Communication and Decision-Making in Corporate Boards*

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Abstract

This paper develops a model of communication and decision-making in corporate boards. The key element of the paper is that the quality of board discussions is endogenous, because it depends on the effort directors put into trying to communicate their information to others. In the model, directors may have biases regarding the decisions and may also be reluctant to disagree with other directors. If the only interaction between board members is at the decision-making stage, when decisions are made but discussion is limited, these frictions impede effective decision-making because directors' decisions are not fully based on their information. However, if in addition directors can communicate their information more effectively at a cost, then stronger preferences for conformity or stronger biases might improve the board's decisions, because directors have a stronger motivation to convince others of their position. The paper provides implications for the design of board meetings and board structure, including the role of committees, the open ballot voting system, and the benefits of executive sessions of directors.

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1 Introduction

The board of directors is the main governing body of a corporation. It plays a crucial role in key decisions of the firm, such as appointment and replacement of the CEO, and approval of major transactions, including mergers, acquisitions, and reorganizations. The board is a collective body, whose members have diverse knowledge and experience that is valuable to the company. Indeed, when describing their criteria for selecting new board members, directors and executives stress the importance of having board members with strategically relevant and diverse expertise, because their "knowledge and skills should complement those of the CEO and top management, providing a richer consideration and resolution of strategic issues."[1] Therefore, effective board design should ensure that board decisions efficiently aggregate information of all directors, an important prerequisite for which is adequate communication and deliberation between directors.[2]

Although interaction and communication among directors is essential to board decision-making, it has been largely unexplored in the literature, since most papers model the board as a single entity. This paper develops a theoretical framework for studying communication and decision-making in boards by analyzing the behavior of individual directors. The key element of the paper is that the quality of board discussion is endogenous: it depends on how much time and effort directors are willing to put into trying to communicate their knowledge to other board members. I show that this feature is very important for understanding how board characteristics and decision-making rules affect board performance. In particular, when directors can communicate their information more effectively at a cost, certain frictions in their preferences may improve board decisions by encouraging more efficient communication and information aggregation. The analysis has implications for the design of board meetings and board structure, including the use of the open ballot voting system, the establishment and composition of committees, and the role of executive sessions of outside directors.

To examine the decision-making process in boards, it is important to account for the frictions that may affect directors' behavior. First, due to their relationships with the management, ownership, or affiliation, directors may have preferences that are different from those of shareholders. Second, even if directors are completely independent and aim to maximize shareholder value, they may be reluctant to disagree with the prevailing view in the

[1] John Cook, CEO and chairman of Profit Recovery Group (see the interview evidence in Finkelstein and Mooney, 2003). See also survey evidence in O'Neal and Thomas (1996).

[2] As Robert Monks, a well-known corporate governance expert, said, "I think it's very important to be able to talk; otherwise you simply can't make the most use of the board's human capital" (Ward, 2000).

boardroom. This reluctance can be due to several reasons, such as the influence of the CEO or directors' reputational concerns. For example, there is anecdotal evidence that directors who criticize the CEO during the board meeting without support from other directors are likely to face managerial retaliation and feel the pressure to resign.[3] Reputational considerations can also prevent directors from expressing a dissenting opinion. According to survey evidence in Lorsch and MacIver (1989), 49% of directors feel inhibited in taking a minority stand, citing their reluctance to appear incompetent and uninformed in front of their peers among the main reasons for such concerns. As one of the directors explained in an interview after approving a controversial loan, "Because it's hard to sit in a room and disagree with people you respect who think it's okay" (Jennings, 2007).

This anecdotal evidence suggests that directors' biases regarding the decisions and their preferences for conformity may be important factors influencing decision-making in corporate boards. Biased directors may try to skew the board's decisions in the direction of their preferences, while realizing that such decisions are not optimal from shareholders' perspective. A desire for conformity may induce a director to disregard his private opinion and conform his actions to what he believes is the consensus of other directors. At first glance, this seems to imply that the presence of conflicts of interest and preferences for conformity is always detrimental for board decision-making. This argument, however, does not take into account that directors communicate with each other prior to making decisions and that the quality of their communication is endogenously determined by the efforts of all directors, acting individually according to their preferences.

Communicating effectively and convincingly requires time and effort. In order to fully convey knowledge in a way that it will be understood and internalized by other board members, a director may need to support his view with objective evidence and persuasive arguments, which involves preparation. For instance, in the case of an acquisition, a director who believes that the proposed valuation of the target is too high and wishes to convince other directors of this, may need to review in advance the board information package and the details of the valuation model, so that he is able to present his case effectively and persuade others. Moreover, the time allocated to discussion during the board meeting is usually very limited. Because of that, directors may be reluctant to take the time from their peers and may have

[3] Mace (1986) describes a case study where an outside director was excluded from the company's proxy statement after openly criticizing the manager's press releases during a board meeting. "Don't raise questions with the president unless you can, for sure, count on the support of others on the board," commented the director afterwards.

to engage in discussions outside the meeting, which imposes additional costs.[4] Since communicating effectively is privately costly, directors may choose to simply present the bottom line of their considerations or vote in favor or against the decision.

This paper develops a model that incorporates in a stylized way the key features of board decision-making described above - endogenous quality of board discussions, the presence of biases regarding the decisions, and directors' preferences for conformity. In the model, the board is contemplating a decision whose value is uncertain, e.g., a potential acquisition or CEO replacement. Each director has private information relevant to the decision. The board's decision process takes place in two stages - discussion, followed by decision-making. At the discussion stage, each director decides whether to incur a cost in order to credibly communicate his knowledge to other directors. By incurring the cost, he ensures that his information is fully understood by other board members and used in their decisions at the second stage. If the cost is not incurred, other directors do not learn his information. At the second, decision-making, stage, each director takes an action based on his private information and all information received at the first stage. Directors' individual actions are aggregated into the final board's decision according to an exogenously specified function. For example, the second stage could correspond to a straw poll, in which each director indicates his preferred decision, or to an actual vote. Because communication at the decision-making stage is limited (e.g., both a straw poll and a vote are binary actions, which cannot fully convey directors' information), a director's private information will not be fully and efficiently incorporated in the final decision unless it is shared with others at the discussion stage.

To study how directors' preferences for conformity affect board decisions, I assume that directors suffer a loss if their actions at the decision-making stage deviate from the actions of other directors (e.g., if they vote differently from the majority). The basic model considers the symmetric case, where directors are equally averse to being more and less supportive of the proposal under consideration than the rest of the board. In an extension of the model, I analyze the case where directors are particularly averse to being less supportive than the rest of the board, corresponding to a situation where the proposal is favored by the CEO. The results of the two cases are qualitatively similar.

At the decision-making stage, directors' desire to conform to what they believe is the consensus of other directors leads to "herding" and induces them to put less than optimal weight on their private information. This might result in a situation where each individual director privately doubts the board's decision but votes in favor of it because he believes that

[4] See Finkelstein and Mooney (2003) and Stevenson and Radin (2009) for a discussion of these issues.

other directors support it. Such coordination problems might have been one of the factors behind some recent corporate board failures. For example, the failure of the Enron board to exercise oversight despite being named one of the five best boards in the U.S. in 2000, has been frequently attributed to strong pressure for conformity among its members.[5]

These arguments imply that strong preferences for conformity often prevent a director from using his private information in his decisions. Is this effect always detrimental for board functioning? The analysis of the paper demonstrates that this is not necessarily the case when pre-decision costly communication is taken into account. To see the intuition, suppose a director has reservations about a proposal that other board members seem to support. Unless he is able to convincingly communicate his reservations to other directors, a desire for conformity will induce him to vote in favor of the proposal, leading to its approval. Because the director cares about the firm and does not want a suboptimal decision to be made, this gives him incentives to incur the costs of communication and convince other directors of his negative view. Importantly, by making other directors fully understand his concerns, the director might be more effective in preventing the proposal from being approved than if he kept his doubts to himself and simply voted against. Consistent with this intuition, the analysis shows that at least some degree of preferences for conformity is beneficial to board performance. Essentially, preferences for conformity encourage directors to incur communication costs and thereby improve the quality of pre-decision discussion. As long as conformity bias is not very strong, its positive effect at the discussion stage dominates its negative effect at the decision-making stage.

The result that some degree of preferences for conformity may be beneficial has implications for the structure of board meetings and the rules governing the decision-making process. It suggests, for example, that the open ballot voting system, while inducing directors to vote in favor of the CEO's preferred decisions, does not necessarily lead to more CEO entrenchment. This is because directors' reluctance to openly vote against the CEO during the meeting is likely to encourage more active communication outside the meeting, without the CEO present, which may improve the overall quality of board decisions. Of course, directors are willing to engage in pre-meeting discussions, i.e., spend the costs of communication, only if these costs are not prohibitively high. This emphasizes the importance of the mandate for regularly scheduled executive sessions of outside directors, imposed on public companies by the NYSE and Nasdaq in 2003.[6] This requirement is likely to have

[5] See, e.g., O'Connor (2003) and Sharfman and Toll (2008).

[6] An executive session is a meeting of outside directors without any management directors or other members of the management present. See SEC Release No. 34-48745 (November 4, 2003) at

substantially reduced outside directors' costs of communication by preventing any negative inference the CEO could draw from the initiation of such discussions.[7] Section 5 provides a more detailed discussion of these issues and their implications for different companies and different types of decisions.

Another friction that may affect directors' behavior is their biases regarding the board's decisions. I demonstrate that stronger biases may also have a positive effect of encouraging directors to communicate more effectively. The intuition why a more biased director is more willing to credibly communicate his information, even at a cost, is the following. Suppose, for example, that a director is known to be biased in favor of the proposal under consideration. This director is expected to actively participate in the discussion and present evidence supporting the proposal whenever he can find such evidence. Hence, if the director is silent, other directors infer that he has no arguments supporting the proposal or, put differently, that his information about the proposal is unfavorable. Such negative inference reduces the probability that the proposal will be approved by the board. The more biased is the director towards the proposal, the more he wants it to be approved and hence, the more harmful for him is the negative inference of other directors when he is silent. At the margin, this gives a more biased director stronger incentives to incur the costs of communication and credibly convey his information. This result contrasts with the literature on costless communication of non-verifiable information, where the presence of biases negatively affects communication (see, e.g., Crawford and Sobel, 1982).

A stronger director's bias regarding the decision can therefore improve the quality of pre-decision discussion between directors. Of course, a more biased director is also more likely to bias his actions (e.g., skew his vote) in the direction of his preferred alternative. Nevertheless, the positive effect of the bias at the discussion stage can strictly dominate its negative effect at the decision-making stage. In particular, I show that, even if all directors except one are completely independent and maximize shareholder value, shareholders benefit from having a strictly biased remaining director.

In practice, some directors on the board may be more influential than others. Examples

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http://www.sec.gov/rules/sro/34-48745.htm.

[7] The executive session requirement came into effect after Enron's collapse, suggesting that the costs of communication between its directors might have been rather high. Consistent with this hypothesis, Enron's directors had "very little interaction or communication" outside board meetings, according to the U.S. Senate report on the role of the board in Enron's collapse. See U.S. Senate Permanent Subcommittee on Investigations, "The Role of the Board of Directors in Enron's Collapse" (Report 107-70, July 8, 2002). It is interesting to speculate whether pressure for conformity among Enron's directors would have played a different role if the executive session requirement had been imposed earlier.

include the CEO when he is simultaneously a board member, and directors who have a high status or are well-known experts in the field. To capture this feature, I consider an extension of the model in which different directors have different influence over the final decision. I show that the smaller is the director's influence, the more incentives he has to communicate his information to other directors. This is because his information will only affect the outcome if other, more influential board members incorporate it in their decisions.

Directors' influence over a decision can be changed exogenously by allocating authority to a subset of directors, e.g., through a committee structure. I examine the optimal division of authority between directors, taking their characteristics and preferences as given. Interestingly, even if all directors are completely symmetric in their preferences and level of expertise, it is often optimal to allocate full control over the decision to only one director. Such a division of authority leads to the most efficient use of directors' private information: directors without decision power have strong incentives to convey their knowledge to the director in charge, who then aggregates all the available information into the final decision. Thus, the paper offers an additional, information-based, explanation for the widespread use of board committees. When directors are asymmetric, it is optimal to allocate authority to directors who have the lowest concern for conformity because such directors distort their decisions the least. This provides a rationale for the requirement that the audit, compensation, and nominating committees, responsible for delicate and often controversial issues, are composed entirely of independent directors.

The paper proceeds as follows. The remainder of this section reviews the related literature. Section 2 presents the benchmark case where there is no pre-decision communication between directors. Section 3 provides the analysis of the model with communication. I analyze separately the case where directors have preferences for conformity, the case where they have biases regarding the decision, and the general case where both frictions are present. Section 4 considers two extensions of the basic model. Section 5 provides implications of the model for board governance policies. Finally, Section 6 offers some concluding remarks and directions for future research. Appendix A discusses several explanations for directors' desire for conformity. All proofs are given in Appendix B.

Related literature

The paper is related to several strands of literature. First, it contributes to the theoretical literature on corporate boards. Many papers in this literature focus on the interaction between the board and the manager and therefore, consider the board of directors as a single decision-making agent.[8] In contrast, the current paper considers the board as a collective decision-making body and focuses on the interaction between board members in the presence of preferences for conformity and conflicts of interest.[9] In this respect, my paper is most closely related to Warther (1998) and Chemmanur and Fedaseyeu (2010), who analyze individual directors' voting decisions whether to fire the manager in the presence of costs of dissent: they assume that if the manager is eventually not fired, directors who voted against him incur a cost. Costs of dissent are similar to the asymmetric case of preferences for conformity examined in the extension of the current paper, because they make directors reluctant to deviate from the majority when they oppose the manager. In the context of a two-member board, Warther (1998) shows that costs of dissent make directors reluctant to vote against the manager even if their private information about him is negative.[10] Chemmanur and Fedaseyeu (2010) consider a more general model than Warther (1998), with an arbitrary number of directors, and demonstrate that this coordination problem becomes even more severe as the size of the board increases. They also analyze the effect of public signals on board decision-making and examine which boards are more likely to wait longer before firing the manager. The current paper contributes to this literature by emphasizing the importance of pre-vote communication between directors for alleviating the coordination problem at the voting stage. It also suggests that when communication requires effort, the presence of costs of dissent may give directors stronger incentives to make this effort and communicate more effectively, which may improve the board's decisions.

The importance of communication within the board is also emphasized in Harris and Raviv (2008), who examine communication between informed but biased inside directors and outside directors, when outside directors can acquire decision-relevant expertise at a cost. The focus of their paper is on how delegation of control between insiders and outsiders affects the extent of communication between the two groups and the outsiders' incentives to acquire expertise. In contrast, the focus of this paper is on how a desire for conformity and

[8] See, e.g., Hermalin and Weisbach (1998), Almazan and Suarez (2003), Hermalin (2005), Song and Thakor (2006), Adams and Ferreira (2007), Kumar and Sivaramakrishnan (2008), and Chakraborty and Yilmaz (2010).

[9] Baranchuk and Dybvig (2009) study individual directors' preferences and information, but use a cooperative solution concept instead of modeling directors' decisions explicitly.

