Competing Influence*

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Abstract

This paper investigates the incentives of experts competing to influence decision making. Competition for influence is shown to have an ambiguous effect on truthtelling incentives and a decision maker might be better off relying on one source of information only. This result allows to derive important implications for organizational design: the paper shows that delegation and favouritism can arise as a way to promote the right flow of information within an organisation. Delegation can lead to stronger truthtelling incentives than communication and it is optimal when the importance of the decision is intermediate, while both more routinary and critical decisions should be made by a committee. Favouritism, consisting in biasing the competition for influence in favour of one expert, can further increase truthtelling incentives.

Keywords: reputation, competition, delegation, favouritism.

Jel classification codes: C73, D82, L23

1 Introduction

This work aims at a better understanding of delegation and favouritism in organisations through the analysis of the incentives created by competition to influence decision making. This paper argues that the choice between delegating decision powers versus relying on communication of information from multiple experts is crucially shaped by the incentives created by competition for influence. The results are based on the analysis of the effects of competition in a dynamic

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game of information transmission where those senders (experts) who have a conflict of interest with the decision maker are motivated by reputational concerns to report information truthfully. The novel theoretical feature of this paper is that it introduces multiple senders in this framework and identifies two conflicting forces generated by competition among senders. On the one hand competition for influence induces a reduced influence effect: biased senders will have less chances to influence decision making both in the current and in the future period. Reduced future influence decreases biased senders' incentives to maintain an untarnished reputation as the presence of competitors makes it less likely that a sender who behaves in the present is able to cash in the benefits of her undamaged reputation. Reduced current influence limits a biased sender's opportunity to mislead the decision maker in the current period and increases his incentives to report information truthfully. On the other hand competition generates a lost reputation effect which can raise truthtelling incentives: a sender fears other senders gaining more influence as his own reputation flutters when other senders may have non congruent preferences with his own. The balance between these effects is ambiguous and facing multiple senders is not always beneficial for the receiver. This result has important implication for organizational choice. Organisations can decide to let agents compete to influence decision making, thus aggregating all the available information. When the reduced future influence effect is very strong, however, organisations might find it optimal to commit to delegate decision powers to only one sender. The model shows that experts might be delegated decision powers on certain tasks in order to limit competition for influence and spur truthtelling incentives. The model also shows that it can be optimal to commit to bias the competition for influence as favouring one of the experts helps creating additional incentives to report information truthfully. Although favouritism characterizes the every day life of many organizations, it has received little attention in formal economic analysis and this work shows it could arise as a rational organizational response to the problem of fostering truthtelling incentives. Finally, the model shows that different organisational forms are preferred as a function of the importance of the decision at stake. In particular, delegation should be used when the importance of the decision is neither very low nor too high. In the latter situations it is optimal to aggregate different opinions, so that decision makers will be better off relying upon communication of information.

The results can be applied to describe many real world situations in which a decision maker relies on the information provided by experts who may have a vested interest in inducing some decisions. A major application is the analysis of resources allocation within a firm: the chief financial officer, CFO (the decision maker), is allocating funds among projects in a firm and wants to elicit information about such projects from project leaders (experts) in order to allocate funds to the most promising project. However, project leaders may derive a private benefit if more funds are allocated to the project they work on. This paper shows how the incentives of project leaders to report the truth change if the CFO collects information from all competing projects leaders and centralizes the decision as opposed to delegating decisions to one project leader. The results of the paper can be applied to describe other interesting economic interactions such as: politicians competing to be elected, lobbies willing to influence politicians, financial analysts providing information to investors, investment banks providing advice to corporate clients.

1.1 Related literature

The analysis of this paper is related to the literature investigating the transmission of information from possibly biased experts. The contribution of Sobel (1985) and of Benabou and Laroque (1992) are especially related. They derive conditions ensuring that reputational incentives are effective in inducing biased experts to report their information truthfully. The present work differs from these contributions as it introduces a second informed sender (and analyzes the extension to n senders), so that truthtelling incentives are created both by the desire to keep a reputation and by the competition for influence. Moreover, it differs in the way the bias of senders is modelled: in both Sobel and Benabou and Laroque a biased sender always has a conflict of interest with the decision maker, while in this model senders always prefer a given decision which might coincide with the preferences of the decision maker according to the realization of the state of the world. This can be a more interesting way to model the preferences of experts in many applications.

Horner (2002) is also related as he shows how reputation and competition interact to create incentives. He analyses a model featuring both moral hazard and adverse selection where "good" agents are able to produce a high quality product at some cost. Competition has the role of enforcing the production of goods of high quality because it creates an outside option for consumers as they will switch to a different producer upon receiving a low quality good. The present model is different as it deals with an environment where monetary transfers are not allowed. Moreover, Horner does not discuss the implications of the interactions of reputational incentives and competition on organisational form, in particular on the choice of delegating authority.

The latter issue is investigated by a large and rich economic literature, with Aghion and Tirole (1997) being one of the most important contributions, but few papers deal with settings where transfers are not allowed and the rationale for delegation is based upon the desire to improve the transmission of information within an organisation. The contribution of Dessein (2002) is the first to discuss delegation in a cheap talk setting. Dessein compares the use of delegation in contrast to communication in a model a la Crawford and Sobel (1982), where the sender's bias is public knowledge. Delegation is shown to improve upon communication as the latter involves a garbling of information due to the sender bias. On the contrary, the present work shows that sometimes communication (letting the agents compete for influence while the receiver chooses the course of action) is preferable to delegation, depending on the importance of the decision and independently of the bias of the experts (which is unknown in this model). This model also shows that a combination of communication and delegation can improve upon both pure communication and pure delegation. This seems to be a broader view of organisational life, as delegation and communication coexists in practice and the choice between the two is often dictated by the importance of the decision at hand, as predicted by the model[1]. This paper is also related to Aghion, Dewatripont and Rey (2004). They investigate the role of transferring control in situations where an expert is motivated by reputational concerns. However, they do not analyse the role of competition. A few recent works analyse the optimal design of delegation as a way to promote information transmission. Alonso and Matouschek (2007 - I) investigate the optimal design of decision rules and show situations in which agents are delegated decision powers as a function of their bias. They also show that agents can be delegated power over some decisions and that rules may contain gaps. Alonso and Matoushck (2007 - II) analyze a repeatd interaction between a principal and an agent and show how optimal decision rules evolve as a function of the principal commitment power tp use the information provided by the agent. Both papers do not discuss the effects of competition and in both papers reputational incentives are absent as the bias of the agent is known. Melumad and Shibano (1991) and Szalay (2005) also provide related results. They investigate whether the decision maker can improve information transmission by committing to follow certain decision rules. Both papers, however, do not deal with competition and rather focus on the role of the alignment of interest between the sender and the decision maker.

This paper is related to the literature on favouritism. There exists a few papers in economics dealing with this issue: the literature mainly developed in sociology and to the best of my knowledge, there are only two contributions from economists in the area. The first is Prendergast and Topel (1996) who show that allowing managers to reward their favourite employees might be a cheap way of providing incentives. However the authors assume that managers utility is increasing if their subordinates get promoted. This assumption is key to generate a role for favouritism. The second is Kwon (2006) who generates endogenously a preference for favouritism in a model where inventors compete to have their project implemented and the decision maker designs an optimal incentive scheme. However, he deals with a model where inventors become informed after exerting costly effort and the effects generated by competition are rather different[2].

This work is related to the literature on influence activities. Milgrom and Roberts (1988) represents an early important contribution in the area. They show that employees might want to allocate effort to produce information about their ability. Such information is valuable for the firm, but comes at the cost of subtracting effort away from other productive activities. Milgrom and Roberts discuss organisational responses to the presence of excessive influence activities. My

[1] An important point to stress is that Dessein studies communication versus delegation with one sender. In my model, in the one sender case, communication and delegation yield the same truthtelling incentives. On the contrary, communication differs from delegation in the two senders case due to the incentives effects created by competition for influence.

[2] In Kwon (2006) the assumptions about effort costs are key in delivering the result that symmetric effort (induced by "fairness") improves upon favouritism.

model shares the view that organisational form is an instrument that can be employed to improve the transmission of important information. However, influence activities are modelled rather differently and this literature has placed little attention on the explicit analysis of the effects of competition in inducing the correct transmission of information[3].

Finally, this work is related to the theoretical literature on cheap talk. However, the fact that agent's bias is unknown and that the game is dynamic differentiates this paper from most part of the literature in this area. Following the seminal contribution of Crawford and Sobel (1982), a large literature developed focussing on different variations on the theme, taking both a purely theoretical and an applied perspective. Among these contributions, Krishna and Morgan (2001) is the reference closest to the present work. They investigate the effects of the presence of a second sender in a static cheap talk game a la Crawford and Sobel (1982). They show that unless the bias of the senders is extreme, the presence of a second sender is beneficial in that the informativeness of equilibria increases. They also show that when the bias of senders goes in the same direction, the information provided by the more biased expert is redundant. Krishna and Morgan (2001) assume that the bias of the agents is publicly known. The presence of a second sender in their model helps in assessing the credibility of information transmitted and is especially useful when senders have opposed biases. This is clearly different from the role competition plays in my set up. Finally, Krishna and Morgan do not study organisational form. Gilligan and Krehbiel (1989) discuss a static game with two senders to describe the desirability of open versus closed rule in the legislative process. In their model, the bias of informed parties is known and they do not consider repeated interactions.

1.2 Structure of the paper

The paper is structured as follows: section 2 introduces the base model and competition is modeled as a situation where two senders interact with one decision maker, section 3 derives the equilibrium when the receiver cannot commit to delegate decision powers to a given sender, section 4 discusses the role of establishing an organization and delegating authority to one of the senders, and why favouritism can be optimal, section 5 discusses the welfare of the decision maker, section 6 shows when it can be optimal to delegate decision powers to an agent with a less established reputation, such as a junior, section 7 extends the model to the case of n senders competing to influence the decision maker, section 8 contains a discussion of the assumptions, the modelling strategy, results and applications, section 9 concludes.

[3] Rotemberg and Saloner (1995) is also broadly related as the authors show that conflict between members of an organisation can foster information production. The bad side of conflict is that producing information is costly, and too much conflict can lead to excessive effort being devoted to information production.

2 The model

The strategic interaction between the decision maker (she) and senders (he) is modelled as a two period game. The same stage game is repeated in each period.

Players and actions: The decision maker interacts with one or two senders. In each period the decision maker has to implement a decision $d \in \{-1, 0, 1\}$. Senders provide a message $m \in \{-1, 0, 1\}$, suggesting the appropriate course of action. After observing the messages, the decision maker decides what action to implement.

Information structure: At the beginning of the first period nature draws the types of senders. They might be unbiased, left biased or right biased. A sender's type is his private information, is constant over time, and is distributed according to the probability distribution $\Pr(i = Honest) = p^i$, $\Pr(i = Left\ biased) = \Pr(i = Right\ biased) = \frac{1-p^i}{2}$. Firstly both senders will be assumed to have the same ex-ante chance of being honest. In such a case, $\Pr(i = H) = \Pr(-i = H) = p$. This assumption will be removed later. The type of each sender represents his preferences. An unbiased sender has no conflict of interest with the decision maker, left biased senders always prefer the decision maker to take action -1, while right biased senders always prefer the decision maker to take action 1.

Every period, nature draws a random variable $y \in \{-1, 0,\ 1\}$ representing the state of the world. Define state 0 as the status-quo. State zero occurs with probability $\frac{1}{4}$, while states -1 and 1 occur with probability $\frac{3}{8}$ each, so that the decision maker randomizes between states -1 and 1, getting an expected payoff of zero when she is uninformed[4]. States of the world in different periods are drawn independently. Senders privately observe a perfect signal about the realization of the state of the world. Moreover, nature draws a random variable that defines period importance. This is represented by the random variable A with support $\Gamma = [\underline{A}, \overline{A}]$, $\underline{A} > 0$, and distributed according to a continuous distribution function $G(\cdot)$ for the decision maker, and by the random variable B, with support $\Phi = [\underline{B}, \overline{B}]$, $\underline{B} > 0$ and distributed according to the continuous distribution function $H(\cdot)$, for senders. The distribution H is atomless. The realization of period importance is common knowledge and observed before messages are sent and decisions taken. Finally, decision maker's payoff is commonly observed, while each sender's payoff is his private information[5].

Player's payoffs: The decision maker would like to implement the decision that matches the state of the world. Formally, $U^{DM} = A$ if $d = y$ and $U^{DM} = -A$ if $d \neq y$[6]. Honest senders have the same preferences over actions as the decision maker, so that $U^H = B$ if $d = y$, and $U^H = -B$

[4]The assumption on the relative likelihood of the states of the world is with some loss of generality. Depending upon the likelihood of the different states, the relative maginitude of the effects generated by competition changes. However, their existence is not affected.

[5]This assumption is needed to avoid perfect revelation of a sender's type when payoffs are realized. However, decision maker's payoffs could be assumed to be unobservable without altering any of the results.

[6]The subscripts DM, H, L, R denote, respectively, the payoff functions of Decision Maker, Honest, Left biased and Right biased.

otherwise. On the contrary, left biased senders always prefer the decision -1 to be implemented, so that $U^L = B$ if $d = -1$ and $U^L = -B$ if $d \neq -1$. Analogously right biased senders always prefer decision 1 to be implemented, so that $U^R = B$ if $d = 1$ and $U^R = -B$ if $d \neq 1$. Notice that I am assuming that biased types suffer the same "damage" if their preferred decision is not implemented, independently of the "distance" of the decision from their preference. In fact, a left biased sender incurs a loss of $-B$ both if decision 0 is made and if decision 1 is made. It could well be the case that left biased senders prefer decision 0 over decision 1 and right biased senders prefer decision 0 over decision -1. Allowing for this possibility complicates the notation adding little to the economic intuition and determining limited changes in results. I am also assuming the decision maker cannot adjust the intensity of the action as a function of the reputation of each sender nor as a function of the magnitude of the "consensus": the decision maker might want to trust more the information provided by senders if the senders agree, and less if there is disagreement. I will explore this possibility further in the paper when I extend the model to allow for the presence of more than two senders. Finally, I am assuming there is no type biased towards the status-quo. This is both interesting in itself, as it allows to explore the effect of having a decision that is "unbiased"[7], and useful to keep the model simple and tractable.

