investment", *American Economic Review*, vol. 80, pp. 465-479.

[32] Sobel, J. (1985). "A Theory of Credibility", *Review of Economic Studies*, vol. 52, pp. 557–573.

[33] Stickel, S.E. (1992). "Reputation and Performance Among Security Analysts", *Journal of Finance*, vol. 47, pp. 1811–1836.

[34] Trueman, Brett (1994). "Analyst Forecasts and Herding Behavior", *Review of Financial Studies*, vol. 7, pp. 97-124.

[35] Weatherford, M. Stephen (1987). "How Does Government Performance Influence Political Support?", *Political Behavior*, vol. 9, pp. 5–28.

[36] Welch, Ivo (1992). "Sequential Sales, Learning, and Cascades", *Journal of Finance*, vol. 47, pp. 695-732.

[37] Wilson, James Q. (1989). "Bureaucracy: What Government Agencies Do and Why They Do It", New York: Basic Books.

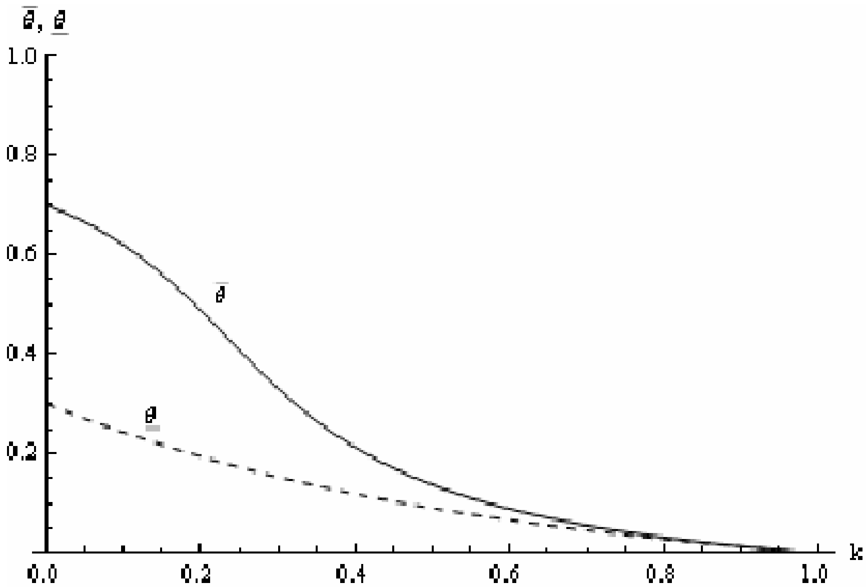

Figure 1: Truthtelling thresholds as functions of k

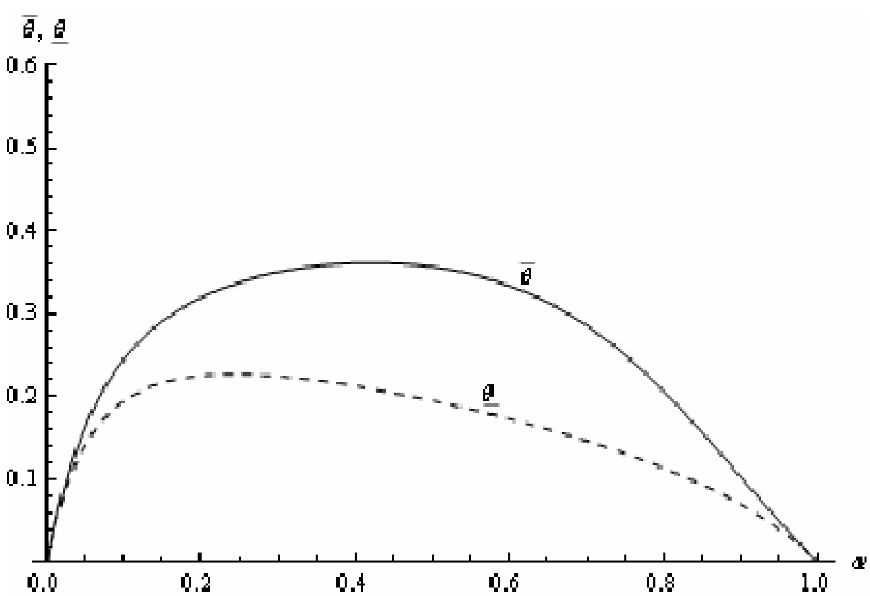

Figure 2: Truthtelling thresholds as functions of α

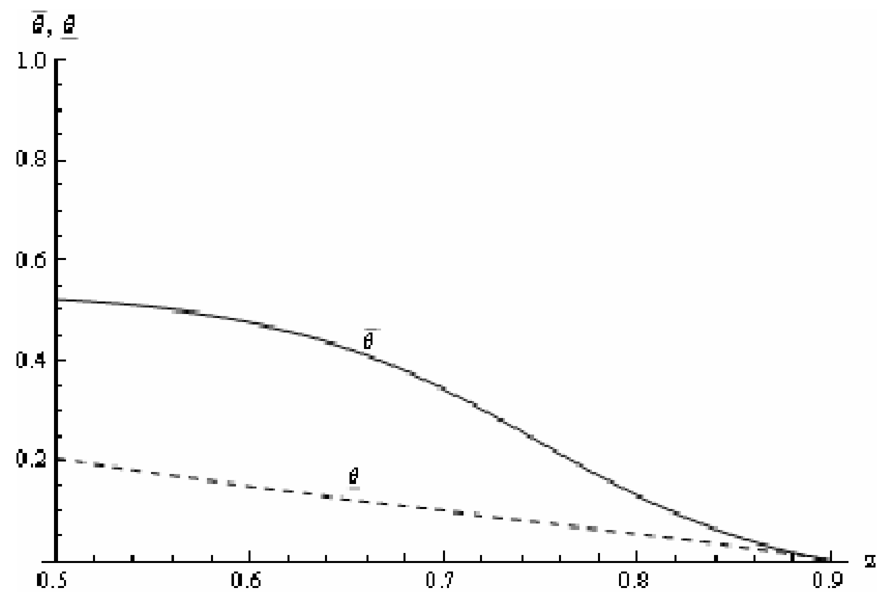

Figure 3: Truthtelling thresholds as functions of z