[10] More precisely, Warther (1998) considers a board that consists of three members – two outside directors and the CEO. However, given that the CEO always votes against firing himself, the board effectively consists of two directors.

conflicts of interests between directors affect communication between them.[11]

The paper also contributes to the political economy literature that examines voting in committees when information is dispersed among committee members. It is most closely related to several papers in this literature - Coughlan (2000), Doraszelski, Gerardi and Squintani (2001), and Austen-Smith and Feddersen (2005), who allow for pre-vote communication between committee members. The main difference of my paper is its emphasis on the endogenous quality of communication. In particular, the above papers assume that communication is costless and thus its level is exogenous, while in the current paper, directors have to incur a cost in order to communicate their information to others. The presence of communication costs plays a crucial role in my analysis and results. In addition, my paper is different from this literature in its modeling of the decision-making stage. Because the analysis of voting under asymmetric information is rather involved and gives rise to a variety of equilibria when a pre-vote communication stage is added, the above papers focus on the case of either two- or three-member committees. The current paper abstracts from voting and models the decision-making process in a reduced form way, which allows a closed-form solution for any number of directors and makes the model easy to generalize.

My paper is also related to the literature on costly communication in teams.[12] This literature acknowledges that communicating information from one team member to another is costly and examines the benefits of specialization and the effectiveness of various communication schemes. In contrast to the current paper, where a director can choose between more and less efficient ways of communicating his information, most papers in this literature treat the quality of communication as exogenous. In this respect, my paper is close to Dewatripont and Tirole (2005), who also allow agents to incur costly effort to make communication between them more effective. Differently from my paper, Dewatripont and Tirole (2005) assume that the quality of communication depends on the combined effort of both the sender and the receiver and focus on the "moral hazard in teams" problem in communication.

Another related strand of research examines the incentives of agents to conform to other agents. Scharfstein and Stein (1990) show that the tendency to ignore one's own private information and follow other agents' actions arises endogenously when agents have reputational concerns and wish to appear competent. Ottaviani and Sorensen (2001) and Visser and

[11] Communication between insiders and outsiders is also considered in Raheja (2005). She studies a model where informed insiders, who compete with each other to become the CEO's successor, may reveal their private information to uninformed outsiders.

[12] See, e.g., Radner (1993), Bolton and Dewatripont (1994), Dessein and Santos (2006), and Dewatripont and Tirole (2005).

Swank (2007) examine the effect of similar reputational concerns in the context of committee decision-making. Zwiebel (1995) shows how career concerns can make managers reluctant to deviate from the herd in their choice between traditional and innovative projects, resulting in corporate conservatism. In contrast, the current paper treats directors' preferences for conformity at the decision-making stage as exogenous and studies how these preferences affect pre-decision communication between directors.[13] Morris and Shin (2002) and Angeletos and Pavan (2007) also take preferences for conformity as given and compare the effects of public vs. private information on the agents' actions and social welfare. In these papers, the separation of information between public and private is exogenous, while in the current paper it arises endogenously through communication decisions of directors.

2 Benchmark case: no communication

The analysis begins with the benchmark case in which there is no pre-decision communication between directors. I show that in this case, both directors' preferences for conformity and their biases regarding the decision reduce the effectiveness of board decision-making. In the next section, I introduce pre-decision communication and show that the effect of these frictions in preferences can be very different when communication requires costly effort.

2.1 Model setup

Information structure

The board, which consists of N directors, is contemplating a decision. Which decision is best depends on the unknown state of the world θ, equal to the sum of independent signals x_i:

$$\theta = \sum_{i=1}^{\bar{N}} x_i. \tag{1}$$

Signal x_i is distributed according to a density function $f_i(\cdot)$ on the interval $[-k_i, k_i]$, where $k_i \in (0, +\infty]$, which is symmetric around zero. For example, suppose the board is contemplating an acquisition and has to decide which price to pay, and θ represents the value from the acquisition. This value is generally determined by several factors, such as the prospects

[13] The focus on pre-decision communication also relates the paper to the literature on social learning, which studies how agents change their actions based on information received from others (see, e.g., Ellison and Fudenberg (1993) and DeMarzo, Vayanos and Zwiebel (2003)).

of the industry, the potential for cost reductions, or the value of the target's technologies. These factors are represented by signals x_i.

I assume that director i perfectly observes signal x_i but has no information about other signals. This corresponds to a situation where board members have different areas of expertise and thus, have information that is relevant to different aspects of the decision. Other things equal, a director who receives a more dispersed signal can be interpreted as being more informed about the decision. In practice, of course, information of individual directors is likely to be correlated. However, because the goal of this paper is to examine how efficiently board decisions aggregate information of individual directors, I focus on the extreme case of independent private signals, because in such a setting efficient information aggregation is particularly important. As will be discussed in Section 3, the main results of the paper would continue to hold qualitatively if the private information of directors was correlated.

For simplicity, I also assume that the number of signals is equal to the number of directors ($\bar{N} = N$), so that the state of the world is perfectly known to the board as a whole. All results are exactly the same if some information about the state is not known to the board.[14] The information structure is common knowledge.

Decision-making rule

The outcome of the decision-making stage is action a, taken by the board (e.g., how much to pay for the target). If the state of the world is θ, then the value of the firm is equal to

$$V(a, \theta) = V_0 - (a - \theta)^2 . \tag{2}$$

Hence, the first-best action is equal to θ, and V_0 is the first-best value of the firm.

The process through which the board comes to the final decision is modeled in a reduced-form way. Specifically, I assume that each director takes an action a_i. Individual directors' actions are aggregated into the final action a, taken by the board, according to an exogenous, potentially probabilistic, function: $a = \tilde{g}(a_1, ..., a_N)$. As will become clear later, the exact form of this function does not qualitatively matter for the results. The only necessary condition is that this function does not permit efficient aggregation of directors' private signals into the first-best decision $\theta = \sum_{i=1}^{N} x_i$ when pre-decision communication between directors is not allowed, even in the absence of any frictions in directors' preferences.[15] This

[14] I show that the only difference of the case $\bar{N} > N$ from the case $\bar{N} = N$ is that the equilibrium expected firm value is reduced by a constant equal to the variance of the unknown term $\sum_{i=N+1}^{\bar{N}} x_i$.

[15] Formally, if $(a_1^*, ...a_N^*)$ is the equilibrium at the decision-making stage when the only information available

condition is needed to ensure that communication between directors is necessary for effective decision-making. Majority voting or a non-binding straw poll are the simplest examples of such inefficient information aggregation mechanisms because directors are restricted to binary actions, which cannot fully convey their information. If all but one director have moderately positive signals about the proposal under consideration, the proposal will be approved by a majority of votes, even though the remaining director may have an extremely negative signal, which makes the proposal detrimental.

For tractability, from now on I focus on a linear specification of the function $\tilde{g}(a_1, ..., a_N)$. Such a specification ensures that regardless of the distribution of signals, there is a unique linear equilibrium at the decision-making stage. It also leads to closed form equilibrium strategies at the discussion stage and a closed form expression for the equilibrium firm value. Specifically, I assume that if directors' actions are $a_1, ..., a_N$, then the final action taken by the board coincides with a_i with probability $\frac{1}{N}$. The interpretation of this function is that each director has influence $\frac{1}{N}$ over the final decision: if K out of N directors support alternative A and the remaining $N-K$ directors support alternative B, then alternative A is approved with probability $\frac{K}{N}$, the fraction of directors supporting it. Combined with (2), this specification implies that firm value is the following function of individual directors' actions:

$$V(a_1, ..., a_N, \theta) = V_0 - \frac{1}{N} \sum_{i=1}^{N} (a_i - \theta)^2 . \tag{3}$$

In Section 4.1, I generalize the model to the case where directors have different influence over the decision, so that the action of director i is approved with probability p_i. In unreported analysis, I consider the most general linear specification of the function $\tilde{g}(a_1, ..., a_N)$.[16]

The decision-making process is modeled in a reduced-form way because in practice, there is no clearly defined procedure through which directors settle on the final decision, and different boards are likely to have different dynamics. In a formal sense, board decisions should be made by a majority vote. Even though, as discussed above, modeling the decision-making process as a vote would lead to qualitatively similar results, there is anecdotal evidence that

to director i is his private signal x_i and all directors maximize firm value (2), then $a^* = \tilde{g}(a_1^*, ...a_N^*)$ does not coincide with θ with probability 1.

[16]The general linear specification is characterized by m linear combinations $(\gamma_1^{(j)}, ...\gamma_N^{(j)})$, $j = 1, ..., m$, and probabilities q_j, $\sum_{j=1}^{m} q_j = 1$, attached to these combinations, such that $\tilde{g}(a_1, ...a_N)$ is equal to $\sum_{i=1}^{N} \gamma_i^{(j)} a_i$ with probability q_j. Unless this function is deterministic (i.e., $q_{j^*} = 1$ for some j^*) and assigns a strictly positive weight to all directors ($\gamma_i^{(j^*)} > 0$ for all i), it satisfies the requirement that the decision-making stage alone does not permit first-best decisions by the board.

majority voting might not be the best description of the actual decision-making process in boards.[17]

Preferences

To capture directors' preferences for conformity and their biases regarding the decision, I assume that the preferences of director i are given by

$$U_i(a, a_1, ..., a_N, \theta) = -(a - (b_i + \theta))^2 - r_i(a_i - \bar{a}_{-i})^2, \tag{4}$$

where $\bar{a}_{-i} = \frac{1}{N-1}\sum_{j \neq i} a_j$ is the average action taken by other directors. These preferences are common knowledge. Combined with the above specification for $\tilde{g}(a_1, ..., a_N)$, this implies that the director's utility is given by the following function of $(a_1, ..., a_N)$:

$$U_i(a_1, ..., a_N, \theta) = -\frac{1}{N}\sum_{j=1}^{N}(a_j - (b_i + \theta))^2 - r_i(a_i - \bar{a}_{-i})^2. \tag{5}$$

Each director's utility (4) has two components. The first component reflects the director's bias b_i regarding the decision: if the bias is zero, this component coincides with the corresponding term for firm value in (2). If the bias b_i is different from zero, the director's preferred action is $\theta + b_i$, rather than θ, which is the optimal action from shareholders' perspective. I interpret a positive bias, $b_i > 0$, as a bias in favor of the proposal under consideration. This specification is similar to that of Crawford and Sobel (1982).

The second component reflects the director's desire for conformity: he suffers a loss if his action deviates from the average action of other board members. This specification of preferences for conformity is similar to the specifications of Morris and Shin (2002) and Myatt and Dewan (2008). The assumption that the director is reluctant to deviate from the *average* is only needed to ensure a linear equilibrium.[18] In Appendix A, I discuss several

[17]Boards are usually reluctant to make the decision immediately when the vote is substantially split: additional meetings or discussions are likely to follow until the majority of directors, at least nominally, vote for the decision. See Schwenk (1989) and O'Connor (2003) for related evidence. Perhaps a better description of the decision-making stage is that of a non-binding straw poll, followed by deliberations. During the straw poll, each director announces his preferred decision (a_i), e.g., whether he approves or disapproves the merger. After the initial straw poll, some deliberations take place, as a result of which the board settles on a decision and votes unanimously in favor of it. The decision supported by the majority is more likely to be approved, which is captured by weights $\frac{1}{N}$ attached to each director.

[18]In the extension of the model in Section 4.1, I assume that directors are reluctant to deviate from the weighted average of the actions of other directors, with a higher weight on the actions of more influential directors. Any other function $c(a_1, ..., a_{i-1}, a_{i+1}, ...a_N)$, which positively depends on the actions of other

rational explanations behind directors' desire for conformity.

2.2 Analysis of the benchmark case

In this section, I find the equilibrium of the decision-making stage for the benchmark case. Let $a_i(I_i)$ be the action of director i given his information set I_i at the decision-making stage. Using (5), this action is determined by the first-order condition:

$$a_i(I_i) = \frac{1}{1+Nr_i}(E[\theta|I_i] + b_i) + (1 - \frac{1}{1+Nr_i})E[\bar{a}_{-i}|I_i]. \tag{6}$$

If there are no frictions in the director's preferences ($r_i = 0$ and $b_i = 0$), the director chooses the action $a_i(I_i) = E[\theta|I_i]$, which is his best estimate of the state of the world. The presence of frictions introduces distortions into the director's behavior. Preferences for conformity give him incentives to mimic the actions of other directors. In particular, when $r_i > 0$ and $b_i = 0$, the director tries to balance his desire to maximize firm value and his desire to conform to the average action of other directors. The weight $\frac{1}{1+Nr_i}$, attached to his best estimate of the state, decreases as the director's preferences for conformity become stronger (r_i increases). The presence of a bias b_i introduces an additional distortion, inducing the director to pursue the action $b_i + E[\theta|I_i]$ instead of $E[\theta|I_i]$.

Because there is no pre-decision communication in the benchmark case, the only information available to the director is his own private signal x_i. Hence, $E[x_j|I_i] = 0$ for $j \neq i$ due to the independence assumption, and $E[\theta|I_i] = x_i$.

I now show that there is a unique linear equilibrium of the game. Suppose that a linear equilibrium exists, i.e., action a_i is linear in the director's signal: $a_i = \gamma_i x_i + g_i$. Plugging in the conjectured strategies of other directors in the first-order condition (6), we get

$$a_i = \frac{1}{1+Nr_i}x_i + \frac{1}{1+Nr_i}b_i + \left(1 - \frac{1}{1+Nr_i}\right)\bar{g}_{-i}. \tag{7}$$

Thus, the best response strategy of director i is indeed linear in his signal. Comparing the coefficients, we see that γ_i is equal to $\frac{1}{1+Nr_i}$, and g_i is defined by a system of linear equations

$$g_i = \frac{1}{1+Nr_i}b_i + (1 - \frac{1}{1+Nr_i})\bar{g}_{-i}. \tag{8}$$

Lemma A.2 in the Appendix shows that this system has a unique solution. In particular,

directors (e.g., the median, or another quantile) would lead to qualitatively similar results as $\bar{a}_{-i}$.

when $r_i = 0$, then $g_i = b_i$.

We conclude that the game has a unique linear equilibrium

$$a_i^* = g_i + \frac{1}{1 + Nr_i} x_i. \tag{9}$$

If there are no frictions in directors' preferences ($r_i = b_i = 0$), then $a_i^* = x_i$. Note, however, that the first-best firm value V_0 is not achieved in this equilibrium because the first-best action $\theta = \sum x_i$ is not taken. This inefficiency captures the importance of pre-decision communication between directors and the inability of the decision-making stage alone to fully aggregate directors' information. In particular, specification (3) implies that the first-best is achieved only when the action of each individual director is equal to the first-best action $\theta = \sum x_i$, a necessary requirement for which is that all directors have shared their information with each other.

The presence of frictions introduces additional inefficiencies in the decision-making process.

1. Only preferences for conformity

If directors have preferences for conformity but no biases: $r_i > 0, b_i = 0$, then $a_i^* = \frac{1}{1+Nr_i} x_i$. Thus, a director's desire for conformity induces him to put less than optimal weight on his private information. In the extreme case, when r_i is infinitely large, the director does not care about the correct decision being made and only wishes to deviate as little as possible from the actions of other directors. Because the actions of other directors are determined by their signals and the expected value of these signals is zero, the director takes the action $a_i^* = 0$. Hence, in this case, his private information never affects the board's decision.

2. Only biases regarding the decision

If directors have biases but no preferences for conformity: $b_i \neq 0, r_i = 0$, then $a_i^* = b_i + x_i$. The presence of a bias induces the director to push the board's decision in the direction of his bias, moving it farther away from the optimal decision from shareholders' perspective.

This analysis shows that in the absence of pre-decision communication, both directors' preferences for conformity and their biases regarding the decision impede effective decision-making by the board because directors' actions are not fully based on their private information. The next section examines the effect of these frictions when prior to the decision-making stage, directors can communicate with each other at a cost.