Contracts: this model aims at describing an environment where it is difficult to write complete contracts to govern agents interactions. Sender's private signals are not verifiable to court, and money cannot be transferred among players. The main contractible variable is the power to influence decision making. In the first part of the paper, it will be assumed that the decision maker is not able to credibly commit to delegate decision powers to a sender. This assumption will be removed in the sections on delegation and on favouritism.

Timing: there are two periods (stages). At the beginning of the first period, sender's types are drawn and privately observed by each sender only[8]. Then the state variable is drawn and privately observed by senders only, while the decision maker observes an imperfect signal. The period importance realization for decision maker and senders is drawn and commonly observed[9]. Senders simultaneously report messages, the decision maker chooses a course of action, possibly on the basis of senders reports, and payoffs are realized. The same stage game is repeated in the second period, with the exception that sender's types are drawn once and for all at the very beginning of the game.

Strategies and beliefs: for ease of exposition it is assumed that honest senders are committed types and always report information truthfully[10]. Therefore, attention should be placed on biased

[7] I mean a decision who is not preferred by any biased type.

[8] Sender i knows his type, but not sender j's type.

[9] There is no loss of generality in assuming that the decision maker observes her own period importance realization and senders observe theirs. However, to decide whether delegation or favouritism are better than communication, the decision maker should be able to get at least an informative signal about the realization of period importance for the senders. This point will be discussed further later on.

[10] This is with little loss of generality. Without that assumption, there could exist babbling equilibria in which

senders. Left biased sender i reports the state realization truthfully in period t with probability $q^s_{i,t}(h_t)$, where s represents the true realization of the state of the world, and h_t is the history of the game at the beginning of date t. Analogously, right biased senders report the true realization truthfully with probability $z^s_{i,t}(h_t)$. The dependence on the state of the world follows because the true state can coincide with the preferred decision for the sender, and this affects the willingness to report the state truthfully. The decision maker updates her beliefs about sender i type through Bayes rule. At the beginning of the first period, $p_1 = p$ while at the beginning of the second period

$$p_2 = \frac{p}{p + \frac{1-p}{2}q^s_{i,1} + \frac{1-p}{2}z^s_{i,1}} \quad \text{if } m = y \text{ (report was truthful)}$$

$$p_2 = 0 \quad \text{if } m \neq y \text{ (report was false)}$$

Strategies for the decision maker are mappings from the set $\{m_1, m_2\} \times \{i, -i\}$ to the set of actions. In words, the decision maker chooses decision d, when sender i reported message m_i, and sender $-i$ reported message m_{-i} in period t, with probability $\nu^{i,m_i,m_{-i}}(h_t) \in [0,1]$, where again h_t is the history of the game at the beginning of date t. Such probabilities depend upon the credibility of the sender's report and upon the messages sent.

From now on, until section 6, the probability a sender is honest will be denoted simply by p when $t = 1$.

3 Communication

This section derives the equilibrium of the game under the assumption that the decision maker cannot commit to grant decision powers to a given sender. Senders communicate their information to the decision maker who deliberates on the appropriate course of action.

The equilibrium concept is Perfect Bayesian Equilibrium. Only strategies based upon current history are considered. An equilibrium is a set of strategies $q^s_{i,t}(h_t)$, $z^s_{i,t}(h_t)$ for left and right biased senders and $\nu^{i,m_i,m_{-i}}(h_t)$ for the decision maker, as defined above, and a set of beliefs $\{p, p_2\}$ for the decision maker, such that strategies are sequentially rational for a given set of beliefs and beliefs are consistent given the strategy profile. To ease notation I will drop the dependence of q, z and ν on h_t.

The assumptions that honest senders are committed types and those about the distribution of the state of the world, rule out the existence of babbling equilibria, at least if the probability senders are honest (which I define as "sender's credibility") is large enough to ensure the existence

the decision maker discards all information transmitted and senders randomize among messages, as well as "partial babbling equilibria" in which the decision maker only listens to one sender and discards the messages of the other who randomizes. There are two points to stress on this issue: firstly, all the equilibria derived under the assumption that honest senders always report the truth are still equilibria when that assumption is removed; secondly one could still compare the communication case, in which the decision maker listens to all senders if they have enough reputation, with the partial babbling equilibrium which would coincide with the pure delegation case, and identify the different forces that shape truthtelling incentives.

of equilibria where information transmission can take place. When the credibility of a sender is too low, the decision maker discards the messages received and biased senders randomise.

The analysis is centred on truthtelling equilibria, i.e. equilibria in which biased senders have incentives to report information truthfully and the decision maker finds optiimal to use the information proviided by senders. The goal is to identify conditions such that truthtelling equilibria exist.

It is useful to state two preliminary results, common to the one and two senders games.

Lemma 1 *A biased sender always suggests his preferred decision to be implemented in the last period if he has enough credibility to transmit information.*

Proof. See Appendix ■

In other words, the Lemma says that there cannot exist truthtelling equilibria in the last period.

Lemma 2 *A biased sender always reports the truth when the state of the world coincides with his preferences.*

This is obvious as by reporting the true state of the world he enjoys a current gain without incurring any loss in reputation[11].

The decision maker is willing to implement the decision proposed by the sender with positive probability in period t if and only if

$$A[p_t + \frac{(1-p_t)}{2}(q_t^s - (1-q_t^s)) + \frac{(1-p_t)}{2}(z_t^s - (1-z_t^s))] > 0$$

where 0 is the expected payoff from making an uninformed decision[12] and p_t is the probability that the sender is honest conditional on the information available in period t. Then, the sender will be able to credibly transmit information in period 2 if and only if $A[p_2 + \frac{(1-p_2)}{2}(-\frac{1}{4}) + \frac{(1-p_2)}{2}(-\frac{1}{4})] > 0$, which holds if $p_2 > \frac{1}{5}$. This follows because the sender is honest with probability p_2 and then reports the truth. With probability $\frac{1-p}{2}$ he is left biased, and with probability $\frac{3}{8}$ the true state is -1, so he is reporting the truth, while with probability $\frac{5}{8}$ the state is either zero, or 1, and the left biased sender lies. The same reasoning describes the behaviour of a right biased sender. In period 1 the sender is able to credibly transmit information if and only if $A\{p + \frac{(1-p)}{2}[\frac{1}{4} + \frac{3}{8}q_1^s - \frac{3}{8}(1 - q_1^s)] + \frac{(1-p)}{2}[\frac{1}{4} + \frac{3}{8}z_1^s - \frac{3}{8}(1 - z_1^s)]\} > 0$. In order to ensure the existence of truthtelling equilibria

[11] Furthermore, it never pays to lie by falsely reporting the true state is the status quo. This follows because the sender would suffer both a current period loss, and a reputational loss. The latter is implied by the assumptions that the true state is observed perfectly. Otherwise, it could happen that a biased sender lied in order to gain a reputation for being unbiased. This mechanism would be similar to that unveiled by the Morris (2001) paper.

[12] State 0 is less likely than the other two states. Any strategy that attaches positive weight to this state, when the decision maker is uninformed, is strictly dominated by a strategy that randomizes between states -1 and 1. Such strategy yields an expected payoff of zero.

in pure strategies, it is necessary that $p > \frac{1}{5}$. In fact, in such a case, both types of biased senders report the truth in the first period setting $q_1^s = z_1^s = 1$, so that $p_2 = p$ and information can be credibly transmitted if and only if $p_2 > \frac{1}{5}$.

I firstly analyse the game where one sender tries to influence the decision maker, then I will turn to the two senders game. I describe the behaviour of a left biased sender, as that of a right biased sender is analogous.

One sender. In the second period a left biased sender always reports that the true state is -1, which implies $q_2^{-1} = 1$ if the state is -1, and $q_2^0 = q_2^1 = 0$, otherwise. In the first period a left biased sender trades off current gains with the possibility of influencing the decision in the future. If the true state is -1, the sender reports the truth for sure, as this involves no reputational loss. If instead the true state is either zero or 1, the payoff of a left biased sender by reporting the truth in period 1 is

$$V_T = -B + I_{\left\{p_2 > \frac{1}{5}\right\}} \delta E(B)$$

where $I_{\left\{p_2 > \frac{1}{5}\right\}}$ is the indicator function taking the value 1 if $p_2 > \frac{1}{5}$ and zero otherwise, $\delta \in (0; 1]$ is a discount factor and $E(\cdot)$ denotes the expectation operator, so that $E(B) = \int_\Phi B dH(B)$. The payoff from lying is given by

$$V_L = B$$

This follows because if a sender lies in the first period, his second period reputation is destroyed as the posterior probability he is honest is $p_2 = 0$. Therefore the decision maker will not listen to the sender in the second period, and will make an uninformed decision which yields an expected payoff of zero. As the sender is not believed because his reputation is gone, a biased sender without reputation randomizes among messages. When the true state is different from his preferred state, a biased sender reports the state truthfully in the first period if and only if $V_T > V_L$, while randomizes in the knife edge case occurring when $V_T = V_L$. In the pure strategy equilibrium it is necessary that reputation is large enough for information transmission to take place. Assuming therefore that $p > \frac{1}{5}$, it is possible to prove the following

Proposition 1 *In the one sender case, a biased sender reports information truthfully in pure strategies in the first period if and only if the decision at stake is not too important.*

Proof. See the appendix. ■

The intuition for this result is standard and is analogous to that in Sobel (1985): if the realization of decision importance in the first period is not too high, a biased sender is willing to incur a current loss in order to be able to influence the decision maker in the second period. The proof of the proposition shows that the truthtelling equilibrium in pure strategies exists if and only if

$$B < \frac{\delta E(B)}{2}$$

while there is a continuum of equilibria in mixed strategies, where senders report information truthfully with probability $q_1^{s=0} \in (0, \frac{4p}{1-p}]$, when the true state is the status quo and $q_1^{s=1} \in (0, \frac{9p-1}{1-p}]$,when the true state is 1, if and only if $B = \frac{\delta E(B)}{2}$. However the mixed strategy equilibrium is a zero probability event as period importance is drawn from a continuous and atomless distribution.

I now move to the analysis of the game where two senders report information and show the effects of competition on truthtelling incentives. Then, I will discuss the behaviour of the decision maker and derive the equilibria.

Two senders. It is useful to state two preliminary results that allows to ease the exposition. Firstly, the decision maker never benefits from discarding information when senders have enough credibility to ensure information transmission takes place.

Lemma 3 *The decision maker always uses the information provided by senders if they have enough credibility. Formally,* $\nu^{i,m_i,m_{-i}} + \nu^{-i,m_i,m_{-i}} = 1$

Proof. See Appendix ■

Secondly, from the assumptions of the model, it follows that action 0 (the status quo) is not preferred by any biased type. Therefore when the decision maker observes conflicting messages, and one of the messages is zero, she knows that zero is the true state. This implies that if $m^{-i} = 0$ and $m^i \neq 0$, the decision maker sets $\nu^{i,m_i,0} = 0$. Then

Lemma 4 *There is always truthtelling in the first period if the true state is the status quo*

This follows because the status quo is the "unbiased" action. In a truthtelling equilibrium, the opponent reports the truth. When the true state is the status quo, the decision maker observes a message suggesting the status quo from the opponent. Then, there is no profitable deviation to lying because the decision maker knows that zero is not the preferred action of any biased type and it must be the true state. Thus, in a truthtelling equilibrium, a left (or right) biased sender derives no benefit from reporting false information when observing a true state equal to the status-quo (state zero).

Then, it remains to discuss the behaviour of a biased sender when the observed state is opposite to his preferences. I assume the biased sender is left biased and the true state is 1[13]. Biased senders always lie in the last period. Therefore, I denote as q_i^1 the probability a left biased sender i reports the truth in period 1 when the true state is 1, and I thus drop the reference to the time period.

[13]The case of a right biased sender observing the true state is -1 is identical.

The payoff of a left biased sender i, in such a case, is given by

$$V_T^i = [p + \frac{(1-p)}{2} + \frac{(1-p)}{2} q_{-i}^1](-\nu_1^{i,1,1} - \nu_1^{-i,1,1})B + \frac{1-p}{2}(1 - q_{-i}^1)(-\nu_1^{i,1,-1} + \nu_1^{-i,1,-1})B + \quad (1)$$
$$\delta E(B)[\frac{(1-p)}{2} q_{-i}^1(\nu_2^{i,-1,-1} + \nu_2^{-i,-1,-1}) + p(\frac{3}{8}(\nu_2^{i,-1,-1} + \nu_2^{-i,-1,-1}) - \frac{1}{4} + \frac{3}{8}(\nu_2^{i,-1,1} - \nu_2^{-i,-1,1})) +$$
$$\frac{(1-p)}{2}(\nu_2^{i,-1,1} - \nu_2^{-i,-1,1}) + \frac{(1-p)}{2}(1 - q_{-i}^1)]$$

if he reports truthfully in the first period, and

$$V_L^i = [p + \frac{(1-p)}{2} + \frac{(1-p)}{2} q_{-i}^1](\nu_1^{i,-1,1} - \nu_1^{-i,-1,1})B + \frac{1-p}{2}(1 - q_{-i}^1)(\nu_1^{i,-1,-1} + \nu_1^{-i,-1,-1})B \quad (2)$$
$$+\delta E(B)[\frac{(1-p)}{2} q_{-i}^1 - \frac{(1-p)}{2} + p(\frac{3}{8} - \frac{1}{4} - \frac{3}{8})]$$

if he lies. Both equations have been simplified relying on the fact that

$$p_{-i,2} = \frac{p}{p + \frac{1-p}{2} q_{-i}^1 + \frac{(1-p)}{2}}$$

and on the fact that a right biased sender reports the truth when the true state is 1, thus setting $z_1^1 = 1$. The intuition for the expression for the expected payoff from reporting the truth can be described as follows: when the left biased sender reports the truth in period 1, the decision maker observes two agreeing messages if the opponent is unbiased, or is right biased, or is left biased but is reporting the truth. This happens with probability $[p + \frac{(1-p)}{2} + \frac{(1-p)}{2} q_{-i}^1]$. In such a case the decision maker follows the advice of sender i with probability $\nu_1^{i,1,1}$ and that of sender $-i$ with probability $\nu_1^{-i,1,1}$, where the superscripts $1, 1$ denote the fact that the decision maker is observing two messages suggesting the true state is 1. The payoff is negative because the left biased sender suffers a loss as messages suggest implementing decision 1. With probability $\frac{1-p}{2}(1-q_{-i}^1)$ the opponent is left biased and is lying. Then the decision maker faces two conflicting messages, one suggesting the true state is 1 coming from sender i, the other suggesting the true state is -1 coming from sender $-i$, and she implements the decision suggested by sender i with probability $\nu_1^{i,1,-1}$ leading to a loss for that sender (this explains the negative sign), or the decision suggested by sender $-i$ with probability $\nu_1^{-i,1,-1}$ and this benefits a left biased sender i (this rationalizes the positive sign). The second and the third lines represent expected continuation payoffs, while equation 2 represents the payoff from lying in the first period (i.e. reporting that the true state is -1 when instead it is 1) and all can be understood following the same logic.