3 Communication prior to decision-making

This section considers a general model, in which there is a discussion stage prior to the decision-making stage. I start by describing the setup of the discussion stage and then present the analysis of the model. I consider separately the setting where directors only have preferences for conformity, the setting where directors only have biases regarding the decision, and then the general setting where both frictions are present.

3.1 Discussion stage

The endogenous quality of board discussion, which is determined by the efforts directors put into trying to communicate their knowledge, is the main driving force behind the results of the paper. Only when directors need to incur costly effort to communicate their information more effectively, will their biases or preferences for conformity play a positive role in board decision-making. To illustrate these results in the simplest possible manner, I abstract from many realistic aspects of pre-decision communication between directors and model the discussion stage in a stylized way. In the model, directors communicate simultaneously and cannot choose who to disclose their information to. In practice, of course, directors communicate sequentially and decide whether to speak up after hearing the views of their fellow directors. In addition, if discussion occurs outside the board meeting, directors are able to disclose their information selectively to certain board members.[19] While these issues are important aspects of the actual communication process and provide directions for future research, they are beyond the scope of this paper.

Specifically, I assume that at the discussion stage, each director decides whether to incur a cost c_i in order to communicate his signal x_i to other directors. These communication decisions are made simultaneously. If the director pays the cost, other directors learn x_i with certainty. The costs c_i can be interpreted as the time and effort needed to prepare supporting evidence and arguments and present them convincingly to fellow directors.[20] Given the interpretation of this stage as that of effective and persuasive communication, I

[19] While the opportunity for selective disclosure would not change the analysis when directors have the same preferences regarding the decision (if $r_i > 0$ and $b_i = 0$, directors always want to report their information to all board members), biased directors might have incentive to disclose their information selectively, e.g., only to board members who have similar preferences.

[20] For example, these costs are likely to be lower for firms in capital-intensive industries and a large proportion of tangible assets, where hard information is relatively more important and supporting evidence may be easier to collect. See. e.g., Alam et al. (2010) and Cornelli, Kominek, and Ljungqvist (2010) for evidence on the use of hard vs. soft information in board decisions. Alternatively, the costs could correspond to the ability of directors to communicate outside of board meetings, e.g., through social networks.

assume that information is verifiable. That is, the director may choose to remain silent and not communicate his information, but if he communicates, he has to do it truthfully. The assumption that information is verifiable is not crucial for most results.[21]

Another simplifying assumption of the model is that disclosure decisions are binary: at the discussion stage, directors can either communicate their information fully at a cost, or not communicate any information at all. Note, however, that although I refer to the second stage of the model as the decision-making stage, this stage could also be interpreted as a stage of costless and less effective communication, as opposed to the first stage of costly and effective communication. Indeed, during the decision-making stage some of the director's information is conveyed through his action a_i (e.g., if the director participates in a non-binding straw poll or votes for the decision). However, by the assumption made about the function $\tilde{g}(a_1, ..., a_N)$, directors' private signals are not fully aggregated in the final board's decision, meaning that this form of communication is cruder.

Note also that concern for conformity does not arise at the discussion stage. If preferences for conformity are due to managerial retaliation and the discussion stage is interpreted as pre-meeting communication between directors, whereas the second stage corresponds to decision-making during the meeting, then concerns about managerial retaliation are likely to be weaker at the discussion stage because the manager is not present. Alternatively, preferences for conformity can be due to reputational considerations, e.g., because a director may appear incompetent or opportunistic if he expresses a controversial opinion without supporting it with convincing arguments (which is the form of communication that the decision-making stage corresponds to). Such reputational considerations do not arise when a director communicates more effectively and persuasively, e.g., by backing up his opinion with objective and verifiable evidence (which is the form of communication that the discussion stage corresponds to).[22] In Appendix A, I describe several mechanisms that could underlie directors' concerns for conformity and explain in more detail why these concerns are less likely to appear at the discussion stage.

[21] When directors do not have conflicts of interest with respect to the decision and only have preferences for conformity ($b_i = 0, r_i > 0$), they always have incentives to report their information truthfully. When directors have biases regarding the decision, they would have incentives to manipulate their reports if information was non-verifiable. Nevertheless, as will be discussed in Section 3.3, the positive effect that a director's bias might have on his incentives to incur the costs of disclosure and present *some* information to his fellow directors, is likely to exist even when information can be manipulated.

[22] In addition, if the discussion stage is interpreted as pre-meeting communication between directors, reputational considerations at this stage are likely to be weaker even if information is not verifiable, because directors can engage in one-on-one informal discussions with each other instead of publicly announcing their views in the boardroom.

3.2 Preferences for conformity

The analysis begins with the case where the only friction comes from directors' preferences for conformity. In other words, $r_i \geq 0$ but $b_i = 0$ in (4).

The model is solved by backwards induction. Suppose that during the discussion stage signals $x_1, ..., x_M$ were communicated, $M \in [0, N]$. Also suppose that given the equilibrium strategies at the discussion stage, the expected value of director i's signal conditional on it not being communicated is $y_i, i \geq M+1$.

Equilibrium at the decision-making stage

We search for linear equilibria at the decision-making stage. In a linear equilibrium, the action of each director is some linear function of the signals $x_1, ..., x_M$ that were communicated and his private signal x_i. Similarly to the benchmark case, using the first-order condition (6), it can be shown that there is a unique linear equilibrium at the decision-making stage. The following proposition characterizes this equilibrium.

Proposition 1: *Suppose that at the discussion stage signals $x_1, ..., x_M$ were communicated, and that y_i is the expected value of signal x_i conditional on no communication. Then there is a linear equilibrium at the decision-making stage characterized by the following strategies:*

1. *If director i communicated his signal, $i \in \{1, ..., M\}$, his action is given by*

$$a_i^* = \sum_{j=1}^{M} x_j + \sum_{j=M+1}^{N} y_j. \tag{10}$$

2. *If director i did not communicate his signal, $i \in \{M+1, ..., N\}$, his action is given by*

$$a_i^* = \sum_{j=1}^{M} x_j + \sum_{j=M+1, j \neq i}^{N} y_j + \frac{1}{1+Nr_i} x_i + \left(1 - \frac{1}{1+Nr_i}\right) y_i. \tag{11}$$

The intuition behind the equilibrium strategies (10) and (11) is the following. All directors who communicated their signals take the same action, equal to their estimate of the state of the world conditional on their information. Thus, a desire for conformity does not distort these directors' actions. Intuitively, if a director managed to credibly convey his information to other directors, he understands that other directors will efficiently incorporate this information into their own decisions. Therefore, the director is not concerned that he will be the only one taking a controversial position, even if his information is sufficiently extreme. In contrast, the action of a director who did not communicate his signal is affected by his desire for conformity. Similarly to the benchmark case, such a director puts less than optimal weight on his private signal, trying to make his action less extreme. This is captured by the last two terms in the expression (11) above: instead of using his private signal x_i with weight 1, as would be optimal from shareholders' perspective, the director uses a linear combination of his private signal and the expectation of his private signal by other directors, y_i.

Equilibrium strategies at the discussion stage

At the discussion stage, each director takes into account the equilibrium strategies at the decision-making stage and compares the expected payoff from paying the cost c_i to communicate his signal to other directors to the expected payoff from not communicating. The following proposition characterizes the equilibrium strategies at the discussion stage.

Proposition 2: *There exists an equilibrium in which director i communicates his signal x_i if and only if $|x_i| > d_i$, where*

$$d_i = \sqrt{\frac{c_i}{1 - \frac{1}{N}\frac{1}{1+Nr_i}}}. \tag{12}$$

In the Appendix, I prove that if the distribution of signals is single-peaked at zero (e.g., normal), then the equilibrium defined by Proposition 2 is the unique equilibrium.[23]

The intuition behind Proposition 2 is the following. The director does not have incentives to pay the cost to communicate his signal if the signal is sufficiently close to its expected value ($|x_i| < d_i$), because such disclosure is not very valuable for the board's decisions. In contrast, if the signal is sufficiently extreme, the director wants all other board members to take it into account in their actions and hence, pays the cost of communication. This argument is valid regardless of whether the director has preferences for conformity.

Preferences for conformity give the director additional incentives to communicate his signal

[23] I also show that for a general distribution that is symmetric around zero, the number of equilibria is bounded above by the number of points of symmetry (the symmetry requirement is due to the symmetric nature of the problem). For a uniform distribution, which is symmetric around any point, there is a continuum of equilibria characterized by $y_i \in [-k_i+d_i, k_i-d_i]$. The intuition behind the multiplicity of equilibria is similar to the intuition why there exist multiple self-fulfilling equilibria in rational expectations models. The director does not have incentives to communicate his signal if it is close to other directors' expectations conditional on no communication (rather than their unconditional expectation, which is zero). Therefore, if other directors believe that conditional on no communication, the expected value of x_i is y_i, these expectations become self-fulfilling. Importantly, regardless of the equilibrium chosen, the result that concern for conformity improves communication is valid for any distribution.

convincingly: the threshold d_i is strictly decreasing in r_i. Intuitively, a director with a strong desire for conformity anticipates that if he does not credibly convey his information to other directors, he will tend to under-rely on this information at the decision-making stage (see Proposition 1). As a result, his information will not only fail to influence other directors' actions, but will also have a much smaller effect on his own action and therefore, on the ultimate board's decision. Because the director cares about the correct decision being made, he tries to avoid this inefficiency by communicating his signal, even at a cost.

The result that stronger preferences for conformity give directors stronger incentives to communicate their private information to others does not rely on the assumption that directors' private signals are independent. As long as the correlation between directors' signals is not perfect, preferences for conformity induce each director to put less than optimal weight on his signal at the decision-making stage unless it is communicated to other directors. This, in turn, motivates the director to incur the cost and convey his information to others. The main difference between the models with independent and correlated private signals is that correlation in directors' signals would give rise to a free-rider problem: each director would have weaker incentives to spend the cost and communicate his information to others, hoping that some other director with similar information would do this.

Firm value

Using the equilibrium communication and decision strategies, we can calculate the expected value of the firm, which is given by the following lemma.

Lemma 1: *Expected firm value is equal to*

$$E(V) = V_0 - \sum_{i=1}^{N} \left[1 - \frac{1}{N} + \frac{1}{N} \left(\frac{N r_i}{1 + N r_i} \right)^2 \right] \left[\int_{-d_i}^{d_i} x^2 f_i(x)\, dx \right], \tag{13}$$

where d_i is given by (12).

Each director's contribution to firm value is the product of two terms. The first term, $1 - \frac{1}{N} + \frac{1}{N}(\frac{Nr_i}{1+Nr_i})^2$, is increasing in r_i, and the second term, $\int_{-d_i}^{d_i} x^2 f_i(x)\, dx$, is decreasing in r_i because d_i is decreasing in r_i. These two terms capture the two opposing effects of the director's concern for conformity on firm value. The negative effect at the decision-making stage is reflected in the first term: higher r_i leads to a lower weight that the director puts on his private signal if it has not been communicated. The positive effect is reflected in the second term: a stronger desire for conformity encourages more communication (decreases d_i). Because signals that are communicated are used efficiently by all directors, this allows the board to make more informed decisions. The next result demonstrates that in the current setting, the positive effect always dominates for sufficiently small r_i, which implies that the optimal value of r_i is strictly greater than zero.

Proposition 3: *If $0 < c_i < k_i^2(1 - \frac{1}{N})$, then firm value is maximized at $(r_1^*, ..., r_N^*)$, where r_i^* is strictly positive.*

The assumption $c_i < k_i^2(1 - \frac{1}{N})$ is needed to ensure that the costs of communication are not prohibitively high. If this assumption is not satisfied, then the director does not communicate any information when $r_i = 0$.

Proposition 3 emphasizes that when communication requires costly effort, directors' desire for conformity can play a positive role by encouraging more efficient communication between directors. Thus, some degree of preferences for conformity may improve board decisions in situations where detailed communication between directors is crucial for effective decision-making, e.g., when the board is making an executive, rather than a supervisory, decision. This can be achieved by changing the rules that govern the decision-making process, e.g., voting rules. Section 5 provides a detailed discussion of these implications.

3.3 Biases

In this section, I consider the effect that directors' biases regarding the decision have on board decision-making. The main result of this analysis is that a stronger bias may give a director stronger incentives to incur the costs in order to credibly communicate his information to others. This effect improves the quality of pre-decision discussion between directors and may dominate the negative effect of the bias at the decision-making stage.

To illustrate the intuition behind this result more clearly, I start with the case when directors' biases regarding the decision are the only friction. In other words, $r_i = 0$ but $b_i \neq 0$ in (4). The next section analyzes the combined effect of directors' biases and preferences for conformity and shows how these frictions interact. The proofs of all results in the Appendix are provided for the general model that includes both frictions.

Lemma A.1 in the Appendix shows that the equilibrium at the decision-making stage is linear and is similar to the equilibrium in the benchmark case. The action of each director is skewed by his bias b_i. Specifically,

$$a_i^* = b_i + E\left[\theta | I_i\right], \tag{14}$$

where I_i is the information set of director i after the discussion stage, which consists of signals $x_1, ..., x_M$ that were communicated, the expectations $y_{M+1}, ..., y_N$ for the signals that were not communicated, and his own signal x_i.

In the presence of biases, the communication strategy of directors is no longer symmetric around zero. Directors reveal their signals strategically, trying to support their preferred alternative with the information they disclose. Because the model is less tractable in the presence of biases, I assume for the rest of the section that the distribution of directors' signals is uniform, and discuss the results for a general distribution at the end of the section. The following lemma summarizes the communication strategy of directors.

Lemma 2: *Suppose that the distribution of signals is uniform: $x_i \sim U\left[-k_i, k_i\right]$. Then the equilibrium strategies at the discussion stage are the following:*

(i) if $b_i > \bar{b}_{-i}$, director i reveals his signal if and only if $x_i > -k_i + 2\delta_i^+$,

(ii) if $b_i < \bar{b}_{-i}$, director i reveals his signal if and only if $x_i < k_i + 2\delta_i^-$,

where $\delta_i^- < 0 < \delta_i^+$ are the roots of the quadratic equation

$$\delta^2 + 2\delta\left(b_i - \bar{b}_{-i}\right) - \frac{c_i}{1 - \frac{1}{N}} = 0. \tag{15}$$

The condition $b_i > \bar{b}_{-i}$ implies that director i is on average more biased towards the proposal under consideration than other directors. Thus, the lemma demonstrates that if a director is biased towards the proposal relative to the rest of the board, he reveals information that is favorable about the proposal but conceals unfavorable information.[24]

Note also that if k_i is sufficiently small relative to c_i, then $-k_i + 2\delta_i^+ > k_i$ and $k_i + 2\delta_i^- < -k_i$, i.e., the director does not communicate any information in equilibrium. Intuitively, this is because by communicating a signal that is sufficiently close to its expectation, the director does not contribute much to the value of the firm and hence, does not have incentives to spend the cost. In what follows, I assume that k_i is sufficiently large, so that at least some information is communicated by each director. In that case, Proposition 4 below

[24] If $b_i = \bar{b}_{-i}$, then similar to the model without biases, the game has multiple equilibria when the distribution of signals is uniform. Importantly, as shown in the Appendix, firm value is the same in all equilibria.

demonstrates that the more biased is the director relative to other board members, the more information he communicates in equilibrium.