By examining payoffs, it can be seen that the presence of a second sender generates two effects. There is a reduced influence effect both in the current period and in the future. Reduced future influence implies that now a biased sender who maintained his reputation, will not be able to influence the decision maker for sure in the second period. So it is less important to be trusted and this reduces incentives for building a reputation for being an honest adviser. This can be seen by noting that the expected continuation payoff from reporting the truth

$$\delta E(B)[\frac{(1-p)}{2}q_{-i}^{1}(\nu_2^{i,-1,-1}+\nu_2^{-i,-1,-1})+p(\frac{3}{8}(\nu_2^{i,-1,-1}+\nu_2^{-i,-1,-1})-\frac{1}{4}+\frac{3}{8}(\nu_2^{i,-1,1}-\nu_2^{-i,-1,1}))+\frac{(1-p)}{2}(\nu_2^{i,-1,1}-\nu_2^{-i,-1,1})+\frac{(1-p)}{2}(1-q_{-i}^{1})]$$

is smaller than $\delta E(B)$, the continuation payoff from telling the truth in the one sender case, as

$$\frac{(1-p)}{2}q_{-i}^{1}(\nu_2^{i,-1,-1}+\nu_2^{-i,-1,-1})+p(\frac{3}{8}(\nu_2^{i,-1,-1}+\nu_2^{-i,-1,-1})-\frac{1}{4}+\frac{3}{8}(\nu_2^{i,-1,1}-\nu_2^{-i,-1,1}))+\frac{(1-p)}{2}(\nu_2^{i,-1,1}-\nu_2^{-i,-1,1})\frac{(1-p)}{2}(1-q_{-i}^{1})]<1$$

Reduced current influence softens the temptation to deplete own reputation because the sender might not be able to influence first period decision either, as the decision maker follows the advice of sender i with probability $\nu^{i,m_i,m_{-i}} \leq 1$. In other words, reduced current influence decreases the opportunity cost of keeping own reputation. Therefore reduced future influence and reduced current influence determine opposite effects on truthtelling incentives.

Finally, competition has a lost reputation effect when senders messages are credible: if a biased sender lets competitors gain influence, he expects decisions against his preferences more than half of the times. This is represented by the expected continuation payoff from lying:

$$[-\frac{(1-p)}{2}(1-q_{-i}^{1})-\frac{p}{4}]\delta E(B)<0$$

which represents the cost of a lost reputation. In any equilibrium with information transmission, this term is smaller than zero which is the continuation value by lying in the one sender case[14]. The balance between the reduced influence (current and future), and the lost reputation effect determines whether competition increases or reduces truthtelling incentives.

The final step consists in analysing the behaviour of the decision maker. It was proved above that when the decision maker observes a message suggesting decision zero should be implemented and another message suggesting decisions -1 or 1, she knows the true state is zero, as no biased sender prefers decision zero. However, when the decision maker observes a message suggesting action -1 and a message suggesting action 1, she cannot extract any information about the true state of the world. The following lemma shows the equilibrium behaviour of the decision maker

[14] Notice that the sign of this effect depends upon the assumptions about the "status quo" decision. In this model the "status quo" is not too bad for a biased sender, but under different hypotheses it could be that depleting own reputation leads to a very unfavourable decision when the decision maker goes for the status quo, while with multiple sender, there will be some chances another sender with the same bias is able to influence future decisions away from the status quo.

in such a case

Lemma 5 *In equilibrium the decision maker always randomizes between messages when she observes conflicting messages* -1 *and* 1 *from senders with the same reputation.*

Proof. See Appendix ■

The next lemma shows that there cannot exist equilibria where the decision maker always takes an action or always implements the message of a given person in case of disagreement

Lemma 6 *There cannot exist truthtelling equilibria when the decision maker always follows the advice of a given sender.*

Proof. See Appendix ■

This is true as long as the decision maker cannot credibly commit to implement the advice of a given sender. ##intuition?

It is now possible to prove the following

Proposition 2 *In the first period, there exists a truthtelling equilibrium in which biased senders always report the truth, if the true state is the status quo; when the true state does not coincide with their preferences, they report information truthfully in pure strategies when the importance of the decision is not too large, and report information trutrhfully in mixed strategies if the importance of the decision is intermediate.*

Proof. See the appendix ■

The proof of the proposition shows that the pure strategy equilibrium occurs if and only if

$$B < \delta E(B)(\frac{1}{2} - \frac{p}{8}) \equiv B_2^*$$

and $p > \frac{1}{5}$. The mixed strategy equilibrium occurs when

$$\max\{\delta E(B)(\frac{1}{2} - \frac{p}{8}); E(B)(\frac{3}{2} - \frac{41}{8}p)\} < B < \delta E(B)(1 - \frac{5}{8}p) \equiv B_2^{mix}$$

and $p > \frac{1}{9}$. Biased senders report truthfully (when the true state is neither zero, nor their preferred state) with probability

$$q = \frac{2[\delta E(B)(1 - \frac{5}{8}p) - B]}{\delta E(B)(1 - p)}$$

The intuition is analogous to that of the one sender game: if period importance is low enough, it pays to give up current period payoffs to retain influence on future decisions. If period importance is larger, it is optimal to report information truthfully only at times. Finally, if period importance is very high, it is optimal to influence the decision maker in the current period as the stakes are high and it is unlikely that future decisions will be even more important.

The discussion so far makes it possible to investigate whether competition fosters truthtelling incentives. The following proposition summarizes one of the main results of the paper.

Proposition 3 *Competition has ambiguous effects on truthtelling incentives. If the true state is the status quo, competition raises truthtelling incentives. On the contrary, when the true state is different from the status quo, competition can substantially decrease truthtelling incentives.*

Proof. See the appendix ■

If the true state is the status quo, competition has a beneficial effects as aggregating information ensures the decision maker learns about the true state of the world. If instead the true state of the world is not the status quo, the proposition shows that when there is truthtelling in pure strategies under competition there always is truthtelling in pure strategies with one sender only, and if the probability senders are honest is large enough, there are levels of period importance such that there is no truthtelling under competition (not even in mixed strategies) and truthtelling in pure strategies with one sender. Therefore, competition for influence can reduce the incentives of biased senders to report the truth. Truthtelling incentives are greatest if a sender is certain that his effort to gain influence on future decisions will not be jeopardized by the analogous effort of another player. However the fear the other sender gains influence on future decisions and turns these against own preferences generates incentives to preserve credibility to influence future decisions. Moreover, the presence of a second sender reduces the value of a current deviation and this softens the temptation of giving up reputation to enjoy current payoff. The balance among these effects determines whether competition raises truthtelling incentives. A key factor is the likelihood the other sender is honest. If that is high, then it does not pay very much to retain influence on future decisions as the honest sender will surely influence the future decision if the true state is the status quo.

4 Delegating authority - delegation and favouritism

Previous discussion made clear how the interplay of two forces (reduced current and future influence, and lost reputation effect) shapes truthtelling incentives when the decision maker cannot commit to follow the advice of a specific sender. This section investigates whether organisational design can be used to improve matters for the decision maker. In particular, delegating decision making powers to a sender could be a way to retain the lost reputation effect while softening reduced future influence. In order to achieve this, the decision maker needs to be able to commit to implement the decision proposed by one sender. A way to reach a credible commitment is to delegate authority to make decisions. Decision making powers can be awarded to a sender until he maintains his reputation. When the latter is depleted the agent is fired and another agent gets the authority to decide in the second period. Intuitively this might be beneficial because it eliminates the reduced future influence effect and raises incentives for having a reputation in the future. On the other hand, however, this policy increases the gains from a deviation in the current period. I consider two possibilities. The first is "delegation", the second is "favouritism". Delegation implies that $\nu_1^i = 1$, $\nu_1^{-i} = 0$, under the assumption that $p^i = p^{-i} = p > \frac{1}{3}$, so that player i denotes the influential sender. If he does not lie in the first period, $\nu_2^i = 1, \nu_2^{-i} = 0$, and the opposite otherwise. Favouritism allows for the possibility that the decision maker commits to follow the advice of sender i with a given probability $\nu_1^i < 1$ in the first period, and to commit to delegate decision making to one of the senders in the last period, so as to preserve future influence. This can be regarded as a form of favouritism, as the decision maker biases the competition for influence in favour of one of the senders. In practice, delegation can be considered as a special form of favouritism.

Notice that in both delegation and favouritism, the strategy of the decision maker is not contingent on the observed messages as the decision of the influential sender can not be overturned: the decision maker credibly committed to delegate decision making powers to that sender. If the decision maker could overturn the influential sender decision, the equilibrium would be the same as in the communication case. An important aspect to stress is what the set of available contracts is. The only assumptions needed are that the decision maker cannot overturn the decision chosen by the influential sender after observing the reports and that senders cannot be fined for a wrong report. Then contracts can be made contingent on different variables. Firstly, a contract could just state that decisions in the first period are made by sender i. Then after a good report in the first period, the decision maker is indifferent between letting sender i influence second period decision or remove him. Alternatively, contracts can be contingent on the importance of the decision. Then delegation could be implemented by stating that an agent will be delegated powers (in both the current and the future period) as a function of current period importance: this will take care of equilibrium behaviour of biased senders. Finally, a contract could state that a sender can fully influence decisions and if he is fired after the first decision, the principal (the decision maker) has to pay penalties for breaching the contract. This is self enforcing because the sender would prefer to fire the agent and pay the fine only when the first decision was wrong[15]. This is very similar to a severance payment system.

I am assuming the decision maker can fully commit not to renegotiate the contract offered. However, it is interesting to examine whether such contracts are renegotiation proof. The influential sender would need a payment of $2B$ to accept a contract that overturns the decision, so the benefit for the decision maker has to be larger than this quantity. Moreover, the possibility of renegotiation would reduce incentives for a biased non influential sender to report information

[15] Provided, of course, the fine is not too large.

truthfully: in fact when reports do not coincide, the biased non influential sender might induce the decision maker to overturn the influential sender decision. Hence, the decision maker will have to pay $2B$ and will implement the correct decision only with probability $p + \frac{(1-p)}{2}q + \frac{(1-p)}{2}z$. This might not be in the interest of the decision maker and will not be the case if period importance for her is perfectly correlated to that for senders[16].

I start analysing whether (full) delegation leads to stronger truthtelling incentives than communication does. Suppose the sender is left biased (the right biased case is analogous). If the true state is -1, he will report the truth. When the true state is either zero, or 1, a left biased sender i reports the truth when delegated authority if and only if:

$$V_T^i = -B + \delta E(B) > V_L^i = B + \delta E(B)[\frac{1-p}{2} + \frac{3}{8}p - \frac{p}{4} - \frac{3}{8}p - \frac{1-p}{2}]$$

The first term represents the expected payoff from reporting the truth: the biased sender implements the action preferred by the decision maker (and thus gets a payoff of $-B$) in the first period, and is able to fully influence the decision in the second period when he implements his preferred action yielding $\delta E(B)$. If he lies he gets the current period payoff B. In the second period he is fired and the other sender is delegated authority. This agent tells the truth if he is honest (this occurs with probability p), and implements an action which accords with sender i preferences if next period state is -1, which occurs with probability $\frac{3}{8}$, and implements an action against sender i preferences when the state is either zero or 1 (these states occur respectively with probability $\frac{1}{4}$ and $\frac{3}{8}$). The other sender is left biased with probability $\frac{1-p}{2}$ and implements action -1, while he is right biased with probability $\frac{1-p}{2}$ and implements action 1. Therefore a left biased sender tells the truth (in the first period, if the true state is 1) under delegation as long as

$$B < \frac{\delta E(B)(1 + \frac{p}{4})}{2} \equiv B^{del}$$

Notice that mixed strategy equilibria here exists only for a set of parameters whose joint occurrence is a measure zero event. This follows because the sender who is not delegated authority reports the truth with probability one in the first period. The following proposition shows in what circumstances delegation is optimal.

Proposition 4 *When the true state is different from the status quo, delegating decision powers to one sender induces stronger truthtelling than letting senders compete for influence.*

Proof. See the appendix ■

The proof shows that there are values of period importance such that there is truthtelling in pure strategies under delegation, while under communication with two senders there is truthtelling

[16] In this case $A = B$.

in mixed strategies only. Furthermore, if the probability the opponent is honest is large enough ($p > \frac{1}{2}$), there is truthtelling under delegation, while there is not even truthtelling in mixed strategies under communication with two senders[17]. Delegating decision powers to an agent amounts to let the agent influence the decision both in the first and in the second period if he does not jeopardise his reputation. Thus, delegation protects influence. On the other hand, if the influential sender destroys his reputation, he will not have any chance to influence the decision maker in the future and newcomers will have full decision powers. In every equilibrium with information transmission both senders must have a large enough prior reputation. Thus each sender thinks the opponent is relatively more likely to be honest. Therefore the fear that future decisions will be influenced by an agent with opposed interests raises truthtelling incentives of the influential sender.

Hence, the relative benefits and costs of delegation as opposed to communication, are to be identified along two dimensions. First, delegation protects influence while maintaining discipline. The dark side of delegation is obvious: the influential sender has unfettered ability to implement his preferred action in the current period. Moreover, under competition, the decision maker implements the correct action for sure, whenever the true state requires the unbiased action to be chosen.

Thus far, the analysis showed that a policy of full delegation has the drawback that the influential sender has unfettered ability to cash in the full value of a false report in the current period. A way to overcome this problem is to delegate power with less than probabilitiy one in the first period. This is what I define as "favouritism". Then, assume, without loss of generality, that sender i is delegated decision powers in the second period, provided he reports information truthfully in the first period. Call sender i the "influential sender". The policy consists in offering the influential sender the following contract: the decision he proposes is implemented with probability $\frac{1}{2} < \nu_1^i < 1$ in the first period. The probability ν_1^i can be regarded as the degree of favouritism and as ν_1^i is close to one, the degree of favouritism is said to be "strong". If the report turns out to be correct, the sender gets full decision powers in the second period. Formally $\nu_2^i = 1$ if $m_{i,1} = y_{i,1}$, $\nu_2^i = 0$ otherwise[18]. It is assumed the decision maker commits to follow the advice of each sender with probability ν_1^i and $\nu_1^{-i} = 1 - \nu_1^i$, and that the probability senders are honest is large enough so as to ensure information transmission occurs in equilibrium. Under favouritism players can behave asymmetrically: in fact, when the influential sender finds it optimal to report information truthfully, a biased non influential sender prefers to lie in the first period as he will not have any chance to influence second period decision. On the other hand, he might tell the

[17]When instead, $p < \frac{1}{2}$, there are values of period importance such that $B^{del} < B^2_{mix}$.

[18]Essentially, I am assuming that the decision maker has access to a commitment technology that does not allow to condition the decision about who influences the decision in the first period on the messages received. Another possibility is that the decision maker, in the first period, does not rely on favouritism when she observes conflicting messages and one of these messages suggests the status quo. This would change very little in the results, and would just increase the desirability of favouritism.

truth, when the influential sender is lying, provided that current period importance is not too large. It is possible to prove the following

Proposition 5 *Favouritism induces stronger truthtelling incentives for the influential sender than delegation. It induces stronger truthtelling incentives than communication when the true state is different from the status quo. When favouritism is strong, a biased non influential sender chooses to report the truth for intermediate realizations of period importance.*

Proof. See Appendix. ■

Favouritism allows the decision maker to provide the influential sender with stronger truthtelling incentives. On the other hand, the non influential sender might lie, and a wrong decision suggested by the non influential sender is implemented with positive probability. When the degree of favouritism is very strong[19], a biased non influential sender reports the truth for period importance realizations that ensure a biased influential sender lies, and that are not extremely large. Therefore, favouritism leads to stronger truthtelling incentives than pure delegation and communication when the true state is different from the status quo.

5 Decision Maker Payoff

Previous discussion made clear how competition for influence shapes truthtelling incentives. This section investigates the conditions ensuring the decision maker prefers communication rather than delegation[20]. This choice depends upon four factors. The first is truthtelling incentives, the second is the distribution of period importance for the decision maker, the third is the distribution of period importance for senders, the fourth is the distribution of the states of the world. In fact, the more likely the unbiased state (the "status quo"), the more communication is likely to lead to a larger payoff for the decision maker. However, if the status quo is more likely, truthtelling incentives under delegation become stronger.

In order to establish whether decision maker payoff is larger under delegation or under communication it is crucial to distinguish two cases: in the first the decision maker chooses whether to delegate decision powers to one sender or to rely upon communication, after observing first period importance (both for himself and for the senders), but before senders propose a decision; in the second, decision maker chooses communication or delegation before observing the realization of first period importance. The main intuition can be gained from the analysis of the first case. When the decision maker chooses organizational form after observing the realization of first period importance, the optimality of communication as opposed to delegation depends exclusively upon

[19] The degree of favouritism is a choice variable of the decision maker who will set ν_1^i so as to maximize her expected payoff.

[20] The comparison with favouritism is similar, it just involves more tedious algebra.

truthtelling incentives and the distribution of period importance for the decision maker. Then, it is possible to prove the following

Proposition 6 *Communication leads to a larger payoff for the decision maker if period importance for senders is low. When period importance is intermediate, delegation can be preferred to communication. When period importance for senders is very high, delegation can be preferred to communication only if period importance for the decision maker and for senders features strong negative correlation.*

Proof. See Appendix ∎

The first part of the result refers to the case when there is truthtelling in pure strategies both under delegation and under communication. In general (unless period importance for senders and for the decision maker have a very large negative correlation), communication is preferred to delegation for low and high values of period importance[21]. In other terms, when there is truthtelling both under communication and under delegation or when there is no truthtelling either under communication, or under delegation, the former is preferred. The main reason is that communication allows to fully exploit the presence of a non biased action and the conflict of interest between senders with opposed bias. On the contrary, when period importance is intermediate, delegation can be preferred to communication thanks to the stronger truthtelling incentives it induces.

This analysis underlines that truthtelling incentives can be interpreted as incentives for biased senders to pool with honest senders. Delegation can increase such incentives, thus delaying learning about senders' type. Notice that if the decision maker attaches the same importance to decisions as senders do, truthtelling occurs for decisions that the decision maker does not regard as especially important. As truthtelling incentives represent conditions under which biased types pool with honest, the decision maker learns senders types when it is more costly for him to do so. To see this, notice that truthtelling incentives under delegation and communication imply that there is never truthtelling for values of period importance $B > \delta E(B) \max\{(\frac{1}{2}+\frac{p}{8});(1-\frac{5}{8}p)\}$, and $\max\{(\frac{1}{2}+\frac{p}{8});(1-\frac{5}{8}p)\} < 1$, so that if biased senders pool there is a benefit today of implementing a decision yielding $B < \delta E(B)$, but there are greater chances of making a wrong decision in the second period, when expected importance is $\delta E(B)$. Essentially, the decision maker cannot hedge against agency conflicts, so that when her period importance is very positively correlated with that for senders she prefers to learn as quickly as possible about senders' types. In such a case truthtelling incentives might be bad as they reduce learning about a sender's type.

A further effect arises when the decision maker has to choose between relying upon communication or upon delegation before knowing the realization of first period importance: now, the

[21] In fact, when $B > B^{del} = \delta E(B)\frac{2+p}{4}$ and $corr(A,B) > 0$, the condition $A < \delta E(A)\frac{\frac{5}{2}p-1}{3+p}$ is very difficult to meet.

distribution of first period importance for senders plays a role. Intuitively, the distribution of period importance for senders attributes different weights into the decision maker payoff to the four regions for period importance realizations identified above. In order to provide further results it is necessary to make specific assumptions on the distribution of period importance for the decision maker and that for senders.

These results show that the optimality of delegation as opposed to communication essentially depends upon the importance of the decision for senders.

6 Promoting a junior

Previous discussion showed that the decision maker can raise truthtelling incentives by delegating decision powers to a sender elected as "more influential". Delegation is beneficial because it protects influence while maintaining discipline. The latter is larger, the more the influential sender fears the opponent is honest. It is thus interesting to extend the model and analyze a situation in which one sender has already an established reputation (the senior), while the other is promising, but has still to prove his qualities (the junior). This is modelled by assuming that one sender has a larger prior probability of being honest, although both have enough reputation to ensure truthtelling occurs in equilibrium. Suppose, without loss of generality, that player s (the senior) is more likely to be honest ex ante. Thus the discipline effect will be stronger if player j (the junior) is chosen as the influential sender. The decision maker faces an interesting trade off: on the one hand, delegating power to the player with the more established reputation yields a larger probability to get truthful reporting in both periods because it is more likely that he is honest; on the other hand, a biased sender has stronger incentives to report the truth, the higher the reputation of the opponent. This is reminiscent of the result in the reputation literature that once a player's reputation is more established its incentivizing role fades out. However, in this model, the intuition is very different as it is rather the reputation of the opponent that acts as an incentive mechanism. This can be verified by inspecting the condition for truthtelling for biased senders, under delegation. This is

$$B < \frac{\delta E(B)(1 + \frac{p^{-i}}{4})}{2} \equiv \widehat{B}^i$$

If the senior is delegated powers, $p^{-i} = p^j$, while if the junior is delegated decision powers, $p^{-i} = p^s$ and it is clear that if $p^s > p^j$, player j has stronger incentives to report the truth in the first period than player s. The choice between a junior and a senior trades off a larger chance that a biased influential sender reports the truth in the first period, against a lower chance that the influential sender is honest. The results for the case when the decision maker delegates power to either sender after observing period importance is along the lines of the analysis conducted in the previous section. Therefore, I will explicitly discuss the case when the decision maker chooses the influential sender before knowing the realization of period importance. By delegating powers to the senior, she gets an expected utility of

$$W_s = p^s[E(A) + \delta E(A)] + (1-p^s)\{[\Pr(B < \widehat{B}^s)[E(A \mid B < \widehat{B}^s) - \frac{\delta E(A)}{4}] +$$
$$\Pr(B > \widehat{B}^s)[\frac{-E(A \mid B > \widehat{B}^s)}{4} + \delta E(A)p^j - (1-p^j)\frac{\delta E(A)]}{4}]\}$$

The first term represents the case in which a biased sender reports truthfully in the first period because the realized first period importance is low enough to sustain truthtelling, while the second represents the opposite case. Following a wrong report in the first period, sender 2 becomes influential in the second period. The expression for the case in which the junior is chosen as the influential sender is analogous and given by

$$W_j = p^j[E(A) + \delta E(A)] + (1-p^j)\{[\Pr(B < \widehat{B}^j)[E(A \mid B < \widehat{B}^j) - \frac{\delta E(A)}{4}]\} +$$
$$\Pr(B > \widehat{B}^j)\Pr(B > \widehat{B}^j)[\frac{-E(A \mid B > \widehat{B}^j)}{4} + \delta E(A)p^s - (1-p^s)\frac{\delta E(A)]}{4}]\}$$

The decision maker is better off by delegating power to sender j if $W_j > W_s$ and this can occur in equilibrium depending upon the distribution of the decision maker's payoff, so that

Proposition 7 *Delegating decision powers to a junior can be an optimal policy if the decision maker is interested in ensuring that early decisions are made correctly.*

This analysis predicts that organisations can decide to transfer powers from a senior to a junior as a function of the relative importance of period decisions. A junior has stronger incentives to behave in first period because he has more to loose by misbehaving in early periods. In fact in such a case, if the senior is appointed in the second period, it is very likely he will distort decision making against the preferences of a biased junior.

7 Competition among many senders

All results so far rest on the assumption that the decision maker does not interact with more than two senders. This implies that each sender can be pivotal for the decision at least if the true state is different from the status quo. On the contrary, if there are at least three senders, all with the same reputation, there will trivially be truthtelling under communication, if, as assumed in the model so far, the decision maker cannot adjust the intensity of the action as a function of the breadth of the "consensus", or as a function of the probability the message is correct. Notice that this would be true even in a static game. In that case, there would not be any truthtelling equilibrium with two senders, while there could be a truthtelling equilibrium when at least three senders report information. To see what happens if more than two senders report information and the decision maker can adjust the intensity of the decision, suppose there are 3 senders and focus attention on the last period[22]. In a truthtelling equilibrium all senders report the same state. If the decision maker observes two senders reporting state -1 and one sender reporting state 1, she knows at least one sender is lying. She must attach probability $3p^2\frac{1-p}{2} + 6p(\frac{1-p}{2})^2 + 3(\frac{1-p}{2})^3$ that state -1 is correct, because conflicting messages can arise if two senders are honest and one left biased (this occurs with probability $3p^2\frac{1-p}{2}$), one sender is honest, one left biased, one right biased (this occurs with probability $6p(\frac{1-p}{2})^2$), two senders are left biased and one sender is right biased (this occurs with probability $3(\frac{1-p}{2})^3$). On the contrary, state 1 is the true state with probability $3p(\frac{1-p}{2})^2 + 3(\frac{1-p}{2})^3$ because it must be that there are two left biased senders and either one honest or one right biased sender. Then decision -1 is correct with probability

$$\frac{3p^2\frac{1-p}{2} + 6p(\frac{1-p}{2})^2 + 3(\frac{1-p}{2})^3}{3p^2\frac{1-p}{2} + 6p(\frac{1-p}{2})^2 + 3(\frac{1-p}{2})^3 + 3p(\frac{1-p}{2})^2 + 3(\frac{1-p}{2})^3}$$

where the denominator represents the probability of observing two messages suggesting the true state is -1 and one message suggesting the true state is 1. If the decision maker observed 3 agreeing messages suggesting the true state is -1, it could be that all senders are honest, or that two senders are honest and one left biased and the true state is -1, one sender is honest, two left biased, and the true state is -1, that all senders are left biased. The total probability of this is $p^3 + 3p^2\frac{1-p}{2} + 6p(\frac{1-p}{2})^2 + \frac{1}{4}(\frac{1-p}{2})^3$. The message can be wrong only if all senders are left biased and the true state is not -1, this event has probability $\frac{3}{4}(\frac{1-p}{2})^3$. Then, action -1 is correct, when observing three agreeing messages with probability

$$\frac{p^3 + 3p^2\frac{1-p}{2} + 6p(\frac{1-p}{2})^2 + \frac{1}{4}(\frac{1-p}{2})^3}{p^3 + 3p^2\frac{1-p}{2} + 6p(\frac{1-p}{2})^2 + \frac{1}{4}(\frac{1-p}{2})^3 + \frac{3}{4}(\frac{1-p}{2})^3}$$

Thus, decision -1 is more likely to be correct when the decision maker observes three agreeing messages, than when she observes two messages suggesting it, and one message suggesting action 1 instead. In any equilibrium with information transmission the decision maker would take the action suggested by the majority. However, if she can adjust the intensity of the action she will be more willing to take an action closer to the true state, the larger is the majority. Then, it is reasonable to think that the decision maker will be willing to put more resources on decision -1 in the first case, than in the second. This is true even if senders observe perfectly the state of the world and there is no direct information aggregation effect about the true state of the world.