Proposition 4: *Suppose that director i is biased towards the proposal relative to other directors: $b_i > \bar{b}_{-i}$. Then the director reveals more information as his bias increases further. Similarly, if the director is relatively biased against the proposal, $b_i < \bar{b}_{-i}$, then he reveals more information as his bias decreases further.*

Proposition 4 emphasizes the positive effect that a director's bias might have on the amount of information he reveals in equilibrium. The intuition behind this result is the following. Suppose, for example, that a director has a bias towards the proposal under discussion relative to the rest of the board. Then, other directors expect him to present evidence in favor of the proposal whenever he has it. Therefore, if the director is silent, other directors infer that his signal must be bad. The more biased is the director towards the proposal, the more he wants other board members to have a positive opinion about it. Hence, the more harmful for him is their negative inference when he does not reveal his information. At the margin, this leads the director to disclose more. Formally, suppose that a director with a positive bias reveals his signal x_i when it satisfies $x_i > t_i$, so that for $x_i = t_i$ he is indifferent between the inference t_i if he communicates the signal at a cost, and the more negative inference $E[x_i|x_i < t_i]$ if he does not communicate. If his bias increases further, the director is no longer indifferent when $x_i = t_i$: the inference $E[x_i|x_i < t_i]$ becomes relatively more harmful for him. Hence, he strictly prefers to reveal his signal, which moves t_i to the left. This intuition is close to the intuition behind the "unraveling result" in the voluntary disclosure literature (see, e.g., Grossman (1981) and Milgrom (1981)).

The result of Proposition 4 contrasts the result of the cheap talk literature that conflicts of interest between the sender and the receiver are detrimental for communication (see, e.g., Crawford and Sobel (1982)). There are two distinctions between the current setup and the setup of cheap talk models: one is the assumption that communication is costly, and the other is the assumption that information is verifiable. While the assumption of costly communication is crucial for the result that a stronger bias can induce more information revelation, the assumption of verifiable information is not. Suppose first that information is verifiable but communication is costless. In that case, there is always full communication in equilibrium and thus, the probability of communication does not change with the bias. This is clearly seen from Lemma 2 and is essentially the "unraveling result" of the voluntary disclosure literature. Second, suppose that information is non-verifiable but communication is costly. In that case, two opposite effects are in place, and it is not clear which of them dominates. On the one hand, as follows from the cheap talk literature, an increase in the director's bias reduces the amount of information he is able to convey because the director has stronger incentives to manipulate his report. On the other hand, if communication entails a cost, then as long as some information is conveyed conditional on communicating, a more biased director may have stronger incentives to incur the cost and try to convey *some* information. This is because the negative inference of other directors conditional on the cost not being paid is more harmful for a more biased director. The net effect of a stronger bias on the amount of information conveyed in equilibrium is not clear: the director communicates more often but is able to convey less information when he communicates.

By encouraging more effective communication between directors, a stronger bias of a director may have a positive effect on board decisions. This positive effect may counteract the negative effect of the bias on the director's behavior at the decision-making stage. According to Lemma A.4 in the Appendix, expected firm value is given by

$$E(V) = V_0 - \frac{1}{N}\sum_{i=1}^{N} b_i^2 - \frac{N-1}{N}\sum_{i=1}^{N}\int_{t_i}^{T_i} (x_i - y_i)^2 f_i(x_i)\, dx_i, \tag{16}$$

where $[t_i, T_i]$ is the equilibrium non-communication region of director i and y_i is the expected value of the signal over this region, $y_i = E[x_i | x_i \in [t_i, T_i]]$. Expression (16) demonstrates the twofold effect of a director's bias on the value of the firm. First, the bias induces the director to skew his actions at the decision-making stage, which pushes the board's decision away from the first-best decision. This negative effect on firm value is represented by the term $-\frac{1}{N}b_i^2$. Second, the bias also affects the director's incentives to communicate his information at the discussion stage. This effect is reflected by the last term in (16): $\int_{t_i}^{T_i}(x_i - y_i)^2 f_i(x_i)\, dx_i$ measures the variance of the director's signal over the non-communication interval $[t_i, T_i]$. A stronger bias may give the director stronger incentives to communicate his information, shrinking the non-communication interval $[t_i, T_i]$ and reducing the variance of the signal over this interval.

The next proposition demonstrates that the positive effect of a stronger bias at the discussion stage may dominate its negative effect at the decision-making stage. In particular, in the current setting, even if $N-1$ directors are unbiased, shareholders are strictly better off if the remaining director is biased than if he is unbiased.

Proposition 5: *Suppose that $b_2 = ... = b_N = 0$. Then firm value is maximized at $b_1 = \pm b$, where b is strictly positive.*

The standard rationale for having biased inside directors on the board is that such directors are more likely to have valuable information about the company. Proposition 5 provides an additional motivation for appointing some biased directors, even when all directors are equally informed. When directors need to incur costly effort to communicate their information more effectively, more biased directors might have stronger incentives to make this effort. This increases the amount of information available to the board as a whole and might improve the quality of board decisions.

While most results of this section have been derived for the case of a uniform distribution of signals, the intuition behind them is also valid for a more general distribution.[25]

3.4 Preferences for conformity and biases

This section generalizes the models in the previous two sections and studies the joint effect of directors' preferences for conformity and biases on board decisions.

Let $a_i^* (b_1, ..., b_N)$ be the equilibrium action of director i at the decision-making stage. Lemma A.1 in the Appendix shows that

$$a_i^* (b_1, ..., b_N) = g_i + a_i^* (0, ..., 0), \tag{17}$$

where $a_i^* (0, ..., 0)$ are the equilibrium strategies in the absence of biases, given by (10) and (11), and the constants g_i solve the system of linear equations (8). Lemma A.2 in the Appendix shows that this system has a unique solution given by

$$g_i = \sum_{j=1}^{N} \lambda_{ij} b_j, \tag{18}$$

[25] Consider a general distribution that is symmetric and single-peaked around zero. In the Appendix (see Lemma A.3), I show that the communication strategy of a director is characterized by two thresholds t_i, T_i, such that signal x_i is disclosed if and only if $x_i \notin [t_i, T_i]$. Although the communication strategy is not necessarily boundary for a more general distribution, positively biased directors are again more likely to disclose positive rather than negative signals. In particular, if $b_i > \bar{b}_{-i}$, the non-communication interval $[t_i, T_i]$ is shifted to the left of zero, so that $\Pr(x_i \textit{ is disclosed} \mid x_i > 0) > \Pr(x_i \textit{ is disclosed} \mid x_i < 0)$. As the director's bias increases, both t_i and T_i decrease and hence, an increase in the bias does not necessarily increase the probability of disclosure. However, if the costs of communication are sufficiently small and the support is finite, the communication strategy is again boundary, i.e., $t_i = -k_i$. In that case, an increase in the director's bias strictly improves communication, as in the case of a uniform distribution.

where $\lambda_{ii}, \lambda_{ij} \in (0,1)$ if $r_i > 0$, and $\lambda_{ii} = 1, \lambda_{ij} = 0$ if $r_i = 0$. In the case when all directors have the same preferences for conformity: $r_i = r$ for $i = 1, ..., N$, the solution is given by

$$g_i = \omega b_i + (1-\omega)\,\bar{b}_{-i}, \text{ where } \omega = \frac{N-1+Nr}{N-1+N^2 r}. \tag{19}$$

Directors' biases regarding the decision introduce distortions g_i in their actions. According to (18), g_i is a weighted average linear combination of the director's own bias and the biases of other directors with non-negative coefficients. Note that g_i is always strictly increasing in b_i: the more biased is a director, the greater he distorts his actions in the direction of his preferences. If a director does not care about conforming to other directors ($r_i = 0$), g_i is exactly equal to b_i and the weight on other directors' biases is zero. Whenever preferences for conformity are present, g_i is also strictly increasing in other directors' biases. Intuitively, if other directors are known to be favorably inclined towards the proposal, a director who wants to conform to others is reluctant to oppose the proposal.

This result emphasizes an additional positive effect of directors' desire for conformity when their preferences are sufficiently diverse: a desire for conformity may constrain directors' opportunistic behavior. Absent concern for conformity, directors with diverse preferences pull the decision in opposite directions, and the resulting outcome, which is the preferred outcome of the strongest group, turns out to be far from the optimal outcome from shareholders' perspective. A desire for conformity induces directors to be more cautious in pursuing their individual interests, making the ultimate decision taken by the board less extreme. For example, in the case of two directors, $r_1 = r_2 = r$ and $b_1 = -b_2$, distortions (g_1, g_2) in directors' actions are most pronounced for $r = 0$ and converge to zero as r increases. Of course, a desire for conformity may also exacerbate opportunistic behavior when preferences are not diverse. In particular, pressure for conformity may induce independent directors, who would otherwise make unbiased decisions, to favor the policies preferred by their opportunistic colleagues: when $r_i > 0$, g_i can be different from zero even though $b_i = 0$.

Extending Lemma 2 to this more general case, I show that director i's disclosure decisions are skewed towards positive signals if and only if $b_i > \bar{g}_{-i}$. This condition is a generalization of the condition $b_i > \bar{b}_{-i}$ for the case $r_i = 0$ and intuitively means that director i is on average more biased against the proposal than other directors. For example, when $r_i = r$ for all i, this condition is exactly equivalent to the condition $b_i > \bar{b}_{-i}$. For general r_i, the biases of other directors are weighted with coefficients that depend on $r_1, ..., r_N$.

There are now two distinct reasons why a director who is more biased towards the proposal under-discloses information that is unfavorable about the proposal. The first reason is the same as before: the director has more incentives to reveal information that favors his preferred alternative. The second reason comes from the director's desire to conform to other directors. Suppose that a director who is biased towards the proposal gets a negative private signal about it. This negative information will induce him to act against the proposal despite his bias. However, if the director discloses this information to other directors, they will become even more opposed to the proposal than before, and the disparity in his and other directors' actions will remain. In contrast, if the director conceals his unfavorable signal, then the actions of other directors will be more favorable and therefore closer to his own action, satisfying his preferences for conformity. Thus, both effects act in the same direction, giving the director incentives to communicate positive and conceal negative information.

The extension of Proposition 4 to the general case demonstrates that if a director is biased towards the proposal relative to other directors, $b_i > \bar{g}_{-i}$, then he reveals more information in equilibrium as he becomes even more positively biased, i.e., as b_i increases. I also show that in the current setting, the positive effect of a stronger bias at the discussion stage dominates its negative effect at the decision-making stage when the bias is sufficiently small. In particular, regardless of directors' preferences for conformity, the firm strictly benefits from including a biased director on the board when the remaining $N-1$ directors are unbiased. In other words, the result of Proposition 5 holds for the general case as well.

When $N-1$ directors have their own biases, there might be an additional benefit of including a strictly biased remaining director because his presence might constrain the opportunistic behavior of other directors. Suppose, for example, that $N-1$ directors are biased in favor of the proposal: $b_i > 0$ for $i \geq 2$. In this case, there are two reasons why a director with a bias against the proposal ($b_1 < 0$) may be more beneficial to the company than a completely independent director ($b_1 = 0$). First, as before, a stronger divergence in preferences between this director and the rest of the board induces more information revelation both by himself and by other directors. When concern for conformity is present, there is an additional positive effect: the appointment of a director who has different preferences from the rest of the board induces other directors to pursue their interests less aggressively. As a result, the behavior of all directors becomes less extreme, and the resulting board decision is closer to the optimal one from shareholders' perspective. For general preferences $(b_2, ..., b_N)$, the optimal type of the remaining director, b_1^*, is determined by the interplay between these two effects.

4 Extensions

This section considers two extensions of the basic model. The first extension analyzes a setting where some directors have more influence on the board than others. The second extension considers a setting where preferences for conformity are asymmetric, in the sense that directors are more reluctant to deviate from other board members when they oppose the CEO than when they support him.

4.1 Different influence of directors

In practice, different directors are likely to have different influence over the final decision. Stronger influence may be due to a higher status or a greater level of expertise in a strategically relevant area. Alternatively, influence can come from the position held on the board, e.g., if a director is the board chairman or a member of one of the key board committees.

In this section, I consider the extension of the model that allows some directors to have more influence than others and study the following questions. How does the director's influence on the board affect his incentives to communicate his information effectively? What is the optimal allocation of responsibilities given directors' preferences? What kind of directors should be appointed to leading positions?

To allow different directors to have different influence over the decision, I assume that the action a_i of director i is chosen by the board with probability p_i, where $\sum_{i=1}^{N} p_i = 1, p_i \geq 0$. Combined with (2), this means that firm value is given by

$$V(a, \theta) = V_0 - \sum_{i=1}^{N} p_i (a_i - \theta)^2 . \tag{20}$$

The higher p_i, the greater is the influence of director i over the final decision.

It is likely that when some directors are more influential than others, other directors are particularly reluctant to disagree with them. To capture this effect, I assume that the utility of director i is given by

$$U_i(a, \theta) = -\sum_{k=1}^{N} p_k (a_k - \theta)^2 - r_i \left(a_i - \sum_{k=1, k \neq i}^{N} \tilde{p}_k^i a_k \right)^2 , \tag{21}$$

where $\tilde{p}_k^i = \frac{p_k}{1-p_i}$ reflects the relative weight of director k among the remaining directors, $\sum_{k=1,k\neq i}^{N} \tilde{p}_k^i = 1$. In other words, the director wants to conform to the weighted average of the actions of other directors, where the weights reflect their influence on the board.[26] The basic model is a special case of this extension when $p_i = \frac{1}{N}$ for all i. To focus attention on the effect of directors' heterogenous influence, I assume in this section that directors do not have biases regarding the decision.

Lemma A.1 in the Appendix demonstrates that the equilibrium action of director i at the decision-making stage is given by

$$a_i^* = \sum_{j=1}^{M} x_j + \sum_{j=M+1}^{N} y_j \tag{22}$$

for directors who communicated their signals, and by

$$a_i^* = \sum_{j=1}^{M} x_j + \sum_{j=M+1, j\neq i}^{N} y_j + \frac{p_i}{p_i + r_i} x_i + \left(1 - \frac{p_i}{p_i + r_i}\right) y_i \tag{23}$$

for directors who did not communicate their signals.

The equilibrium has similar properties to the equilibrium of the basic model. The signals that have been communicated at the first stage enter the actions of all directors efficiently (with weight 1). In contrast, if a director did not communicate his signal, his desire for conformity induces him to put less than optimal weight on his signal. However, the greater is the influence of the director, the smaller is the negative effect of preferences for conformity on his actions: the weight $\frac{p_i}{p_i+r_i}$ on his private signal increases with p_i. This is because such a director understands that by under-relying on his private signal, he has a particularly strong negative impact on firm value due to his stronger influence.

At the discussion stage (see Lemma A.3 in the Appendix), director i chooses to pay the cost to communicate his signal if it satisfies

$$|x_i - y_i| > d_i = \sqrt{\frac{c_i}{1 - \frac{p_i^2}{p_i + r_i}}}. \tag{24}$$

The length of the non-communication region, $2d_i$, increases with p_i, which reflects the fact that the stronger is the director's influence p_i, the less effort he makes to communicate his information convincingly. For example, when $p_i = 1$ (director i has full control over the board's decisions) and $r_i = 0$ (the director does not care about the opinion of other board

[26] In unreported analysis, I also consider the specification where preferences for conformity are the same as in the basic model, i.e., $\tilde{p}_k^i = \frac{1}{N-1}$ in (21) regardless of p_i. The results are similar under both specifications.

members about his actions), the threshold d_i is infinite, implying that the director never makes an effort to share his information with other directors. In contrast, directors with no decision power ($p_i = 0$) have the strongest incentives to communicate their information. Intuitively, a director who has little influence over the decision realizes that his information can only be useful for the firm if he is able to credibly convey it to more influential directors. He therefore makes a stronger effort to convince other directors of his information.