[22] This just simplifies the exposition as it is clear that right biased senders would always report the true state is 1, and left biased senders that the true state is -1. The analysis of the first period would be essentially the same, with the difference that right biased senders might be willing to report information truthfully.

In fact, observing more senders reporting the same message provides information about the type of senders, as in equilibria with information transmission it must be relatively more likely that each sender is reporting information truthfully. In order to investigate the effects of competition for influence when an arbitrary, but finite number of senders report information to the decision maker, I assume the decision maker can adjust the intensity of the decision as a function of the breadth of the consensus among senders. In particular, assuming there are n senders, the decision maker adjusts the intensity of the action so that the payoff will be A^n and B^n in case of maximum consensus, and $A^{\frac{n}{2}+1}$, $B^{\frac{n}{2}+1}$, if there are $\frac{n}{2}+1$ concordant messages and therefore a majority of one or two messages, depending upon whether n is odd or even. As in the two senders model, there will not be equilibria where, in case of disagreement, the decision maker always implements the suggestion of a given sender. If there is no consensus, but at least one of the conflicting messages suggests the status quo, then the latter is implemented, while if there are conflicting messages suggesting actions -1 and 1 and there is no majority, the decision maker prefers to randomize. Consider the case of a left biased sender observing the true state is 1. Suppose also that there are $n+1$ senders, with n even[23]. I denote with l the number of left biased senders, with r that of right biased and with h that of honest senders. Then in a pure strategies truthtelling equilibrium, payoffs under communication from reporting the truth and lying are given by

$$V_T = -B^{n+1}+$$

$$\frac{3}{8}[\sum_{r=0}^{\frac{n}{2}}\sum_{l=0}^{n-r}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{l+r}\delta E(B^{n+1-r})+$$

$$\sum_{r=\frac{n}{2}+1}^{n}\sum_{l=0}^{n-r}\frac{n!}{l!r!(n-r-l)!}p^{n-(r+l)}(\frac{1-p}{2})^{l+r}(-\delta E(B^r))]$$

$$+\frac{1}{4}\{\sum_{h=1}^{n}\binom{n}{h}p^h(\frac{1-p}{2})^{n-h}(-\delta E(B^f)+(\frac{1-p}{2})^n[\sum_{r=0}^{\frac{n}{2}}\binom{n}{r}(\delta E(B^{n+1-r})-\sum_{r=\frac{n}{2}+1}^{n}\binom{n}{r}(\delta E(B^r)]\}+$$

$$\frac{3}{8}[\sum_{l=\frac{n}{2}}^{n}\sum_{r=0}^{n-l}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{l+r}\delta E(B^{l+1})+\sum_{l=0}^{\frac{n}{2}-1}\sum_{r=0}^{n-l}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{l+r}(-\delta E(B^{n-l})$$

[23] The case n odd is essentially analogous.

and

$$V_L = -B^n +$$

$$\frac{3}{8}[\sum_{r=0}^{\frac{n}{2}-1}\sum_{l=0}^{n-r}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{l+r}\delta E(B^{n-r}) + \sum_{r=\frac{n}{2}+1}^{n}\sum_{l=0}^{n-r}\frac{n!}{l!r!(n-r-l)!}p^{n-(r+l)}(\frac{1-p}{2})^{l+r}(-\delta E(B^{r}$$

$$+\frac{1}{4}\{\sum_{h=1}^{n}\binom{n}{h}p^h(\frac{1-p}{2})^{n-h}(-\delta E(B^f) + (\frac{1-p}{2})^n[\sum_{r=0}^{\frac{n}{2}-1}\binom{n}{r}(\delta E(B^{n-r}) - \sum_{r=\frac{n}{2}+1}^{n}\binom{n}{r}(\delta E(B^r)]\}+$$

$$\frac{3}{8}[\sum_{l=\frac{n}{2}+1}^{n}\sum_{r=0}^{n-l}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{l+r}\delta E(B^l) + \sum_{l=0}^{\frac{n}{2}-1}\sum_{r=0}^{n-l}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{l+r}(-\delta E(B^{n-l})$$

The expressions follow by the same reasoning as in the two senders case and by noting that senders are "drawn" from a trinomial distribution, with parameters n, p, $\frac{1-p}{2}$. If the sender reports the truth in a truthtelling equilibrium, current period payoff is $-B^{n+1}$ as all $n+1$ senders are reporting the same message. Then in the second period the true state is -1 with probability $\frac{3}{8}$. There will be a majority of messages suggesting state -1 as long as there are no more than $\frac{n}{2}$ right biased senders. This is captured by the term

$$\sum_{r=0}^{\frac{n}{2}}\sum_{l=0}^{n-r}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{(l+r)}\delta E(B^{n+1-r})$$

With probability $\frac{1}{4}$ the true state is 0. If there is at least an honest sender, he reports the truth and the decision maker knows the true state is 0 and sets the intensity to the maximum, which I denote B^f. If there is no honest sender, the decision depends upon whether the majority is left or right biased. The former case occurs with probability $(\frac{1-p}{2})^n\sum_{r=0}^{\frac{n}{2}}\binom{n}{r}$ and the expected payoff is given by $(\frac{1-p}{2})^n[\sum_{r=0}^{\frac{n}{2}}\binom{n}{r}(\delta E(B^{n-r})$, because there is a majority of left biased senders and decision -1 is implemented. The latter case occurs with probability $(\frac{1-p}{2})^n\sum_{r=\frac{n}{2}+1}^{n}\binom{n}{r}$, and the expected payoff is given by $-\sum_{r=\frac{n}{2}+1}^{n}\binom{n}{r}(\delta E(B^r)]$ because there is a majority of right biased senders and decision 1 is implemented. Then, with probability $\frac{3}{8}$ the true state is 1. With probability $\sum_{l=\frac{n}{2}+1}^{n}\sum_{r=0}^{n-l}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{l+r}$ there is a majority of left biased senders who induce the decision maker to choose action -1, with intensity $\delta E(B^{l+1})$, while with probability $\sum_{l=0}^{\frac{n}{2}-1}\sum_{r=0}^{n-l}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{l+r}$ there is a majority either of unbiased, or of right biased senders, and decision 1 is implemented with intensity $\delta E(B^{n-l})$. The payoff from lying can be understood analogously. It should be noticed that when sender i lies, the total number of credible senders in the second period is n. Then, if the true state of the world in the second period is -1, (this occurs with probability $\frac{1}{4}$), decision -1 is implemented when there is a majority of either left biased or of unbiased senders, and this occurs with probability $\sum_{r=0}^{\frac{n}{2}-1}\sum_{l=0}^{n-r}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{l+r}$. It can be seen that when there are $\frac{n}{2}$ left biased or unbiased senders, and $\frac{n}{2}$ right biased senders, the decision maker observes exactly the same number of conflicting messages and she randomizes, while, if the $(n+1)^{th}$ sender reported the truth in the first period, he could be pivotal and create a majority of messages suggesting decision -1. The other terms can now be easily understood, and I omit a detailed explanation.

The main effects of competition highlighted in the two senders version of the model are still at work. There is a reduced future influence effect, as the sender does not know whether he will be able to influence next period decision. In fact, there can be a majority of right biased senders, or the true state can be different from -1 and there can be a majority of honest senders. On the other hand there is a discipline effect, as next period decision could be influenced by right biased senders, or the true state might be different from -1 and there can be a majority of honest senders. Both effects are further affected by the adjustment in action intensity: if the sender maintains his reputation, he can affect next period decision by changing the breadth of the majority: if all senders are left biased, the intensity will be B^{n+1}, if there is one right biased, the intensity will be B^{n}, etc. Similarly, the reduced current influence effect depends now upon the ability of the sender to affect the intensity of the decision. There is truthtelling in pure strategies if and only if $V_T > V_L$ which can be rewritten as

$$
\begin{aligned}
& \frac{3}{8}\{\sum_{r=0}^{\frac{n}{2}-1}\sum_{l=0}^{n-r}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{l+r}][\delta E(B^{n+1-r})-\delta E(B^{n-r})]\}+ \\
& \frac{3}{8}\{\sum_{l=0}^{\frac{n}{2}}\binom{\frac{n}{2}}{l}p^{\frac{n}{2}-l}(\frac{1-p}{2})^{l+\frac{n}{2}}[\delta E(B^{\frac{n}{2}+1+l})]\}+ \\
& \frac{1}{4}(\frac{1-p}{2})^{n}\sum_{r=0}^{\frac{n}{2}-1}\binom{n}{r}[\delta E(B^{n-r+1})-\delta E(B^{n-r})]+ \\
& +\frac{1}{4}(\frac{1-p}{2})^{n}\binom{n}{\frac{n}{2}}\delta E(B^{\frac{n}{2}+1}) \\
& \frac{3}{8}\{\sum_{l=\frac{n}{2}+1}^{n}\sum_{r=0}^{n-l}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{(l+r)}[\delta E(B^{l+1})-\delta E(B^{l})] \\
& +\frac{3}{8}\{\sum_{r=0}^{\frac{n}{2}}\binom{n}{\frac{n}{2}+r}p^{\frac{n}{2}-r}(\frac{1-p}{2})^{r+\frac{n}{2}}[\delta E(B^{\frac{n}{2}+1})]\} \\
> \quad & B^{n+1}-B^{n}
\end{aligned}
$$

Now, competition induces a further "consensus" effect: if the sender lies in the current period, he changes the decision from B^{n+1} to B^n. Analogously, keeping a reputation allows to increase the intensity of the decision when this is favourable, and to decrease it when it is unfavourable. Thus, the choice between giving up own reputation and giving up current period payoff will depend upon the interplay of the reduced influence, discipline and consensus effects. The latter contributes to determine both the magnitude of the opportunity cost of keeping own reputation and the strength of the future benefit of keeping own reputation. In fact, if the difference $(B^{n+1} - B^n)$ is very small, the sender will not be able to modify much the intensity of the decision in the current period. The benefit of keeping own reputation will depend upon the likelihood next period decision accords to the preferences of the sender. This crucially depends upon the probability distribution of types and upon the strength of the change in intensity of the action when the majority gets larger. The latter is represented by the differences $\delta E(B^{n+1-r}) - \delta E(B^{n-r})$, $\delta E(B^{n-r+1}) - \delta E(B^{n-r})$, $\delta E(B^{l+1}) - \delta E(B^l)$. Such consensus effect stems from the assumption that the decision maker can now adjust the intensity of the decision. This creates a new dimension to be analysed also when discussing delegation of authority: the decision maker might delegate decision powers, while constraining the ability to set decision intensity. Denoting the latter as B^d, the payoff of a left biased sender who is delegated authority and the state is different from -1 is

$$\begin{aligned} V_T &= -B^d + \delta E(B^d) \\ V_L &= B^d + \delta E(B^d)[\frac{1-p}{2} + \frac{3p}{8} - \frac{p}{4} - \frac{3p}{8} - \frac{1-p}{2}] \end{aligned}$$

This follows as it is assumed the proportion of honest, left biased and right biased is the same in the sample of n senders. Then, there is truthtelling as long as

$$B^d < \frac{\delta E(B^d)(1 + \frac{p}{4})}{2} \equiv B^{del}$$

Whether delegation or communication leads to stronger truthtelling incentives depends upon the parameters of the problem, and it is necessary to impose more structure on the model to get a precise threshold[24]. However, it is clear that in principle either organizational form could be superior, and the main insight of the two senders model carry forward to the n senders case extended to the possibility that the decision maker adjusts the intensity of the decision. This is formalized in the following

Proposition 8 *All effects highlighted in the two senders case are still present if n senders compete for influence and the decision maker can adjusts the intensity of the decision.*

Proof. See Appendix. ■

[24] For example, it is necessary to establish the way the difference $B^n - B^{n-1}$ evolves as n changes, as well as how large this is in comparison with B^d.

8 Discussion

This section discusses the role of the main assumptions, the modelling strategy, and applications of the model.

8.1 Assumptions and modelling strategy

The model captures, in a parsimonious way, the effects of introducing competition in a dynamic game of information transmission when the bias of senders is not known. The set up of the model is quite standard, and alternative ways to model the bias of senders (such as in Sobel 1985, or in Benabou and Laroque (1992)) would not alter the main results of the model. The assumption that one action is not preferred by any biased type is not critical, as different specifications would work, although it makes communication with multiple senders naturally more attractive, as biased senders would always report information truthfully when observing the state corresponding to the unbiased action. Similarly, the assumption that biased senders derive the same disutility when actions different from their preferred one are implemented, is not essential. Assuming left biased senders prefer state 0 over state 1, would slightly complicate the analysis, but would not alter any of the results.

A first point that needs to be deepened is the assumption about the prior distribution of the state of the world. As mentioned in section 2, this affects the relative magnitude of the reduced influence and of the lost reputation effects, but not their existence. An alternative modelling strategy is to parameterize the prior probability of the unbiased state, and thus discuss the effect of competition as such prior probability changes. I chose not to pursue this route, in order to avoid introducing a further parameter in the model and streamline the exposition. Moreover, little further economic intuition would be gained by parameterizing the prior probability each state occurs.

An important element that deserves further discussion is the definition of competition. Most part of the analysis models competition as a situation where two senders are interacting with the decision maker. However, situations where an arbitrary, but finite, number of senders provide information to the decision maker is discussed in section 8, where it is shown that the main forces at work are the same as in the two senders case. Moreover, with n senders, a further effect, which I label "consensus effect", contributes to shape truthtelling incentives. In order to provide a full treatment of the n senders case it would be necessary to impose more structure on preferences: however, even at a greater level of generality it is possible to conclude that due to the interaction of the reduced influence, discipline and consensus effects, there can be cases when delegation may improve upon competition, and situations when the opposite occurs.

Another assumption is that senders observe perfectly the state of the world. This impacts on the dynamics of reputation: once a sender makes a mistake his reputation is gone. If he observed the state imperfectly, a mistake could be attributed to him receiving a wrong message, rather than to opportunistic behaviour. In that case, reputation would evolve more realistically over time as, for example, in the paper of Benabou and Laroque. Furthermore, the assumption makes information aggregation useless, and shuts a potential important benefit of competition: if the state of the world was observed noisily, aggregating the messages of multiple senders would increase the precision of the information received, even if some senders reported information strategically. This is clearly an important element, but its inclusion would complicate substantially the analysis preventing a clear investigation of the other effects generated by competition (reduced influence and discipline effect). Moreover, situations where experts observe a variable, relevant for decision making, without noise are quite common. Take as an example the evaluation of a report about the prospects of a firm: even if the report is a noisy signal of the true value of the firm, the latter might be observed very far in the future, and the right decisions in the short-medium term could be dependent upon the content of the report. This in turn can influence short or medium term payoffs, which could be the relevant performance measure for the decision maker.

8.2 Further applications

to be revised ### The model lends itself to analyse situations characterized by the presence of experts who can provide information relevant for sound decision making and who are interested in influencing the decision making process. The leading application is the analysis of the interaction among managers competing for corporate resources. Managers (the experts) observe information relevant to determine what is the most appropriate decision to maximize firm profits, or financial ratios, or other measures of performance. Managers can be of two types: biased managers derive private benefits from an action which is not necessarily in the best interest of the firm; honest managers do not derive any private benefit and are thus willing to report information truthfully. For example one manager can be the head of domestic operations and another manager the head of overseas operations. The state of the world can be the state of the economy: if the domestic economy is very strong, the central management of the firm (the decision maker) should allocate more resources to the domestic operations department, but not if the overseas economy is growing strongly. If global markets are stagnating, the firm should allocate resources neither to domestic, nor to overseas operations. Biased managers prefer more money to be allocated to their department, irrespective of the state of the economy. The central management observes whether the information provided was correct, and evaluates the reliability of managers for future decisions. The central management can choose to collect information from managers and decide on the appropriate corporate strategy, or can delegate decisions to one of the managers, say, the head of domestic operations. The results of the paper show that delegation can improve the quality of the decision making process when the importance of the decision is neither too low, nor too high. In the latter cases, the central management should collect information from all managers.

Another interesting application is the analysis of the financing of a new technology on part of governmental bodies. Suppose one team of scientists is working to improve the technology to derive fuel from ethanol, while another team is working on wind energy. The government might be interested in allocating scarce funds to the project which is most likely to succeed. The government can hire different experts from the academia to assess the relative merits of the two and evaluate the one that deserves funds the most. However, some experts could be captured by agricultural lobbies supporting ethanol as it would boost the value of corn crops, while other experts could be captured by some corporations producing components for wind farms. The paper shows the relative benefits of consulting multiple experts as opposed to rely only on one and shows conditions under which the latter can be preferable.

The results of the paper can also be applied to the investigation of other important real world interactions such as politicians competing to be elected, lobbies trying to influence politicians, financial analysts providing information to investors, investment banks providing advice to customers, and in general all those situations where experts can have a vested interest in the decision maker choosing a particular action.

9 Conclusion

This paper analysed truthtelling incentives of players competing for influence. Two conflicting forces are identified. On the one hand competition for influence determines a "reduced influence" effect both in the current and in the future period: a biased sender knows he is less likely to influence future decisions, so that he is less willing to sacrifice current payoffs to build a reputation for providing sound advice; however a biased sender is not able to enjoy the full value of a current deviation, thus the opportunity cost of maintaining a reputation is reduced. On the other hand, competition for influence determines a discipline effect: biased senders fear that if they deplete their reputation, other senders will influence future decisions. The interplay among these effects generates interesting results and offers novel insights for organisational design. The first is that the decision making process can be less prone to errors if only one sender reports information, as competition may harm decision making. This happens when reduced future influence dominates the discipline effect. Thus, the quality of decision making can be improved if one sender is delegated authority to make decisions, becoming an "influential sender". This happens because delegation preserves influence while keeping discipline. The second result is that decision making could be further improved if the decision maker biases the competition for influence: this shows favouritism can arise as an optimal way to foster truthtelling incentives. The third result is that delegation is optimal if the importance of the decision is neither very low, nor too high. Both routine and very important decisions should rather be assigned to a committee. Thus, this paper provides a new theory for the allocation of authority and for the use of favouritism in organisations: they arise endogenously as rational organizational responses to the incentives created by competition to influence decision making. The leading application of these results is the analysis of resource allocation among divisions within an organisations, but the insights of the model can be applied to investigate a variety of economic interactions: politicians competing to be elected, lobbies willing to influence politicians, financial analysts providing information to investors, investment banks providing advice to corporate clients.

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10 Appendix- Proofs

Proof of Lemma 1

In the last period the sender has no reputational concerns. By reporting his preferred decision he can enjoy a positive payoff, while his payoff is non positive if he does not report his preferred decision. When he does not have enough credibility, he randomizes and the decision maker puts zero weight on the message provided.

Proof of Lemma 3

This follows from the fact that when senders have enough credibility, the expected payoff from following their advice is larger than that from making decisions without information. When this is true, as the decision maker has a linear payoff function, it is optimal to set $\nu^{i,m_i,m_{-i}}+\nu^{-i,m_i,m_{-i}}=1$.

Proof of Lemma 5

The expected payoff by randomizing is

$$4p\frac{1-p}{2}(\frac{1}{2}A-\frac{1}{2}A)+2(\frac{1-p}{2})^2(-\frac{1}{4}A)=-\frac{(1-p)^2}{8}A$$

In fact, conflicting messages -1 and 1 can occur when the decision maker faces an honest sender and a biased sender (this occurs with probability $4p\frac{1-p}{2}$, or when both sender are biased, but one is left biased and the other right biased (this occurs with probability $2(\frac{1-p}{2})^2$). The decision maker might use a strategy that implements action $k\in\{-1,0,1\}$ when observing disagreeing messages -1 and 1. In such a case, suppose the true state is -1 and the strategy is "implement state 1 when messages disagree": a left biased sender will report the truth because he has no way to influence the decision maker. A right biased sender, on the contrary, can decide to ensure getting the current period payoff by lying. When observing conflicting messages -1 and 1, the decision maker knows the true state is -1 and will want to deviate from the proposed strategy. The same applies to strategies prescribing to choose 0 when observing messages -1 and 1. The decision maker gets $-\frac{(1-p)^2}{8}A$ by randomizing while gets $4p\frac{1-p}{2}(-A)+2\frac{(1-p)^2}{4}(-\frac{1}{2})$ by choosing 0. The latter follows because if there is at least one honest sender, and messages are -1 and 1, by choosing decision zero, the decision maker surely implements a wrong action. If both senders are biased, and messages are conflicting, expected payoff by choosing action zero is $\frac{1}{4}A-\frac{3}{4}A=-\frac{A}{2}$. It can be seen that $-\frac{(1-p)^2}{4}A > 4p\frac{1-p}{2}(-A)+2\frac{(1-p)^2}{4}(-\frac{1}{2})$. With the same reasoning it is possible to rule out strategies that implement action k in mixed strategies, with asymmetric probabilities.

Proof of Lemma 6

Suppose not and suppose that when there is disagreement the action of sender i is implemented. This cannot be true if sender i suggests action -1 and sender $-i$ suggests action zero. In general, sender $-i$ will prefer to tell the truth as she will not be able to influence the current decision, but then, in case of disagreement, the decision maker knows sender i is lying and she will prefer not to abide by the proposed equilibrium strategy.

Proof of Proposition 1

The payoff of a biased sender, when the true state is different from the one he prefers, is given by

$$V_T = -B + \delta E(B)$$

if he tells the truth in the first period, and

$$V_L = B$$

if he lies in the first period. The necessary condition for a pure strategy equilibrium with truthtelling is $V_T > V_L$, which is verified when

$$B < \frac{\delta E(B)}{2}$$

The model has a continuum of mixed strategy equilibria. When the true state is 0, both a left and a right biased senders lie. As payoffs are the same, the equilibrium is symmetric and $q^0 = z^0 = q$, therefore, $p_2 = \dfrac{p}{p+(1-p)q}$. The posterior probability that an agent is honest should be high enough in the second period, in particular $p_2 = \dfrac{p}{p+(1-p)q} > \dfrac{1}{5}$ which is verified as long as $q < \dfrac{4p}{1-p}$ which is a necessary condition for a mixed strategy equilibrium to exist. When instead the true state is 1, $z^1 = 1$, and $p_2 = \dfrac{p}{p+\frac{(1-p)}{2}+\frac{(1-p)}{2}q}$, the condition $p_2 > \frac{1}{5}$ then is verified as long as $q < \dfrac{9p-1}{1-p}$. These mixed strategy equilibria occur over a set of measure zero. In fact, it is a measure zero event that parameters are exactly such that the first period importance happens to be

$$B = \frac{\delta E(B)}{2}$$

Proof of Proposition 2

In a pure strategy equilibrium, by definition, $q^1_{i,1} = q^1_{-i} = 1$. Also, as proved by Lemma 5 and 6, $\nu^{i,m_i,m_{-i}} = \nu^{-i,m_i,m_{-i}} = \frac{1}{2}$ where $m_i, m_{-i} = -1, 1$. The proof of the second part follows by comparing payoffs from lying and telling the truth and imposing the condition $V_T > V_L$. Consider now mixed strategy equilibria. When the sender is left biased, he is willing to randomize if the true state in the first period is 1, otherwise when the true state is zero, or -1 there is truthtelling in pure strategies. Then q^1_{-i} has to be such that $V^i_T = V^i_L$, and to ease notation, drop the dependence of q on the observed state. Then, by rearranging equations 1 and 2, it follows that

$$\begin{aligned}
&[p(-\nu_1^{i,1,1} - \nu_1^{-i,1,1} - \nu_1^{i,-1,1} + \nu_1^{-i,-1,1}) + \\
&(\frac{1-p}{2})(-\nu_1^{i,1,1} - \nu_1^{-i,1,1} - \nu_1^{i,1,-1} + \nu_1^{-i,1,-1} - \nu_1^{i,-1,1} + \nu_1^{-i,-1,1} - \nu_1^{i,-1,-1} - \nu_1^{-i,-1,-1})]B + \\
&\delta E(B)[p(\frac{3}{8}(\nu_2^{i,-1,-1} + \nu_2^{-i,-1,-1}) - \frac{1}{4} + \frac{3}{8}(\nu_2^{i,-1,1} - \nu_2^{-i,-1,1})) + \\
&\frac{(1-p)}{2}(\nu_2^{i,-1,1} - \nu_2^{-i,-1,1}) + \frac{(1-p)}{2} + \frac{(1-p)}{2} + \frac{p}{4}] \\
&= \\
&q^1_{-i}[(\nu_1^{i,-1,1} - \nu_1^{-i,-1,1} - \nu_1^{i,-1,-1} - \nu_1^{-i,-1,-1} + \nu_1^{i,1,1} + \nu_1^{-i,1,1} + \nu_1^{i,1,-1} - \nu_1^{-i,1,-1})\frac{1-p}{2}B + \\
&\delta E(B)(\frac{1-p}{2} + \frac{1-p}{2} - \frac{1-p}{2}(\nu_2^{i,-1,-1} + \nu_2^{-i,-1,-1}))]
\end{aligned}$$

Plugging the equilibrium values of $\nu^{i,m_i,m_{-i}}$:

$$q_{-i} = \frac{2[\delta E(B)(1 - \frac{5}{8}p) - B]}{\delta E(B)(1-p)}$$

the equilibrium is clearly symmetric and therefore $q_{-i} = q_i = q$. In order for this to be an equilibrium, two additional conditions have to be met. Firstly, q has to be a well defined probability, hence $0 < q < 1$, secondly $p_2 > \frac{1}{5}$, i.e., second period reputation must be high enough for senders to exert influence. This implies $\frac{p}{p + \frac{(1-p)}{2} + \frac{(1-p)}{2}q} > \frac{1}{5}$, or $q < \frac{9p-1}{1-p}$, which requires $p > \frac{1}{9}$ as $q > 0$.The fact that the symmetric mixed strategy equilibrium is unique follows by the non-existence of asymmetric equilibria, established by Lemma 5 and 6. Other necessary conditions, for a mixed strategy equilibrium are $0 < q < 1$ and $q < \frac{9p-1}{1-p}$. These yield

$$\begin{aligned}
B &< \delta E(B)(1 - \frac{5}{8}p) \\
B &> \delta E(B)(\frac{1}{2} - \frac{p}{8})
\end{aligned}$$

which implies that if a mixed strategy equilibrium exists, a pure strategy equilibrium will not exist and vice-versa. Finally, the condition $q < \frac{9p-1}{1-p}$ implies,

$$B > \frac{\delta E(B)}{2}(3 - \frac{41}{4}p)$$

Hence, a mixed strategy equilibrium exists if and only if

$$\delta E(B) \max\{\frac{3}{2} - \frac{41}{8}p; \frac{1}{2} - \frac{p}{8}\} < B < \delta E(B)(1 - \frac{5}{8}p)$$

and it is easy to see that this set is non empty.