Directors' influence over the decision can be changed exogenously by electing them to the leading board positions, such as the chairman or lead director, or by appointing them to key board committees. The fact that less influential directors have stronger incentives to communicate more effectively suggests that allocating greater control to some directors may be beneficial. To study this question formally, I ask which combination $(p_1, ..., p_N)$ maximizes firm value. In other words, I solve the following problem:

$$\max_{(p_1,\ldots,p_N)} E_{(p_1,\ldots,p_N)}(V) \qquad (25)$$

$$s.t. \sum_{i=1}^{N} p_i = 1, p_i \geq 0,$$

where $E_{(p_1,\ldots,p_N)}(V)$ is expected firm value for a given vector $(p_1, ..., p_N)$.

To focus attention on the role of allocation of control, I assume that directors are symmetric in all respects except for p_i. In other words, $r_i = r, c_i = c$, and $f_i = f$ for all i. For simplicity, I consider the uniform distribution of signals: $x_i \sim U[-k, k]$. The following proposition demonstrates that even when directors are completely symmetric, allocation of control to only one director may be beneficial.

Proposition 6: *Suppose that all directors's signals have the same, uniform, distribution, $c_i = c$, and $r_i = 0$ for all i. Then firm value is maximized when control is allocated to one director, i.e., when $p_i = 1$ for some i.*

Numerical analysis demonstrates that the result of Proposition 6 also holds when directors have preferences for conformity, i.e., when $r_i = r$ for some $r \geq 0$. The intuition behind this result is the following. On the one hand, when a director has no control over the decision, his private information does not affect the outcome. However, when a director can communicate his information to others at a cost, there is a counteracting positive effect: the less control the director has, the stronger are his incentives to communicate his information to directors who have control. This is beneficial because information is used more efficiently when it is known to all decision-makers than to one director alone. Thus, when a director's influence is reduced, information that he does not communicate is used less efficiently, but more information is communicated and used efficiently. Because the director's communication strategy involves communication of the most valuable signals ($|x_i - y_i| > d_i$), the trade-off is between more efficient use of more valuable information and less efficient use of less valuable information, suggesting that the positive effect may dominate.

Proposition 6 demonstrates that allocating authority over the decision to one director may result in the most efficient aggregation of directors' information in the final outcome. It therefore provides an information-based rationale for the use of board committees, when a subset of directors is given authority over certain decisions.

Another interesting question is which directors should be appointed to board committees. Of course, preference should be given to directors with strong expertise in the area of the committee's responsibility. To abstract from the effect of expertise, I focus on the case when all directors have the same level of expertise, i.e., when directors' signals have the same distribution: $f_i = f$ for all i. I assume for simplicity that the committee consists of one board member, who has full power over the decision ($p_i = 1$), and ask which director should be appointed to that position, taking directors' types as given.

Proposition 7: *Suppose that control over the decision is allocated to one director:* $p_i = 1, p_j = 0$ *for* $j \neq i$*. If directors are symmetric in all respects except for their preferences for conformity (*$f_i = f$ *and* $c_i = c$*) and the density function of the signals is non-increasing on* $[0, +\infty)$*, then firm value is maximized when control is given to the director with the lowest concern for conformity:* $i \in \arg\min_j\{r_j\}$*.*

Intuitively, a director who strongly cares about the opinion of other directors of his actions (r_i is high) is reluctant to make decisions that are not considered appropriate by the rest of the board, even though he has full power to make these decisions. Thus, control should be given to the director who has the lowest concern for conformity among all directors. Section 5 discusses the implications of this result for the composition of key board committees.

4.2 Preferences for conformity: asymmetric case

In the basic model, directors are equally reluctant to be more or less supportive of the proposal under consideration relative to the rest of the board. Formally, the loss coming from their preferences for conformity depends on the distance between their action and the average action of other directors, but not on its direction. In practice, a director may be more averse to deviating from other board members when he criticizes the CEO than when he supports the CEO. According to anecdotal evidence, directors who oppose the CEO and do not get support from other directors are likely to face managerial retaliation and have to leave their position. While these concerns are relevant for outside directors as well, they are especially important for inside directors, whose career advancement depends a lot on their loyalty to the CEO (see Section 5 for a case study describing such a situation).

In this section, I consider a modification of the basic model to an asymmetric case, where the loss from disagreeing with other directors depends on the direction of disagreement, and show that the intuition of the basic model continues to hold. To capture directors' reluctance to be less supportive of the CEO than the rest of the board, I assume that director i's utility is now given by

$$U_i(a,\theta) = \begin{cases} -\frac{1}{N}\sum_{j=1}^{N}(a_j-\theta)^2 - r_i(\bar{a}_{-i}-a_i) & , \textit{if } \bar{a}_{-i} > a_i \\ -\frac{1}{N}\sum_{j=1}^{N}(a_j-\theta)^2 & , \textit{if } \bar{a}_{-i} < a_i. \end{cases} \tag{26}$$

If a higher action is interpreted as stronger support for the manager, the above specification implies that the director suffers a loss if he is less supportive of the manager than the average director ($a_i < \bar{a}_{-i}$). In contrast, the director does not suffer any loss if he is more supportive of the manager than other directors. To ensure a closed form equilibrium at the decision-making stage, I model the loss from disagreement as a linear term, rather than a quadratic term as in the basic model. Other assumptions of the basic model remain unchanged.

In the context of managerial retaliation against dissenting directors, a natural interpretation of the discussion and the decision-making stages of the game is that of pre-meeting communication in the absence of the manager and the actual board meeting, respectively. By engaging in pre-meeting private discussions with other directors, a director can convey his reservations about the manager without facing a high risk of managerial retaliation. However, such communication imposes some fixed costs on the director because it requires a substantial time investment. In contrast, although presenting his views during the board meeting is not costly per se, it involves the risk of managerial retaliation if the director is more critical than the rest of the board.

The asymmetric specification of preferences for conformity makes the model less tractable. I therefore focus on the case of two symmetric directors and a uniform distribution of signals. Suppose that the equilibrium strategies at the discussion stage take a threshold form:

signal x_i is communicated if and only if it lies outside the interval $[t, T]$ for some t, T. The following lemma describes the equilibrium at the decision-making stage, taking the threshold equilibrium strategies at the discussion stage as given.

Lemma 3: *Suppose that the board consists of two symmetric directors: $c_i = c$ and $r_i = r$ for $i = 1, 2$, and their signals have the same, uniform, distribution. Suppose also that at the discussion stage, signal x_i is communicated if and only if it lies outside the interval $[t, T]$. Then the following strategies constitute an equilibrium at the decision-making stage.*

1. *If both signals were communicated at the discussion stage, then $a_1^* = a_2^* = x_1 + x_2$.*
2. *If no signal was communicated, then the action of director i is*

$$a_i^* = \left(x_i + \frac{t+T}{2}\right) + \frac{r}{T-t}(T - x_i). \tag{27}$$

3. *If signal x_1 was communicated and signal x_2 was not, then $a_1^* = x_1 + A$, and*

$$a_2^* = \begin{cases} x_1 + x_2 & , \text{ if } x_2 > A \\ x_1 + A & , \text{ if } x_2 \in [A - r, A] \\ x_1 + x_2 + r & , \text{ if } x_2 < A - r, \end{cases} \tag{28}$$

where $A = \frac{\frac{t+T}{2} + \frac{rT}{T-t}}{1 + \frac{r}{T-t}} \in (t, T)$.

The intuition behind the equilibrium strategies is the following. First, if both signals were communicated at the discussion stage, directors coordinate on the first-best action $x_1 + x_2$. Preferences for conformity do not distort directors' behavior because they share the same information and can jointly oppose the manager if needed. Second, if no information was communicated, the fear of being less supportive of the manager than the other director induces directors to bias their actions upward. Instead of taking the action $x_i + \frac{t+T}{2}$, equal to the expected value of θ given his information, director i takes a strictly higher action: the term $\frac{r}{T-t}(T - x_i)$ is positive for $r > 0$. Finally, if only one signal was communicated at the discussion stage, then the director who communicated his signal biases his action upwards relative to the action $x_i + \frac{t+T}{2}$ (it can be shown that $A > \frac{T+t}{2}$ for $r > 0$) because he is not sure what the other director will do. The behavior of the director who kept his signal private depends on his information. If his signal is sufficiently high ($x_i > A$), he knows with certainty that he will be more supportive of the manager than the other director even if he takes the first-best action $x_1 + x_2$. However, whenever his signal is lower than A, this director biases his action upwards relative to the first-best action.

Because each director is punished for taking a more negative action than the other director, a director with a negative signal has particularly strong incentives to communicate his information in pre-decision discussion. By sharing his negative information, he makes sure that the other director becomes more pessimistic and hence, lowers his risk of being less supportive of the manager. A director with a positive signal does not have such strong incentives to communicate his information: even if he turns out to be more supportive of the manager than the other director, he does not incur any loss. The following lemma confirms this intuition.

Lemma 4: *If a threshold equilibrium at the discussion stage exists, it takes the following form: director i communicates his signal if and only if* $x_i \leq t$ for some $t \in [-k, k]$.

I demonstrate numerically that a threshold equilibrium exists and is unique and that the threshold t is increasing with r. Hence, the result that stronger preferences for conformity encourage more communication between directors continues to hold in this asymmetric setting as well. I also show numerically that firm value can increase with r, i.e., that similar to the basic model, the positive effect of preferences for conformity at the discussion stage can dominate their negative effect at the decision-making stage.

Intuitively, when a director has a strong fear of managerial retaliation (r is high), he understands that he will not criticize the manager during the board meeting unless he is sure that other directors share his concerns. Thus, to be able to oppose the manager during the meeting, directors with negative information need to convince other directors of their position prior to the meeting. By sharing their negative information with each other beforehand, directors can be more effective in jointly opposing the manager than if each of them acted individually on the basis of his private information. Thus, a stronger ability of the manager to retaliate against dissenting directors does not necessarily result in more managerial entrenchment. Section 5 discusses implications of this result for the design of board meetings, including the use of the open ballot voting system and the role of executive sessions of outside directors.

As an application of this analysis, consider the setting where the decision under consideration is whether the incumbent manager should be fired, and signals x_i correspond to directors' information about the manager's quality. Suppose first that there is no pre-decision communication between directors. In this case, Lemma 3 implies that managerial turnover is likely to be less efficient in companies where directors are particularly reluctant to oppose the manager (high r) because directors use their private information less effectively. According to (27), when no information is communicated beforehand, directors' private signals enter their decisions with weight $(1 - \frac{r}{T-t})$, which decreases in r. As a result, even if each director's individual signal about the manager is sufficiently negative, directors are reluctant to act on this information, fearing that their negative opinion is not shared by others. This coordination problem is similar to the coordination problem examined in Chemmanur and Fedaseyeu (2010). In their paper, a negative public signal can serve as a coordination mechanism and help mitigate the coordination problem among directors. In contrast, in the current paper, the role of a coordination mechanism is played by pre-decision communication between directors. By sharing his negative information about the manager with others, a director makes other directors more pessimistic. Hence, he is less afraid to be the only one to oppose the manager, which makes him more eager to act on his negative information (according to Lemma 3, the weight on x_i is equal to 1 if x_i was revealed).

5 Implications for board policies

This section discusses implications of the paper for board structure and the rules governing the board's decision-making process.

Open vs. secret ballot voting

As the results of Section 3.2 demonstrate, some degree of preferences for conformity in corporate boards may be beneficial because it promotes better communication between board members. Conformity preferences may thus be more useful in situations where effective communication and information sharing between directors is crucial, for example, when the board is making an executive, rather than a supervisory decision. This is because executive decisions, such as nominating a new CEO or setting the appropriate acquisition price, require careful and detailed consideration of all available information.

This argument has implications for the design of board meetings, because directors' desire for conformity may be changed exogenously by changing the rules governing the decision-making process. In particular, an important factor that can affect directors' preferences for conformity is whether voting takes place by open vs. secret ballot. Consider two possible decision-making rules. Under the first rule, board discussion is followed by a simultaneous open ballot vote, while under the second rule, it is followed by a simultaneous secret ballot vote. In both cases the vote determines the final decision, e.g., by a majority rule. Directors' desire for conformity is likely to be weaker under the secret ballot system because the vote of the dissenting director is not identified. A director who disagrees with the majority can suppress his concerns during the discussion in order to appear supportive, but then secretly vote against the proposal. In the context of the model, this suggests that directors' preferences for conformity are weaker if the decision-making stage corresponds to a simultaneous open ballot vote than if it corresponds to a simultaneous secret ballot vote.

As the analysis of the paper shows, stronger preferences for conformity encourage more effective pre-vote communication between directors, but less honest voting decisions. Hence, the open ballot voting system might be more effective in situations where the board needs to make an executive decision and choose the best possible alternative. In contrast, when the board is making a supervisory decision, e.g., when it needs to approve or reject a given proposal put forward by the CEO, it might be more beneficial to encourage honest and unbiased voting by directors. This can be achieved by conducting the vote by secret ballot, allowing directors to vote against the CEO's proposal without fear of retaliation.

While corporate boards mostly use the open ballot voting system, there is substantial variation in the use of open and secret ballot voting across different types of committees. Both voting procedures are used by university tenure committees and by non-profit boards.[27] Government agencies, such as the SEC and the Federal Reserve, not only conduct voting by open ballot, but also disclose their meeting minutes to the general public. When the minutes are observable to the public, committee members' reputational considerations are likely to make them particularly reluctant to disagree with the majority or with the chairman, unless they are able to communicate their view persuasively and convincingly. Therefore, as the paper suggests, the public nature of the meetings of government agencies might encourage more effective and detailed communication between its members, improving the quality of deliberations.[28] Of course, imposing a similar requirement on corporate board meetings may not be the best alternative given the proprietary nature of board discussions.

[27] See "Board elections: Secret ballot or show of hands" by Terrie Temkin, *Philanthropy Journal*, September 30, 2010.

[28] See also Levy (2007), who examines the costs and benefits of revealing committee members' votes to the public in the absence of pre-vote communication.

Executive sessions of directors

Although the current open ballot system gives directors strong incentives to vote in favor of the CEO's interests, it does not necessarily lead to more CEO entrenchment. As the analysis suggests, directors' reluctance to openly vote against the CEO during the board meeting motivates them to share their views with each other in discussions prior to the meeting. As a result, unfavorable information about the CEO or his proposal is more likely to be effectively communicated and shared prior to the meeting, resulting in a unified opposition, when this is indicated.

Of course, directors have incentives to engage in pre-meeting communication only if such communication is not very costly. One regulatory measure that may have substantially reduced the costs of communication between outside directors is the requirement for mandatory and regularly scheduled executive sessions, imposed on public companies by the NYSE and Nasdaq in 2003. Prior to this requirement, engaging in discussions behind the CEO's back could be rather costly. As the analysis of Section 4.2 demonstrates, a director would initiate such discussions only if he had serious concerns about the CEO's actions or performance. Thus, if information about such pre-meeting discussions was ever leaked to the CEO, the director who initiated them was likely to be punished. The requirement to make meetings of non-management directors mandatory and regular eliminated the negative signaling role of such meetings and thus, might have considerably reduced the costs of communication.