Proof of Proposition 3

When the true state is zero, the status quo, there always is truthtelling with two senders, while there is truthtelling with one sender only if period importance is not too large. When the true state is different from the status quo, in the one sender case there is truthtelling (in pure strategies) if and only if

$$B < \frac{\delta E(B)}{2} \equiv B_1^*$$

In the two senders case, truthtelling in pure strategies in the first period occurs iff

$$B < \delta E(B)(\frac{1}{2} - \frac{p}{8}) \equiv B_2^*$$

Truthtelling in pure strategies occurs over a set of parameters of larger measure when there is only one sender, iff

$$\frac{\delta E(B)}{2} > \delta E(B)(\frac{1}{2} - \frac{p}{8})$$

which is always verified. There is truthtelling in mixed strategies with two senders if and only if

$$B < \delta E(B)(1 - \frac{5}{8}p) \equiv B_{mix}^2$$

and

$$\frac{\delta E(B)}{2} > \delta E(B)(1 - \frac{5}{8}p)$$

if and only if

$$p > \frac{4}{5}$$

Therefore there can be parameter values for which there is truthtelling in pure strategies with one sender and truthtelling in mixed strategies with two senders and, if the probability the opponent is honest is large enough, there can even be a region of parameters such that there is truthtelling in pure strategies with one sender and no truthtelling with two senders.

Proof of Proposition 4

It can be seen that delegation generates stronger truthtelling incentives than communication in both the one and the two senders cases. In fact, it is easy to see that

$$\delta E(B)(\frac{1}{2}+\frac{p}{8}) > \frac{\delta E(B)}{2} > \delta E(B)(\frac{1}{2}-\frac{p}{8})\}$$

Moreover,

$$\delta E(B)(\frac{1}{2}+\frac{p}{8}) > \delta E(B)(1-\frac{5}{8}p)$$

if and only if $p > \frac{2}{3}$ so that, when the true state in the first period is different from the status quo, and the probability the opponent is honest is relatively large, delegation improves upon communication, as there are values of period importance for which there is truthtelling in pure strategies under delegation and not even truthtelling in mixed strategies under communication.

Proof of Proposition 5

I assume sender i is left biased. When the true state is -1 he trivially reports the truth. When the true state is not -1, it is important to distinguish the case when the true state is the status quo, from that when the true state is 1. In fact, in the latter case, a right biased opponent surely reports the truth, while, if the true state is the status quo, a right biased sender might prefer to lie. Therefore, the expected payoff of a left biased influential sender is given by:

$$V_T^i(0) = -\nu_1^i B + (1-\nu_1^i)[-\frac{1-p}{2}z - \frac{1-p}{2}(1-z) - p - \frac{1-p}{2}q + \frac{1-p}{2}(1-q)]B + \delta E(B) \quad (3)$$

$$\begin{aligned} V_L^i(0) \quad = \quad & +\nu_1^i B + (1-\nu_1^i)[-\frac{1-p}{2}z - \frac{1-p}{2}(1-z) - p - \frac{1-p}{2}q + \frac{1-p}{2}(1-q)]]B + \quad (4) \\ & \delta E(B)[\frac{1-p}{2}q + \frac{3p}{8} - \frac{p}{4} - \frac{3p}{8} - \frac{1-p}{2}z] \end{aligned}$$

when the true state is the status quo, and by

$$V_T^i(1) = -\nu_1^i B + (1-\nu_1^i)[-\frac{1-p}{2} - p - \frac{1-p}{2}q + \frac{1-p}{2}(1-q)]B + \delta E(B) \quad (5)$$

$$V_L^i(1) = +\nu_1^i B+(1-\nu_1^i)[-\frac{1-p}{2}-p-\frac{1-p}{2}q+\frac{1-p}{2}(1-q)]B+\delta E(B)[\frac{1-p}{2}q+\frac{3p}{8}-\frac{p}{4}-\frac{3p}{8}-\frac{1-p}{2}] \quad (6)$$

when the true state is 1. When the true state is the status quo, the right biased sender reports the truth with probability z, and reports his preferred state otherwise. Therefore, he retains his credibility with probability z. On the contrary, when the true state is 1, a right biased sender always reports the truth and retains his credibility. The first term of equation 3 is current period payoff when reporting the truth. The decision of the influential sender is implemented with probability ν_1^i leading to a payoff of $-B$, while the decision of the non influential sender is implemented with probability $1-\nu_1^i$. The non influential sender can be right biased and reports the truth (this occurs with probability $\frac{1-p}{2}z$), or right biased and reports the true state is 1 (this occurs with probability $\frac{1-p}{2}(1-z)$) and in both cases the left biased influential sender suffers a loss of $-B$. The non influential sender could be honest, reporting the true state is zero (this occurs with probability p), or left biased reporting the true state is zero (this occurs with probability $\frac{1-p}{2}q$), and in both cases the left biased influential sender suffers a loss of $-B$. Finally, the non influential sender could be left biased and lies reporting state -1, this occurs with probability $\frac{1-p}{2}(1-q)$, and leads to a gain of B. In the second period the influential sender exerts full influence on the decision and expected payoff is $\delta E(B)$. Equation 4 is similar, although now the left biased influential sender lied. The intuition underlying equations 5 and 6 is analogous, with the difference that a right biased influential sender would report the truth for sure in the first period (thus $z=1$) and will retain credibility to influence second period decision.

A biased non influential sender always lies in a truthtelling equilibrium, as he will not have any chance to influence future decisions, unless the true state coincides with his preferences. Thus, when the true state is the status quo, biased non influential senders lie (and $q=z=0$) and a left biased influential sender reports the truth in the first period if and only if

$$B < \frac{\delta E(B)(4+p)}{8\nu_1^i}$$

When the true state is 1 and the influential sender reports the truth, a right biased non influential sender report the truth (so that $z=1$), while a left biased non influential sender lies (so that $q=0$) and a left biased influential sender reports the truth if and only if

$$B < \frac{(6-p)}{8\nu_1^i}\delta E(B)$$

If the influential sender lies, a biased non influential sender might prefer to report the truth. Again it is important to distinguish the case when the true state is the status quo from the case when the true state is 1. In the former situation, both a left and a right biased non influential senders behave analogously. Expected payoffs for such senders are given by

$$\begin{aligned} V_T^{-i}(0) &= -\nu_1^i Bp - (1-\nu_1^i)B + \delta E(B)(1-p) - p\frac{\delta E(B)}{4} \\ V_L^{-i}(0) &= -\nu_1^i Bp + (1-\nu_1^i)B - \frac{p}{4}\delta E(B) \end{aligned}$$

The continuation payoff follows because with probability $\frac{(1-p)}{2} + \frac{(1-p)}{2} = (1-p)$ the influential sender is either left, or right biased, and lies in the first period, so that the non influential sender can influence second period decision. On the contrary, with probability p, the influential sender is honest, reports the truth in the first period and influences second period decision leading to an expected payoff of $-\frac{\delta E(B)}{4}$. The payoff from lying can be understood analogously. Therefore, biased non influential senders are willing to report the truth if and only if

$$B < \frac{\delta E(B)(1-p)}{2(1-\nu_1^i)}$$

If the true state is 1 a right biased sender always reports the truth, while a left biased sender has the following expected payoff functions:

$$\begin{aligned}
V_T^{-i}(1) &= -\nu_1^i Bp - (1-\nu_1^i)B + \frac{1-p}{2}\delta E(B) - p\frac{\delta E(B)}{4} - \frac{1-p}{2}\delta E(B) \\
V_L^{-i}(1) &= -\nu_1^i Bp + (1-\nu_1^i)B - p\frac{\delta E(B)}{4} - \frac{1-p}{2}\delta E(B)
\end{aligned}$$

and he is willing to report the truth if and only if

$$B < \frac{\delta E(B)(1-p)}{4(1-\nu_1^i)}$$

It should be noticed that depending upon the degree of favouritism there can exists two equilibria. In fact, the influential sender reports the truth as long as

$$B < \frac{\delta E(B)(4+p)}{8\nu_1^i}$$

if the true state is the status quo and

$$\frac{\delta E(B)(4+p)}{8\nu_1^i} > \frac{\delta E(B)}{2}(1+\frac{p}{4})$$

as $\nu_1^i \leq 1$. This proves that favouritism improves upon delegation, and, therefore upon communication. Moreover, the non influential sender reports the truth if he is honest, or if favouritism is not too strong. According to the degree of favouritism there can be values of period importance such that non influential senders report the truth. When the true state is 1, a left biased sender reports the truth as long as

$$B < \frac{(6-p)}{8\nu_1^i}\delta E(B)$$

and obviously

$$\frac{(6-p)}{8\nu_1^i}\delta E(B) > \frac{\delta E(B)}{2}(1+\frac{p}{4})$$

showing again that favouritism improves upon full delegation. Moreover, the non influential sender reports the truth if he is honest, right biased, or left biased and the degree of favouritism is large enough and period importance is intermediate.

Finally, I can show the conditions ensuring the existence and uniqueness of the equilibria both if the true state is the status quo and if the true state is 1. When the true state is the status quo, a left biased influential sender reports the truth in the first period as long as

$$B < \frac{\delta E(B)(4+p)}{8\nu_1^i}$$

and lies otherwise, while non influential senders always lie if

$$\frac{\delta E(B)(1-p)}{2(1-\nu_1^i)} < \frac{\delta E(B)(4+p)}{8\nu_1^i}$$

which is verified as long as

$$\nu_1^i < \frac{4+p}{8-3p}$$

Such equilibrium is unique as $\frac{4+p}{8-3p} > 1$.

Similarly, when the true state is 1, there exists an equilibrium where the influential sender reports the truth as long as

$$B < \frac{(6-p)}{8\nu_1^i}\delta E(B)$$

and lies otherwise, and a left biased non influential sender always lies. Such equilibrium occurs when

$$\frac{\delta E(B)(1-p)}{4(1-\nu_1^i)} < \frac{(6-p)}{8\nu_1^i}\delta E(B)$$

which is verified when

$$\nu_1^i < \frac{6-p}{8-3p}$$

Such equilibrium is unique as $\frac{6-p}{8-3p} > 1$

Proof of Proposition 6

The proposition can be proved by comparing payoffs for the decision maker for different realizations of period importance. ## to be moved## I will also assume that $p > \frac{1}{2}$ so that $B^2_{mix} < B^{del}$ which implies that there exists realizations of period importance such that there is truthtelling in pure strategies under delegation and no truthtelling (not even in mixed strategies) under communication. The logic of the proof for the opposite case is similar and is thus omitted (although the optimality of delegation as opposed to communication over that range of period importance realizations may differ). ##

1. If $B \in [\underline{B}, B_2^*]$, there is truthtelling in pure strategies both under communication and under delegation. In this case expected payoff for the decision maker under communication is

$$U^{DM}_{Comm} = p^2[A + \delta E(A)] + 4p\frac{(1-p)}{2}[A + \frac{5}{8}\delta E(A)] + (\frac{1-p}{2})^2[4A - 2\frac{1}{4}\delta E(A))]$$

while that under delegation is

$$U^{DM}_{Del} = p^2[A+\delta E(A)]+2p\frac{(1-p)}{2}[A+\delta E(A)]+2p\frac{(1-p)}{2}[A-\frac{1}{4}\delta E(A)]+(\frac{1-p}{2})^2[4A-4\frac{1}{4}\delta E(A))]$$

The intuition for these expressions is as follows: with probability p^2 both senders are honest and report the truth no matter the state and period importance. Then, the decision maker implements the correct decision ensuring a payoff of A in the first period, and an expected payoff of $\delta E(A)$ in the second. With probability $p\frac{1-p}{2}$, one sender is honest, and the other is biased and as the latter can be left or right biased, the total number of such cases is four. Period importance is low enough so that there is truthtelling in pure strategies in the first period, and payoff is A both under delegation and under communication. In the latter case expected second period payoff is $\frac{5}{8}\delta E(A)$, because with probability $\frac{1}{4}$ the true state is zero, and the decision maker observes a zero message from the honest sender and a non zero message from the biased sender, and learns the true state is zero. With probability $\frac{3}{8}$ the true state accords with the preferences of the biased sender and the decision maker observes two agreeing messages and implements the correct decision. Finally, with probability $\frac{3}{8}$ the true state is opposed to the preferences of the biased sender and the decision maker observes conflicting messages and randomises, so that expected payoff is zero. Under delegation, if the honest sender is delegated decision powers, second period decision is made correctly, otherwise, it is correct only when the true state is the one preferred by the biased sender, and this happens with probability $\frac{3}{8}$. In the other cases, the biased sender implements a wrong decision yielding an expected payoff of $-\delta E(A)$. Finally, with probability $(\frac{1-p}{2})^2$ both senders are biased, either left or right. They report the truth in the first period as period importance is lower than B^*_2, while they lie in the second period. Under communication, there can be 2 cases: both senders have the same bias, or they have opposed biases. In the latter case, which occurs with probability $2(\frac{1-p}{2})^2$, the decision maker observes conflicting messages and randomizes. In the former case, which occurs with probability $2(\frac{1-p}{2})^2$, the decision maker observes agreeing messages and implements the decision preferred by senders. That is correct with probability $\frac{3}{8}$ and wrong with probability $\frac{5}{8}$. Under delegation the decision is correct with probability $\frac{3}{8}$ and wrong with probability $\frac{5}{8}$. It is easy to verify that $U^{DM}_{Del} - U^{DM}_{Comm} = \frac{1-p}{2}\frac{\delta E(A)}{2}(\frac{-1-3p}{2})$, so that communication leads to a larger payoff for the decision maker.