The NYSE and Nasdaq listing standards require "regularly scheduled" executive sessions without specifying their minimum frequency. There is considerable variation in the frequency of executive sessions across firms. Some firms set a minimum annual number of executive sessions, which ranges from one to four, while others include an executive session as part of every board meeting.[29] In the context of the paper, an increase in the frequency of executive sessions can be interpreted as a decrease in directors' costs of communication. If executive sessions are relatively frequent, a director may wait till the next executive session to voice his concerns instead of initiating a secret meeting behind the manager's back, which may be costly. However, a higher frequency of executive sessions also involves a cost because it requires substantial time commitment from outside directors. Directors, whose time is in high demand, need to be compensated for the extra time they spend. If we assume that firms optimally choose the frequency of executive sessions and this choice is not affected by the CEO, then we expect executive sessions to be more frequent in firms where reducing

[29] See Shearman & Sterling LLP, "2007 Trends in Corporate Governance of the Largest U.S. Public Companies - General Governance Practices," p.25.

outside directors' costs of communicating with each other is particularly important.

The paper identifies several factors that could explain the observed variation in the frequency of executive sessions, assuming that it is optimally chosen by firms. First, reducing the costs of communicating outside board meetings is more important when there is strong pressure for conformity during the meetings. This is more likely in companies where the CEO is very influential, where the outside directors are not powerful individuals themselves, or where the outside directors are more dependent on the CEO, e.g., due to the presence of a board interlock or directors' business relations with the company. Second, holding regular executive sessions of outside directors is more important when these directors do not have other opportunities to communicate without the CEO present. Thus, executive sessions are likely to be more frequent in companies where the social ties between their outside directors (e.g., through sports and social club membership) are sufficiently weak.

Note also that inside directors have the highest costs of managerial retaliation: they risk not only their position on the board, but also their position as a top manager of the company. A notable example is the departure of Joseph Graziano, the CFO of Apple, who did not receive board support in his criticism of CEO Michael Spindler's strategy during the board's October 3, 1995 meeting and had to resign.[30] Given that inside directors are among the most informed members of the board, some firms might benefit from imposing a similar requirement for meetings of outside directors and individual inside directors without the CEO present. If such meetings were mandatory and regularly scheduled, the CEO would be unable to determine whether any negative information was transferred during these meetings or not. Thus, insiders' costs of sharing their concerns with outside directors would be lower.

Board committees

Another implication of the paper concerns the role of board committees. Boards of publicly held firms have a number of committees who are granted authority over decisions in certain areas: compensation, audit, corporate governance and nomination, as well as other areas depending on the firm's industry and size. The standard rationale for the use of committees is that given directors' time constraints, committees allow more detailed discussions of certain issues. This explanation is consistent with the main message of the paper that reducing communication costs between directors is always beneficial. Indeed, a committee gives its members an opportunity to present their information to a smaller number of directors, who

[30] See, e.g., "Did Apple Shoot The Messenger?", *Business Week*, October 16, 1995.

also often have the same area of expertise. Both factors are likely to reduce the costs of effective and convincing communication.

The paper also provides an additional, information-based, explanation for why the use of committees may improve board decision-making. According to the results of Section 4.1, it may be optimal to allocate full authority over the decision to a subset of directors because such a division of authority ensures the most efficient aggregation of all directors' information in the final decision. Directors without authority have strong incentives to incur communication costs and convince directors who have authority of their position, because this is their only way to affect the decision. Directors who have authority will then efficiently aggregate their own information and the information they received from other board members. In contrast, when all directors have authority over the decision, they might have weaker incentives to communicate effectively with other directors, hoping to influence the decision with their own vote. This logic suggests that the use of committees may be beneficial even if all directors have the same level of expertise in the area of the decision.

The results of Section 4.1 also suggest that if all directors have the same level of expertise, it is better to allocate more control to those directors who have the lowest concern for conformity. The reason is that these directors care the least about the opinions of the CEO and other board members about their decisions, which allows them to make decisions in an unbiased way. Such considerations may be important for those decisions where managerial retaliation and the pressure for conformity are particularly likely. Hence, these results provide a motivation for the listing requirement that the compensation, nominating, and audit committees, which are responsible for many controversial decisions, are comprised entirely of independent directors. The results are also consistent with the observed practices where directors occupying leading positions on the board, such as the chairman or the lead director, are usually among the most experienced board members. Due to their longer tenure and stronger reputation, such directors are likely to have a lower concern for conformity.

6 Concluding remarks

This paper develops a theoretical model of communication and decision-making in corporate boards. The key element of the model is that directors need to incur personal costs in order to communicate their information more effectively and convince other directors. This has important implications for the effect of directors' preferences and decision-making rules on board performance. I show that directors' preferences for conformity give them stronger incentives to incur the costs of communication and present their information more convincingly. Thus, preferences for conformity encourage more efficient communication between directors and may improve board decisions despite their negative effect on directors' behavior at the decision-making stage. In the context of the board's decision whether to fire the CEO, this result suggests that the CEO's ability to retaliate against dissenting directors does not necessarily result in more entrenchment because it may encourage more active and effective discussions prior to the meeting.

In a similar vein, I show that board decision-making can be improved if some directors have biases regarding the decision, because more biased directors may have stronger incentives to credibly communicate their information to other directors. The paper also studies the effect of directors' differential influence on their willingness to efficiently communicate their information and provides implications for the role of board committees.

While the focus of the paper is on decision-making in corporate boards, it can also be applied to study decision-making in other types of committees, such as university tenure and hiring committees, the Federal Reserve Board, the SEC, and various legislative committees. Interestingly, there is considerable variation in the rules governing the meetings of different types of committees. For example, corporate board meetings are different from the meetings of most government agencies in their observability to outsiders: while the minutes of board meetings are private, discussions and votes of the Federal Reserve and the SEC are regularly disclosed to the public. There is also variation in the way voting is conducted: while corporate boards usually vote by open ballot, other committees use the secret ballot voting system. As discussed in the paper, the open ballot voting system is likely to increase directors' desire for conformity because of reputational considerations or fear of managerial retaliation. The paper therefore suggests that the current, open ballot, voting system may be beneficial in situations where effective communication between directors is crucial for decision-making, e.g., when the board is making executive, rather than supervisory, decisions.

The paper makes the first attempt to understand the dynamics of board decision-making and communication. For this reason, it models communication between directors in a stylized way. This suggests several important directions in which the framework developed in the paper could be extended. First, the model assumes that directors simultaneously decide whether to share their information with others. In practice, such decisions are likely to be made sequentially, and the decision to disclose one's signal is influenced by the information that has already been disclosed. While allowing sequential communication does not change the main results of the paper, it gives rise to several interesting questions. For instance, how does the possibility of sequential communication affect the amount of information that is revealed in equilibrium? What types of directors will be the first to speak up, and what kind of information will be revealed at the beginning? Second, the paper assumes that if a director decides to reveal his information, it is learned by all other board members. When conflicts of interests between directors are present, directors might have incentives to share their information selectively, e.g., only with those directors who have similar preferences, which may give rise to the formation of coalitions. Other relevant issues include the effect of board size on the quality of communication among directors and the optimal length and frequency of board meetings for different types of companies. These and other important questions are left for future research.

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Appendix A: Motivating preferences for conformity

Directors' desire for conformity can arise for a number of reasons. One possibility is that it is caused by behavioral factors such as the presence of certain social norms and pressures.[31] In addition, there are several rational explanations for a desire for conformity, coming from directors' reputational concerns. Directors may care about their internal reputation among fellow directors and the CEO, which influences their position on the board. Besides, directors may care about their external reputation in the labor market. In this section, I present some of these explanations and describe how director's desire for conformity at the decision-making stage could arise endogenously.

1. Reputation for being competent and informed

Directors may have preferences for conformity if their actions can be used to infer their ability and, in particular, the quality of their private information. Suppose that directors receive private signals about the state and the precision of their signals depends on their ability: smarter directors receive more precise signals. Directors' actions are based on their private signals and hence, can reveal some information about directors' ability. Suppose that all directors except one take very similar actions. That means that the signals of all directors except one are very similar to each other, but the signal of the deviating director is sufficiently different from these similar signals. Because smart directors tend to receive correlated signals and less competent directors receive pure noise, this would imply that the deviating director is less likely to be smart. Hence, in order to appear smart, each director has incentives to mimic the behavior of other directors, which gives rise to a desire for conformity and under-reliance on private information.

Suppose that part of the director's private information is verifiable and not subject to errors. In the context of the model, we could assume that each director receives a noisy private signal $\theta + \varepsilon_i$, but part x_i of this signal is precise and verifiable. For example, each director could be an expert in his own area, which would give him precise information x_i, but could have have imprecise information about other areas. The discussion stage of the model can then be interpreted as a stage where directors can convincingly communicate the verifiable part of their information at a cost. Importantly, reputational considerations, and hence concerns for conformity, do not arise at the discussion stage because it refers to communication of precise and verifiable information.[32]

[31] For example, these social pressures were demonstrated in the famous Asch conformity experiments, where people tended to conform and provide an incorrect answer to a simple question if the same incorrect answer had been given by the majority of other group members (see Asch, 1955). See also Janis (1972), who first used the term "groupthink" and defined it as "a mode of thinking ... when the members' strivings for unanimity override their motivation to realistically appraise alternative courses of action."

[32] In an alternative interpretation of the discussion stage as that of pre-meeting communication, reputational concerns are likely to be lower because directors can have one-on-one, informal discussions with their peers.

2. Reputation for having opportunistic motives

Preferences for conformity may also arise because dissent may indicate the presence of opportunistic motives. If a director opposes a proposal that is supported by the rest of the board and does not back up his view with convincing arguments, other directors may question his impartiality. Thus, in order to appear unbiased, a director may choose to conform to the majority and support the proposal even if he does not believe it is beneficial to the company. In the context of the paper, preferences for conformity arising from such reputational concerns are more likely to appear at the decision-making stage than at the discussion stage. This is because the discussion stage is interpreted as the stage where a director communicates effectively and convincingly. When a director is able to convey his reservations about the proposal in a way that convinces others, his opposition is less likely to be interpreted as evidence of his private bias against the proposal and thus, preferences for conformity are less likely to arise. In contrast, the decision-making stage refers to much cruder communication, e.g., when a director simply presents the bottom line of his considerations. Because in this case a director's position is not supported by convincing and verifiable arguments, it can be interpreted as indicating his preferences rather than information.[33]

This argument could also explain managerial retaliation against dissenting directors. By criticizing the manager without supporting the criticism with irrefutable and convincing evidence, the director indicates he may have a bias against the manager. Because this bias is likely to lead the director to oppose the manager's actions in the future, even without objective reasons, it becomes optimal for the manager (and the rest of the board as well) to remove the dissenting director. When preferences for conformity arise due to managerial retaliation, the discussion stage can be interpreted as communication of directors prior to the meeting, when the manager is not present. Therefore, fear of managerial retaliation and hence, concern for conformity, are likely to be much weaker at the discussion stage.

One could think of other explanations for directors' desire for conformity coming from their concerns about internal reputation and their position on the board.[34] Similar considerations could also arise because of concerns about external reputation. If the actions of directors are likely to become known to outsiders, directors may be reluctant to voice dissent because it could hinder their reputation in the labor market. As explained above, dissent could indicate to outsiders that the director is incompetent or biased. In addition, dissent could indicate

[33]Some reputational concerns could still arise at the discussion stage because, as the analysis of this paper demonstrates, positively biased directors are more willing to disclose positive signals. However, because unbiased directors have incentives to disclose extreme signals, it would only be costly to disclose *moderate* signals. Thus, reputational considerations at the discussion stage are likely to be weaker than at the decision-making stage.

[34]For example, a director, for reputational or behavioral reasons, may dislike being wrong. If such a director opposes the majority of other directors, he is likely to become counterproductive in the future, trying to prove that his point of view was correct, instead of thinking about more important issues. Anticipating these misaligned incentives in the future, other directors may find it optimal to fire the dissenting director. This, in turn, makes the director reluctant to disagree with the majority in the first place.

the director's inability to communicate effectively and convince others:

3. Reputation for being able to convince others

Directors may have preferences for conformity if they want to be perceived as being influential and effective at convincing others. The outsiders understand that decision-making is usually preceded by discussions, where directors try to convince others of their position. If at the decision-making stage a director votes differently from other directors, he must have done a poor job in communicating his view and thus, lacks the ability to convince others. Such an inference could harm the director's external reputation.

Formally, suppose that when a director communicates his signal at the discussion stage, other directors are persuaded only with probability $q_i < 1$, which positively depends on the director's ability to convince others. With probability $1 - q_i$, other directors do not update their beliefs. Consider a director with unfavorable information about an a priori beneficial proposal. Even if the director pays the cost trying to convey his view to other directors, he may be reluctant to oppose the proposal at the second stage, realizing that he may not have been successful in persuading other directors. If he opposes the proposal while other directors support it, the outsiders will infer that his information is unfavorable but his ability to convince others is low, which may harm his reputation. Note again that such reputational concerns do not arise at the discussion stage: the fact that he may not convince others reduces the director's incentives to communicate uniformly across signals but does not make communicating extreme signals more costly relative to communicating moderate signals.[35]

In the above models of directors' external reputational concerns, the inference of the outsiders is about a single director. In addition, for similar reasons as above, disagreement between directors could give rise to negative inferences about the quality of the board as a whole. Regardless of the reason, the outsiders's negative inference about the overall board is harmful for each individual director because of the associated negative inference about him in particular. This suggests that not only does the director suffer a loss if his own action deviates from the actions of other directors, but he also suffers a loss if there is some other director who acts differently from the majority. This is consistent with anecdotal evidence that board members usually try to achieve unanimous support for all decisions. Although such preferences are not fully captured by the specification $-r_i \left(a_i - \bar{a}_{-i}\right)^2$ assumed in the model, they are unlikely to change the main results. Intuitively, concern for unanimity will give even stronger incentives for the director to share his private information in pre-decision communication. By doing so, he will ensure that all board members have access to his information and hence, are more likely to be unanimous in their actions.

[35] Formally, let $U^C(x_i)$ and $U^{NC}(x_i)$ be the expected utility of director i if his signal x_i is and is not communicated to other directors, respectively. Suppose that the director has the same prior beliefs about q_i as the outsiders, and let $\bar{q}$ be the expected value of q_i given these prior beliefs. Then the director has incentives to pay the cost c_i to try to communicate his signal if and only if $\bar{q}U^C(x_i) + (1-\bar{q})U^{NC}(x_i) - c_i > U^{NC}(x_i)$ or equivalently, if $U^C(x_i) - \frac{c_i}{\bar{q}} > U^{NC}(x_i)$. Thus, introducing $\bar{q} < 1$ is equivalent to increasing the cost c_i.

Appendix B: Proofs

In order to prove the results of the paper, I first prove several auxiliary results for a more general model. In particular, I consider general preferences $(b_1, ..., b_N)$, $(r_1, ..., r_N)$ and general weights $(p_1, ..., p_N)$, $\sum_{i=1}^{N} p_i = 1$, measuring the influence of individual directors. I derive the equilibrium strategies at the discussion and decision-making stage and expected firm value for this more general model. The proofs of the main results will follow from these auxiliary results.

Auxiliary results: general model

Suppose that firm value is given by

$$V_0 - \sum_{i=1}^{N} p_i \left(a_i - \theta\right)^2, \tag{A1}$$

and the utility of director i is

$$U_i\left(a, \theta\right) = -\sum_{k=1}^{N} p_k \left(a_k - \left(b_i + \theta\right)\right)^2 - r_i \left(a_i - \sum_{k=1, k\neq i}^{N} \tilde{p}_k^i a_k\right)^2, \tag{A2}$$

where $\sum_{i=1}^{N} p_i = 1$ and $\tilde{p}_k^i = \frac{p_k}{1-p_i}$.

Lemma A.1 (equilibrium at the decision-making stage): *Suppose that at the discussion stage signals $x_1, ..., x_M$ were communicated, $M \in \{0, ..., N\}$, and that y_i is the expected value of signal x_i conditional on no communication. Then there is a linear equilibrium at the decision-making stage characterized by the following strategies:*

1. If director i communicated his signal, $i \in \{1, ..., M\}$, his action is given by

$$a_i = g_i + \sum_{j=1}^{M} x_j + \sum_{j=M+1}^{N} y_j. \tag{A3}$$

2. If director i did not communicate his signal, $i \in \{M+1, ..., N\}$, his action is given by

$$a_i = g_i + \sum_{j=1}^{M} x_j + \sum_{j=M+1}^{N} y_j + \frac{p_i}{p_i + r_i}\left(x_i - y_i\right), \tag{A4}$$

where

$$g_i = \frac{p_i}{p_i + r_i} b_i + \left(1 - \frac{p_i}{p_i + r_i}\right) \sum_{k\neq i} \tilde{p}_k^i g_k. \tag{A5}$$

Proof of Lemma A.1: Let us verify that the strategies given by $(A3)$-$(A5)$ constitute an equilibrium. Denote the sum of the signals that were communicated by X, and the expected sum of the signals that were not communicated by Y: $X = \sum_{j=1}^{M} x_j$ and $Y = \sum_{j=M+1}^{N} y_j$. Also denote by I_i the information set of director i after the discussion stage. Taking the first-order condition of $(A2)$, the optimal action of director i is given by

$$a_i = \frac{p_i}{p_i + r_i}\left(b_i + E[\theta|I_i]\right) + \frac{r_i}{p_i + r_i} E\left[\sum_{k \neq i} \tilde{p}_k^i a_k | I_i\right].$$

First, consider the best response of director $i \in \{1, ..., M\}$. For him, $E[\theta|I_i] = X + Y$. Also, given the equilibrium strategies (A3) and (A4) of other players,

$$E\left[\sum_{k \neq i} \tilde{p}_k^i a_k | I_i\right] = \sum_{k \neq i} \tilde{p}_k^i g_k + \left(\sum_{k \neq i} \tilde{p}_k^i\right)(X + Y) + \sum_{k=M+1}^{N} \tilde{p}_k^i \frac{p_k}{p_k + r_k} E\left[(x_k - y_k)|I_i\right].$$

Note that $\sum_{k \neq i} \tilde{p}_k^i = 1$ and that the last term is equal to 0 because by definition, $E[x_k|I_i] = y_k$. Plugging in $E[\theta|I_i]$ and $E\left[\sum_{k \neq i} \tilde{p}_k^i a_k | I_i\right]$ into the first-order condition, we get the conjectured equilibrium strategy $(A3)$.

Next, consider the best response of director $i \in \{M + 1, ..., N\}$. For him, $E[\theta|I_i] = X + Y - y_i + x_i$ and by the same argument as above, $E\left[\sum_{k \neq i} \tilde{p}_k^i a_k | I_i\right] = \sum_{k \neq i} \tilde{p}_k^i g_k + X + Y$. Plugging in these values into the first-order condition, we again get the conjectured strategy $(A4)$.

The coefficients g_i can be found by solving the linear system of equations $(A5)$ for $i = 1, ..., N$. This system coincides with (8) when $p_i = \frac{1}{N}$ for all i.

Note also that it is straightforward to prove that the equilibrium $(A3)$-$(A5)$ is unique. This can be done similar to the analysis of the benchmark case in Section 2 by conjecturing a general linear equilibrium and plugging in the conjectured strategies into the first-order condition above. The proof is omitted for space considerations.

Lemma A.2 (properties of g_i): *Suppose $p_i = \frac{1}{N}$ for all i.*

(i) *There is a unique solution to the system of linear equations $(A5)$, which takes the form $g_i = \lambda_{ii} b_i + \sum_{j \neq i} \lambda_{ij} b_j$, where $\lambda_{ii}, \lambda_{ij} \in (0, 1)$ if $r_i > 0$, and $\lambda_{ii} = 1, \lambda_{ij} = 0$ if $r_i = 0$.*

(ii) *Moreover, if $r_i = r$ for all i, then $g_i = \omega b_i + (1 - \omega)\bar{b}_{-i}$, where $\omega = \frac{N-1+Nr}{N-1+N^2 r}$.*

Proof of Lemma A.2: Because $(A5)$ is a system of linear equations on g_i with constant terms equal to $\frac{1}{1+Nr_i} b_i$, the solution to this system takes the form $g_i = \lambda_{i1} b_1 + ... + \lambda_{iN} b_N$ for some λ_{ij}. To find $(\lambda_{1i}, ..., \lambda_{Ni})$ for a particular i, we differentiate each equation in $(A5)$ with respect to b_i and derive a system of N linear equations on N coefficients $\lambda_{1i}, ..., \lambda_{Ni}$. The properties of λ_{ij} in (i) and the statement of (ii) follow directly from solving this system.

Lemma A.3 (equilibrium strategies at the discussion stage):

(i) *Suppose that conditional on director i not communicating his signal, other directors believe that the expected value of x_i is y_i. Then director i has incentives to communicate*

x_i if and only if it satisfies $H_i(x_i - y_i) > 0$, where

$$H_i(\delta) = \delta^2 + 2\delta\left(b_i - \sum_{k\neq i} \tilde{p}_k^i g_k\right) - \frac{c_i}{1 - \frac{p_i^2}{p_i + r_i}}. \tag{A6}$$

The equation $H_i(\delta) = 0$ has two roots δ_i^- and δ_i^+, which satisfy $\delta_i^- < 0 < \delta_i^+$.

(ii) *In any equilibrium, the strategy of director i at the discussion stage is characterized by an interval $[t_i, T_i]$ such that x_i is communicated if and only if $x_i \notin [t_i, T_i]$. The necessary and sufficient conditions for the four possible types of equilibria are the following:*

(a) Equilibrium with $-k_i < t_i < T_i < k_i$ exists if and only if $t_i - y_i = \delta_i^-$ and $T_i - y_i = \delta_i^+$.
(b) Equilibrium with $-k_i = t_i < T_i < k_i$ exists if and only if $-k_i - y_i > \delta_i^-$ and $T_i - y_i = \delta_i^+$.
(c) Equilibrium with $-k_i < t_i < T_i = k_i$ exists if and only if $t_i - y_i = \delta_i^-$ and $k_i - y_i < \delta_i^+$.
(d) Equilibrium with $-k_i = t_i < T_i = k_i$ exists if and only if $-k_i > \delta_i^-$ and $k_i < \delta_i^+$.

Proof of Lemma A.3:

(i) Suppose that the equilibrium communication and non-communication regions of director i are some sets C_i and NC_i, $C_i \cup NC_i = [-k_i, k_i]$. That is, the director communicates his signal x_i if and only if $x_i \in C_i$. Denote $y_i = E[x_i | x_i \in NC_i]$.

First, we derive the payoff of each director, taking the outcome of the discussion stage as given. Suppose that signals $x_1, ..., x_N$ were realized and that during the discussion stage signals $x_1, ..., x_M$ were communicated, $M \in \{0, ..., N\}$. Denote $Q_i = \frac{p_i}{p_i + r_i}$ and

$$\delta_i = x_i - y_i.$$

From $(A2)$ and the equilibrium actions $(A3)$-$(A4)$ at the decision-making stage, the utility of director i after the discussion stage is

$$\begin{aligned} U_i = &- \textstyle\sum_{j=1}^M p_j \left(g_j - b_i - \sum_{k=M+1}^N \delta_k\right)^2 \\ &- \textstyle\sum_{j=M+1}^N p_j \left(g_j - b_i - (1 - Q_j)\delta_j - \sum_{k=M+1, k\neq j}^N \delta_k\right)^2 \\ &- r_i \left(g_i - \sum_{k\neq i} \tilde{p}_k^i g_k - \sum_{k=M+1}^N \tilde{p}_k^i Q_k \delta_k\right)^2 \end{aligned} \tag{A7}$$

for $i = 1, ..., M$, and

$$\begin{aligned} U_i = &- \textstyle\sum_{j=1}^M p_j \left(g_j - b_i - \sum_{k=M+1}^N \delta_k\right)^2 \\ &- \textstyle\sum_{j=M+1}^N p_j \left(g_j - b_i - (1 - Q_j)\delta_j - \sum_{k=M+1, k\neq j}^N \delta_k\right)^2 \\ &- r_i \left(g_i - \sum_{k\neq i} \tilde{p}_k^i g_k + Q_i \delta_i - \sum_{k=M+1, k\neq i}^N \tilde{p}_k^i Q_k \delta_k\right)^2 \end{aligned} \tag{A8}$$

for $i = M + 1, ..., N$.

Consider the decision of director 1 with signal x_1 whether to pay c_1 to communicate his signal. The director does not know the signals of other directors and thus, conditions his decision on all possible values of $x_2, ..., x_N$. Suppose that among the remaining signals, $M-1$ signals are communicated, where $M \in \{1, ..., N\}$. In particular, suppose that signals $x_{n_2}, ..., x_{n_M}$ lie in their respective regions C_j and are therefore communicated, and signals $x_{n_{M+1}}, ..., x_{n_N}$ lie in their respective regions NC_j and are not communicated. If the director communicates his signal, then by (A7), his payoff upon communication, U_1^C, is equal to

$$
\begin{aligned}
& U_1^C = -\sum_{j=1}^{M} p_{n_j} \left(g_{n_j} - b_1 - \sum_{k=M+1}^{N} \delta_{n_k} \right)^2 \\
& -\sum_{j=M+1}^{N} p_{n_j} \left(g_{n_j} - b_1 - \left(1 - Q_{n_j}\right) \delta_{n_j} - \sum_{k=M+1, k \neq j}^{N} \delta_{n_k} \right)^2 \\
& -r_1 \left(g_1 - \sum_{k \neq 1} \tilde{p}_k^1 g_k - \sum_{k=M+1}^{N} \tilde{p}_{n_k}^1 Q_{n_k} \delta_{n_k} \right)^2 .
\end{aligned}
$$

If the director does not communicate his signal, then by (A8), his payoff upon non-communication, $U_1^{NC}(x_1, ..., x_N)$, is equal to

$$
\begin{aligned}
& U_1^{NC} = -\sum_{j=2}^{M} p_{n_j} \left(g_{n_j} - b_1 - \delta_1 - \sum_{k=M+1}^{N} \delta_{n_k} \right)^2 \\
& -\sum_{j=M+1}^{N} p_{n_j} \left(g_{n_j} - b_1 - \left(1 - Q_{n_j}\right) \delta_{n_j} - \delta_1 - \sum_{k=M+1, k \neq j}^{N} \delta_{n_k} \right)^2 \\
& -p_1 \left(g_1 - b_1 - (1 - Q_1) \delta_1 - \sum_{k=M+1}^{N} \delta_{n_k} \right)^2 \\
& -r_1 \left(g_1 - \sum_{k \neq 1} \tilde{p}_k^1 g_k + Q_1 \delta_1 - \sum_{k=M+1, k \neq i}^{N} \tilde{p}_{n_k}^1 Q_{n_k} \delta_{n_k} \right)^2 .
\end{aligned}
$$

The director averages these payoffs over all possible values of $x_2, ..., x_N$ and chooses to communicate his signal if and only if

$$
\int U_1^C f_2(x_2) ... f_N(x_N)\, dx_2 ... dx_N > c_1 + \int U_1^{NC} f_2(x_2) ... f_N(x_N)\, dx_2 ... dx_N. \tag{A9}
$$

If we open the brackets in U_1^C and U_1^{NC}, it is easy to see that the expressions inside the integrals are some linear combinations of quadratic terms δ_i^2, interaction terms $\delta_i \delta_j$, linear terms δ_i, and a constant. Note also that the signal of director $k, k \neq 1$ enters U_1^C and U_1^{NC} with a non-zero coefficient only if $x_k \in NC_k$, i.e., for $k \in \{n_{M+1}, ..., n_N\}$. Also, because $\delta_i = x_i - E[x_i | x_i \in NC_i]$, then

$$
\int_{NC_i} \delta_i f_i(x_i)\, dx_i = 0.
$$

It follows that all linear terms for $\delta_i, i \geq 2$ and all interaction terms $\delta_i \delta_j, i \geq 2$ on both sides of $(A9)$ integrate to zero. Hence, only quadratic terms δ_i^2, $i \in \{1, n_{M+1}, ..., n_N\}$, the linear term δ_1, and the constant remain. Collecting the coefficients for quadratic terms, we note that the coefficients for terms $\delta_{n_i}^2, i = M+1, ..., N$ in both U_1^C and U_1^{NC} are the same. Besides, the integral over $\delta_{n_i}^2$ is taken over the same set NC_{n_i} on both sides of (A9). Hence, the integrals over terms $\delta_{n_i}^2, i = M+1, ..., N$ on both sides of $(A9)$ cancel out. Finally, δ_1^2 and δ_1 do not enter the expression for U_1^C and only enter U_1^{NC}. The coefficient for δ_1^2 in the expression for U_1^{NC} is equal to $-A$, where

$$A = (1-p_1) + p_1 (1-Q_1)^2 + r_1 Q_1^2 = 1 - \frac{p_1^2}{p_1+r_1} > 0,$$

and the coefficient for δ_1 is equal to $2B$, where

$$\begin{aligned} B &= \textstyle\sum_{k\neq 1} p_k (g_k - b_1) + p_1 (1-Q_1)(g_1 - b_1) - r_1 Q_1 \left(g_1 - \sum_{k\neq 1} \tilde{p}_k^1 g_k \right) \\ &= (1 - \tfrac{p_1^2}{p_1+r_1}) \left(\textstyle\sum_{k\neq 1} \tilde{p}_k^1 g_k - b_1 \right). \end{aligned}$$

Hence, $(A9)$ is equivalent to

$$A\delta_1^2 - 2B\delta_1 - c_1 > 0. \tag{A10}$$

Because $A > 0$, $(A10)$ is equivalent to $H_1(x_1 - y_1) > 0$, where $H_1(\cdot)$ is given by $(A6)$ in the statement of the lemma. Note also that the corresponding quadratic equation, $H_1(\delta) = 0$, always has two different roots $\delta_1^- < \delta_1^+$, given by $\frac{B\pm\sqrt{B^2+Ac_1}}{A}$, and $\delta_1^- < 0 < \delta_1^+$.

(ii) Because $\delta_1 = x_1 - y_1$, $(A10)$ implies that the non-communication region is always some interval $[t_1, T_1]$. If one of the boundaries (t_1 or T_1) is interior, i.e., lies inside $(-k_1, k_1)$, then the director should be indifferent between communicating and not communicating his signal at this point. This implies that $(A10)$ should be satisfied as an equality and hence, $t_1 - y_1$ or $T_1 - y_1$ should coincide with δ_1^- or δ_1^+, respectively. If the right boundary T_1 coincides with k_1, then $(A10)$ should be violated at k_1, implying that $k_1 - y_1$ should be smaller than δ_1^+ (being positive, it is always greater than $\delta_1^- < 0$). Similarly, if the left boundary t_1 coincides with $-k_1$, then $(A10)$ should be violated at $-k_1$, implying that $-k_1 - y_1$ should be greater than δ_1^- (being negative, it is always smaller than $\delta_1^+ > 0$).