2. If $B \in [B^*_2, \min\{B^{mix}_2, B^{del}\}]$ there is truthtelling in pure strategies under delegation, and truthtelling in mixed strategies under communication, unless the true state is zero. Payoffs for

the decision maker are:

$$
\begin{aligned}
U^{DM}_{Comm} &= p^2[A+\delta E(A)] + 4p\frac{(1-p)}{2}\{\frac{5}{8}[A+\frac{5}{8}\delta E(A)] + \frac{3}{8}[q[A+\frac{5}{8}\delta E(A)] + (1-q)\delta E(A)]\} + \\
&\quad (\frac{1-p}{2})^2\{2[\frac{5}{8}(A-\frac{\delta E(A)}{4}) + \frac{3}{8}((q^2(A-\frac{\delta E(A)}{4}) + 2q(1-q)(-\frac{\delta E(A)}{4}) + (1-q)^2(-A))] + \\
&\quad +2[\frac{1}{4}A + \frac{3}{4}qA + \frac{3}{4}(1-q)(-\frac{\delta E(A)}{4}))]\}
\end{aligned}
$$

$$
U^{DM}_{Del} = p^2[A+\delta E(A)] + 2p\frac{(1-p)}{2}[A+\delta E(A)] + 2p\frac{(1-p)}{2}[A-\frac{1}{4}\delta E(A)] + (\frac{1-p}{2})^2[4A-4\frac{1}{4}\delta E(A))]
$$

The intuition for these expressions can be understood following the same logic as above. Then,

$$
\begin{aligned}
U^{DM}_{Del} - U^{DM}_{Comm} &= 4p\frac{(1-p)}{2}[\frac{3}{8}A(1-q) + \frac{9q-40}{64}\delta E(A)] + (\frac{1-p}{2})^2[+3A(1-q) - \frac{5+3q^2}{16}\delta E(A)] = \\
&\quad \frac{1-p}{4}[3(1-q)A + \delta E(A)(\frac{-5-75p+18pq-3q^2(1-p)}{16})]
\end{aligned}
$$

In order to investigate the sign of this expression, it is necessary to plug q^* in. However, q^* is function of B and $\delta E(B)$, and it is necessary to make assumptions about the correlation between B and A. I assume they are perfectly correlated, so that $B = A$, and $q^* = \frac{2[\delta E(A)(1-\frac{5}{8}p)-A]}{\delta E(A)(1-p)}$ and this expression is positive if and only if the quadratic equation

$$
12A^2 + 9Ap\delta E(A) + (\frac{175}{16}p - 3p - 7)[\delta E(A)]^2 > 0
$$

which is verified as long as

$$
\begin{aligned}
A &< -\frac{3}{8}p\delta E(A) - \frac{\delta E(A)}{12}\sqrt{3}\sqrt{-37p^2+12p+28} \\
A &> -\frac{3}{8}p\delta E(A) + \frac{\delta E(A)}{12}\sqrt{3}\sqrt{-37p^2+12p+28}
\end{aligned}
$$

of course, as $A > 0$, only the second line is relevant. It is possible to show that the set $-\frac{3}{8}p\delta E(A) + \frac{\delta E(A)}{12}\sqrt{3}\sqrt{-37p^2+12p+28} < A < \delta E(A)(1-\frac{5}{8}p)$ is not empty for $p \geq \frac{2}{3}$, both when $p > \frac{2}{3}$ and $\min\{B_2^{mix}, B^{del}\} = B_2^{mix}$, and when $\frac{1}{5} < p < \frac{2}{3}$ and $\min\{B_2^{mix}, B^{del}\} = B^{del}$

3. When $p > \frac{2}{3}$ and $B \in [B^{mix}, B^{del}]$ there is truthtelling under delegation, and no truthtelling

under communication if the state is not zero. Payoffs for the decision maker then are:

$$\begin{aligned}
U^{DM}_{Comm} &= p^2[A+\delta E(A)] + 4p\frac{(1-p)}{2}[\frac{5}{8}(A+\frac{5}{8}\delta E(A)) + \frac{3}{8}\delta E(A)] + \\
&\quad (\frac{1-p}{2})^2[(2(\frac{1}{4}+\frac{3}{8})(A-\frac{\delta E(A)}{4}) + 2\frac{3}{8}(-A) + 2(\frac{1}{4}A + \frac{3}{8}(-\frac{\delta E(A)}{4}) + \frac{3}{8}(-\frac{\delta E(A)}{4})]
\end{aligned}$$

$$U^{DM}_{Del} = p^2[A+\delta E(A)] + 2p\frac{(1-p)}{2}[A+\delta E(A)] + 2p\frac{(1-p)}{2}[A-\frac{1}{4}\delta E(A)] + (\frac{1-p}{2})^2[4A - 4\frac{1}{4}\delta E(A))]$$

The intuition for these expression can be gained following the same logic as above. It can be shown that:

$$U^{DM}_{Del} - U^{DM}_{Comm} = 4p\frac{(1-p)}{2}[\frac{3}{8}A - \frac{25}{64}\delta E(A)] + (\frac{1-p}{2})^2(3A - \frac{5}{16}\delta E(A))$$

it can be seen that this expression is positive as long as

$$A > \delta E(A)\frac{5(1+9p)}{48}$$

if there is perfect correlation in period importance for managers and the decision maker, $B^{del} = \delta E(A)(\frac{1}{2}+\frac{p}{8})$, and the set $\delta E(A)\frac{5(1+9p)}{48} < A < \delta E(A)(\frac{1}{2}+\frac{p}{8})$ is empty, as $p > \frac{2}{3}$, in order to ensure that $B^{mix} < B^{del}$.

4. When$\frac{1}{5} < p < \frac{2}{3}$ and $B \in [B^{del}, B^{mix}]$ there is truthtelling in mixed strategies under communciation and no truthtelling under delegation. Then payoffs are

$$\begin{aligned}
U^{DM}_{Comm} &= p^2[A+\delta E(A)] + 4p\frac{(1-p)}{2}\{\frac{5}{8}[A+\frac{5}{8}\delta E(A)] + \frac{3}{8}[q[A+\frac{5}{8}\delta E(A)] + (1-q)\delta E(A)]\} + \\
&\quad (\frac{1-p}{2})^2\{2[\frac{5}{8}(A-\frac{\delta E(A)}{4}) + \frac{3}{8}((q^2(A-\frac{\delta E(A)}{4}) + 2q(1-q)(-\frac{\delta E(A)}{4}) + (1-q)^2(-A))] + \\
&\quad +2[\frac{1}{4}A + \frac{3}{4}qA + \frac{3}{4}(1-q)(-\frac{\delta E(A)}{4}))]\}
\end{aligned}$$

$$U^{DM}_{Del} = p^2[A+\delta E(A)] + 2p\frac{(1-p)}{2}[A+\delta E(A)] + 2p\frac{(1-p)}{2}[-\frac{A}{4} + \delta E(A)] + (\frac{1-p}{2})^2[4\frac{5}{8}(-A - \frac{\delta E(A)}{4}$$

The intuition for these expression follows the same logic as above. It can be shown that

$$U^{DM}_{Del} - U^{DM}_{Comm} =$$

5. Finally, if $B \in [\max\{B^{del}, B^{mix}\}, \overline{B}]$ biased senders have no incentives for truthtelling neither under delegation, nor under communication unless the state is zero. Payoffs for the

decision maker in such a case are

$$U^{DM}_{Comm} = p^2[A + \delta E(A)] + 4p\frac{(1-p)}{2}[\frac{5}{8}(A + \frac{5}{8}\delta E(A)) + \frac{3}{8}\delta E(A)] + (\frac{1-p}{2})[(2(\frac{1}{4} + \frac{3}{8})(A - \frac{\delta E(A)}{4}) + 2\frac{3}{8}(-A) + 2(\frac{1}{4}A + \frac{3}{8}2(-\frac{\delta E(A)}{4}) + \frac{3}{8}2(-\frac{\delta E(A)}{4}))]$$

$$U^{DM}_{Del} = p^2[A + \delta E(A)] + 2p\frac{(1-p)}{2}[A + \delta E(A)] + 2p\frac{(1-p)}{2}[-\frac{A}{4} + \delta E(A)] + (\frac{1-p}{2})^2[4\frac{5}{8}(-A - \frac{\delta E(A)}{4}$$

The intuition for these expression is analogous to that of the previous cases. Then, it is easy to see that

$$U^{DM}_{Del} - U^{DM}_{Comm} = 4p\frac{(1-p)}{2}[\frac{15}{64}\delta E(A) - \frac{A}{2}] + (\frac{1-p}{2})^2[-\frac{5}{4}\frac{\delta E(A)}{4}]$$

This expression is positive as long as

$$A < \delta E(A)\frac{5(1-7p)}{64p}$$

and this condition cannot be verified in truthtelling equilibria, as $p > \frac{1}{7}$, and $A > 0$.

Proof of Proposition 8

In the one sender case, the payoff from reporting the truth is

$$V_T = -B^1 + \delta E(B^1)$$

while that from lying is

$$V_L = B^1$$

The gain from lying in the current period is $2B^1$, the expected payoff from exerting influence in the future is $\delta E(B^1)$, the expected future payoff if own reputation is depleted is zero.

In the n senders case, the gain from lying in the current period is

$$B^{n+1} - B^n$$

Thus, competition reduces current influence as long as

$$2B^1 > B^{n+1} - B^n$$

This is likely to happen, especially if the intensity of the action does not "jump" significantly when the consensus becomes more widespread.

The expected future payoff from keeping own reputation is

$$\frac{3}{8}[\sum_{r=0}^{\frac{n}{2}}\sum_{l=0}^{n-r}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{(l+r)}\delta E(B^{n+1-r}) -$$
$$\sum_{r=\frac{n}{2}+1}^{n}\sum_{l=0}^{n-r}\frac{n!}{l!r!(n-r-l)!}p^{n-(r+l)}(\frac{1-p}{2})^{(l+r)}\delta E(B^{r})]$$
$$+\frac{1}{4}\{\sum_{h=1}^{n}\binom{n}{h}p^{h}(\frac{1-p}{2})^{n-h}(-\delta E(B^{f}) + (\frac{1-p}{2})^{n}[\sum_{r=0}^{\frac{n}{2}}\binom{n}{r}(\delta E(B^{n+1-r}) - \sum_{r=\frac{n}{2}+1}^{n}\binom{n}{r}(\delta E(B^{r})]\} +$$
$$\frac{3}{8}[\sum_{l=\frac{n}{2}}^{n}\sum_{r=0}^{n-l}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{l+r}\delta E(B^{l+1}) - \sum_{l=0}^{\frac{n}{2}-1}\sum_{r=0}^{n-l}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{l+r}\delta E(B^{n-l}$$

Firstly, it should be noticed that when the true state is 0, it is sufficient that there is only one honest sender to influence the decision away from a left biased sender preferences. Furthermore, the decision goes against the interests of a left biased sender when the true state is 1 and there is not a majority of left biased senders, when the true state is one and there is a majority of left biased senders, or when the true state is 0 and there are no honest senders and a majority of right biased senders. This shows the sender will not be able to cash in the benefit of keeping own reputation with probability one, although it is not possible to directly compare those benefits with the payoff in the one sender case because the expected intensity of the action is typically different from the intensity corresponding to that in the one sender case (which would correspond to a majority of one sender). However, again, if the intensity of the action does not jump too much when the consensus increases by one unit, future influence is reduced under competition.

A benefit of keeping own reputation is the ability to move next period decision towards own interests by changing the majority, so that a favourable decision will be "more favourable" and an unfavourable decision will be dampened. When own reputation is lost, in the one sender case expected payoff is zero, while with n senders it is given by

$$\frac{3}{8}[\sum_{r=0}^{\frac{n}{2}-1}\sum_{l=0}^{n-r}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{(l+r)}\delta E(B^{n-r})+$$
$$\sum_{r=\frac{n}{2}+1}^{n}\sum_{l=0}^{n-r}\frac{n!}{l!r!(n-r-l)!}p^{n-(r+l)}(\frac{1-p}{2})^{(l+r)}(-\delta E(B^{r}))]$$
$$+\frac{1}{4}\{\sum_{h=1}^{n}\binom{n}{h}p^{h}(\frac{1-p}{2})^{n-h}(-\delta E(B^{f})+(\frac{1-p}{2})^{n}[\sum_{r=0}^{\frac{n}{2}-1}\binom{n}{r}(\delta E(B^{n-r})-\sum_{r=\frac{n}{2}+1}^{n}\binom{n}{r}(\delta E(B^{r})]\}$$
$$\frac{3}{8}[\sum_{l=\frac{n}{2}+1}^{n}\sum_{r=0}^{n-l}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{(l+r)}\delta E(B^{l})+$$
$$\sum_{l=0}^{\frac{n}{2}-1}\sum_{r=0}^{n-l}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{(l+r)}(-\delta E(B^{n-l}))]$$

and again the decision goes against a left biased sender preferences in the same situations as above. An additional difference is that now n is even, so having lost own reputation prevents the left biased sender to be pivotal in those situations. Here it is possible to say something more, as

$$\sum_{l=0}^{\frac{n}{2}-1}\sum_{r=0}^{n-l}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{(l+r)}(-\delta E(B^{n-l}))=$$
$$-\sum_{r=0}^{\frac{n}{2}-1}\sum_{l=0}^{n-r}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{(l+r)}\delta E(B^{n-r})$$

and

$$\sum_{r=\frac{n}{2}+1}^{n}\sum_{l=0}^{n-r}\frac{n!}{l!r!(n-r-l)!}p^{n-(r+l)}(\frac{1-p}{2})^{(l+r)}(-\delta E(B^{r}))=$$
$$-\sum_{l=\frac{n}{2}+1}^{n}\sum_{r=0}^{n-l}\frac{n!}{l!r!(n-r-l)!}p^{n-(l+r)}(\frac{1-p}{2})^{(l+r)}(+\delta E(B^{l}))$$

furthermore

$$\sum_{r=0}^{\frac{n}{2}-1}\binom{n}{r}(\delta E(B^{n-r})=\sum_{r=\frac{n}{2}+1}^{n}\binom{n}{r}(\delta E(B^{r})$$

so that the discipline effect is

$$\frac{1}{2}\{\sum_{h=1}^{n}\binom{n}{h}p^{h}(\frac{1-p}{2})^{n-h}(-\delta E(B^{f})<0$$

and it affects truthtelling incentives as in the two senders game.