Lemma A.4 (firm value): *Suppose that at the discussion stage director i communicates his signal if and only if $x_i \notin [t_i, T_i]$, and let $y_i = E[x_i | x_i \in [t_i, T_i]]$. Then expected firm value is given by*

$$E(V) = V_0 - \sum_{i=1}^{N} p_i g_i^2 - \sum_{i=1}^{N} \left[1 - p_i + p_i \left(\frac{r_i}{p_i + r_i} \right)^2 \right] \int_{t_i}^{T_i} (x_i - y_i)^2 f_i(x_i)\, dx_i,$$

where g_i solves $(A5)$.

Proof of Lemma A.4: Denote $\delta_i = x_i - y_i$ and $Q_i = \frac{p_i}{p_i + r_i}$. For any given realization of $x_1, ..., x_N$, suppose that signals $x_{n_1}, ..., x_{n_M}$ are communicated in equilibrium and signals $x_{n_{M+1}}, ..., x_{n_N}$ are not communicated, $M \in \{0, ..., N\}$. Using the derivations in the proof of Lemma A.3, firm value satisfies

$$V(x_1, ..., x_N) = V_0 - \sum_{i=1}^{M} p_{n_i} [\, g_{n_i} - \sum_{k=M+1}^{N} \delta_{n_k}]^2 - \sum_{j=M+1}^{N} p_{n_j} [\, g_{n_j} - \delta_{n_j} (1 - Q_{n_j}) - \sum_{\substack{k=M+1 \\ k\neq j}}^{N} \delta_{n_k}]^2,$$

and expected firm value is

$$E(V) = \int [\ V(x_1, ..., x_N)]\, f_1(x_1) ... f_N(x_N)\, dx_1 ... dx_N.$$

By the same argument as in the proof of Lemma A.3, the integral over all linear terms δ_i and interaction terms $\delta_i \delta_j$ is equal to 0. Also, because all quadratic terms δ_i^2 enter additively, the integral over these terms is equal to the sum of the corresponding integrals for individual signals. The coefficient before δ_i^2 for $i \in \{n_1, ..., n_M\}$ is 0, and the coefficient before δ_i^2 for $i \in \{n_{M+1}, ..., n_N\}$ is $-[1 - p_i + p_i (1 - Q_i)^2]$. Finally, note that $i \in \{n_{M+1}, ..., n_N\}$ if and only if $x_i \in [t_i, T_i]$. Intergrating over all possible realizations of $x_1, ..., x_N$, we get

$$E[V] = V_0 - \sum_{i=1}^{N} p_i g_i^2 - \sum_{i=1}^{N} \left[1 - p_i + p_i (1 - Q_i)^2\right] \int \delta_i^2 \cdot \mathbf{1}\{x_i \in [t_i, T_i]\}\, f_i(x_i)\, dx_i,$$

which is equivalent to the expression in the statement of the lemma.

Proofs of main results

Proof of Proposition 1: The statement of Proposition 1 follows from Lemma A.1 for the case $b_i = 0$ and $p_i = \frac{1}{N}$ for all i.

Proof of Proposition 2: Let y_i be the equilibrium expected value of x_i conditional on it not being communicated. According to Lemma A.3 (i) for the case $b_i = 0$ and $p_i = \frac{1}{N}$, director i finds it optimal to communicate his signal if and only if

$$(x_i - y_i)^2 > \frac{c_i}{1 - \frac{1}{N}\frac{1}{1+Nr_i}}. \tag{A11}$$

It follows that there always exists an equilibrium where a director communicates his signal if and only if $|x_i| > d_i = \sqrt{\frac{c_i}{1 - \frac{1}{N}\frac{1}{1+Nr_i}}}$. Indeed, in such equilibrium $y_i = 0$ due to the symmetry of the distribution and hence, according to $(A11)$, communicating x_i if and only if $|x_i| > d_i$ is indeed optimal.

Moreover, when the distribution is single-peaked at zero, this equilibrium is also the unique equilibrium of the model. First, there is no other equilibrium where the communication interval is interior. According to $(A11)$, any such equilibrium is characterized by $[t_i, T_i]$ and $y_i = E[x_i | x_i \in [t_i, T_i]]$, such that $T_i - y_i = y_i - t_i = d_i$. It follows that $y_i = \frac{t_i + T_i}{2}$, i.e., the conditional expectation over $[t_i, T_i]$ coincides with the middle of the interval. Because the distribution is symmetric and single-peaked at zero, this is only possible for $y_i = 0$. Hence, no other interior equilibrium exists.

Second, there is no boundary equilibrium. Suppose, for example, that there is a boundary equilibrium in which the non-communication interval is $[t_i, k_i]$, $t_i > -k_i$. According to Lemma A.3 (ii), this is only an equilibrium if $t_i - y_i = -d_i$ and $k_i - y_i < d_i$. Summing up these two expressions, we get $y_i > \frac{t_i + k_i}{2}$, where $\frac{t_i + k_i}{2} > 0$. However, for a single-peaked symmetric distribution, the conditional expectation over $[t_i, k_i]$, $\frac{t_i+k_i}{2} > 0$ is strictly smaller than $\frac{t_i+k_i}{2}$, which contradicts $y_i > \frac{t_i+k_i}{2}$. Similarly, there is no boundary equilibrium in which the non-communication interval is $[-k_i, T_i]$, $T_i < k_i$.

If the distribution has more than one peak, there could be multiple equilibria at the discussion stage. For example, for a two-peak distribution that is symmetric around zero, has peaks at points $(-z, z)$, and is symmetric in the neighborhood of each peak, there are three equilibria with $y_i \in \{-z, 0, z\}$ if c_i is sufficiently small. For a uniform distribution, the condition $E[x_i | x_i \in [t_i, T_i]] = \frac{t_i+T_i}{2}$ is satisfied for any interval $[t_i, T_i]$ and hence, there is a continuum of equilibria characterized by some non-communication interval of length $2d_i$.

Proof of Lemma 1: The statement of Lemma 1 follows from Lemma A.4 for the case $b_i = 0$ and $p_i = \frac{1}{N}$ for all i.

Proof of Proposition 3: Because contributions of individual directors to firm value enter additively, we can examine the effect of each individual r_i separately. Consider the term reflecting the contribution of director i:

$$V_i(r_i) = -\left[1 - \frac{1}{N} + \frac{1}{N}\left(\frac{Nr_i}{1+Nr_i}\right)^2\right]\int_{-d_i}^{d_i} x^2 f_i(x)\,dx, \;\; d_i = \sqrt{\frac{c_i}{1 - \frac{1}{N}\frac{1}{1+Nr_i}}}.$$

Because by assumption, $\sqrt{\frac{c_i}{1-\frac{1}{N}}} < k_i$, then $d_i < k_i$ for any $r_i \geq 0$. It can be shown that $\lim_{r_i \to 0} V_i'(r_i) = f_i\left(c_i^{1/2}(1-\frac{1}{N})^{-1/2}\right) c_i^{3/2}\left(1-\frac{1}{N}\right)^{-3/2} > 0$, which implies that firm value is maximized at some strictly positive r_i, potentially, infinitely large.

Lemma 2, **Proposition 4**, and **Proposition 5** are proved for the general case, where both directors' biases and preferences for conformity are present. Let g_i be the solution to (8).

Lemma 2: *Suppose that the distribution of signals is uniform: $x_i \sim U[-k_i, k_i]$. Then the equilibrium strategies at the discussion stage are the following:*

(i) if $b_i > \bar{g}_{-i}$, director i reveals his signal if and only if $x_i > -k_i + 2\delta_i^+$,

(ii) if $b_i < \bar{g}_{-i}$, director i reveals his signal if and only if $x_i < k_i + 2\delta_i^-$,

where $\delta_i^- < 0 < \delta_i^+$ are the roots of the quadratic equation

$$\delta^2 + 2\delta(b_i - \bar{g}_{-i}) - \frac{c_i}{1 - \frac{1}{N}\frac{1}{1+Nr_i}} = 0.$$

Proof of Lemma 2: The proof is based on Lemma A.3. Suppose that $b_i > \bar{g}_{-i}$. Then the coefficient for the linear term in the quadratic equation $H_i(\delta) = 0$ given by $(A6)$ is equal to $2(b_i - \bar{g}_{-i}) > 0$. It follows that the roots (δ_i^-, δ_i^+) of this quadratic equation satisfy $\delta_i^- + \delta_i^+ < 0$.

First, I show that the equilibrium communication strategy of director i is boundary, i.e., either signal k_i or signal $-k_i$ is not communicated in equilibrium. According to Lemma A.3 (ii), if the equilibrium communication strategy was interior, then director i would communicate x_i if and only if $x_i \notin [t_i, T_i]$, where $t_i - y_i = \delta_i^-$, $T_i - y_i = \delta_i^+$, and $y_i = E[x_i | x_i \in [t_i, T_i]]$. Because the distribution is uniform, $y_i = \frac{t_i + T_i}{2}$, which would imply that $\delta_i^- + \delta_i^+ = 0$, which contradicts the fact that $\delta_i^- + \delta_i^+ < 0$. Hence, the equilibrium must be boundary.

Next, I show that there is no equilibrium where $-k_i$ is communicated and k_i is not communicated. Suppose that such equilibrium exists. By Lemma A.3 (ii), this equilibrium is characterized by the non-communication interval $[t_i, k_i]$, $t_i > -k_i$, where $t_i - y_i = \delta_i^-$ and $k_i - y_i < \delta_i^+$. Summing up these two expressions, we get $t_i + k_i - 2y_i < \delta_i^- + \delta_i^+$. However, $y_i = \frac{t_i + k_i}{2}$ and hence, $0 = t_i + k_i - 2y_i < \delta_i^- + \delta_i^+ < 0$, which is a contradiction.

Therefore, all possible equilibria are characterized by a non-communication interval $[-k_i, T_i]$, where $T_i \leq k_i$. According to Lemma A.3 (ii), in order for an equilibrium with $T_i < k_i$ to exist, T_i must satisfy $T_i - \frac{T_i - k_i}{2} = \delta_i^+ \Leftrightarrow T_i = 2\delta_i^+ - k_i$. Hence, $T_i < k_i$ is an equilibrium if and only if $\delta_i^+ < k_i$. In order for an equilibrium with $T_i = k_i$ to exist, k_i must satisfy $k_i - \frac{k_i - k_i}{2} < \delta_i^+ \Leftrightarrow k_i < \delta_i^+$. Hence, there is a unique equilibrium characterized by the non-communication interval $[-k_i, T_i]$, $T_i = \min\{2\delta_i^+ - k_i, k_i\}$.

Following similar arguments, it can be shown that if $b_i < \bar{g}_{-i}$, there is a unique equilibrium characterized by the non-communication interval $[t_i, k_i]$, where $t_i = \max\{-k_i, k_i + 2\delta_i^-\}$. Finally, if $b_i = \bar{g}_{-i}$, then the coefficient for the linear term in the quadratic equation $H_i(\delta) = 0$ is equal to zero. It follows that there is a continuum of equilibria characterized by point $y_i \in [-k_i + d_i, k_i - d_i]$, such that director i communicates his signal if and only if $|x_i - y_i| > d_i = \sqrt{\frac{c_i}{1 - \frac{1}{N}\frac{1}{1+Nr_i}}}$. As shown in the proof of Proposition 5, firm value is exactly the same in all these equilibria.

Proposition 4: *Suppose that director i is biased towards the proposal relative to other directors: $b_i > \bar{g}_{-i}$. Then the director reveals more information as his bias increases further. Similarly, if the director is relatively biased against the proposal, $b_i < \bar{g}_{-i}$, then he reveals more information as his bias decreases further.*

Proof of Proposition 4: Suppose, for example, that $b_1 > \bar{g}_{-1}$. Then, according to Lemma 2, director 1 communicates his signal if and only if $x_1 > T_1 = -k_1 + 2\delta_1^+$, where

$$\delta_1^+ = -(b_1 - \bar{g}_{-1}) + \sqrt{(b_1 - \bar{g}_{-1})^2 + \frac{c_1}{1 - \frac{1}{N}\frac{1}{1+Nr_1}}}.$$

According to Lemma A.2, $\frac{d}{db_1}\bar{g}_{-1} = \frac{1}{N-1}\sum_{j=2}^{N}\lambda_{j1}$, where $\lambda_{j1} < 1$. Thus, $\frac{d}{db_1}\bar{g}_{-1} < 1$ and $\frac{d}{db_1}(b_1 - \bar{g}_{-1}) > 0$. This implies that $b_1 - \bar{g}_{-1}$ increases with b_1 and hence remains positive as b_1 increases further. Thus, the equilibrium communication region continues to take the form $[-k_1 + 2\delta_1^+, k_1]$. Moreover, δ_1^+ decreases in $(b_1 - \bar{g}_{-1})$ and hence, decreases as b_1 increases. Hence, the director reveals more information as his bias increases. The proof for the case $b_1 < \bar{g}_{-1}$ is similar.

Proposition 5: *Consider any $(r_1, ..., r_N)$ and suppose that $b_2 = ... = b_N = 0$. Then firm value is maximized at $b_1 = \pm b$, where b is strictly positive.*

Proof of Proposition 5: Using Lemma A.4 for $p_i = \frac{1}{N}$ and a uniform distribution of x_i on $[-k_i, k_i]$, expected firm value is given by

$$E(V) = V_0 - \frac{1}{N}\sum_{i=1}^{N} g_i^2 - \sum_{i=1}^{N}\left[1 - \frac{1}{N} + \frac{1}{N}(\frac{Nr_i}{1+Nr_i})^2\right]\frac{1}{3k_i}\left(\frac{T_i - t_i}{2}\right)^3, \tag{A12}$$

where $[t_i, T_i]$ is the non-communication region of director i. Note that firm value only depends on the length $T_i - t_i$ of the non-communication interval and not on its location.

To prove the statement of the proposition, I show below that $\lim_{b_1 \to 0+} \frac{d}{db_1} E(V) > 0$ and $\lim_{b_1 \to 0-} \frac{d}{db_1} E(V) < 0$.

(1) First, consider $b_1 > 0$. Our goal is to prove that $\lim_{b_1 \to 0+} \frac{d}{db_1} E(V) > 0$.

Because $b_2 = ... = b_N = 0$, then according to Lemma A.2, $g_i = \lambda_{i1} b_1$, where $\lambda_{i1} \in [0,1)$ for $i \neq 1$ and $\lambda_{11} \in (0,1]$. Note that $\bar{g}_{-i} = (\frac{1}{N-1}\sum_{k \neq i} \lambda_{k1}) b_1 > 0 = b_i$ for $i \neq 1$ because $\lambda_{11} > 0$. Also, $\bar{g}_{-1} = (\frac{1}{N-1}\sum_{k \neq 1} \lambda_{k1}) b_1 < b_1$ because $\lambda_{k1} < 1$ for all k. Since $\bar{g}_{-i} > b_i$ and $\bar{g}_{-1} < b_1$, then, according to Lemma 2, the equilibrium non-communication regions are $[-k_1, T_1]$, $[t_2, k_2]$, ..., $[t_N, k_N]$, where $T_1, t_2, ..., t_N$ satisfy

$$\begin{aligned} T_1 &= \min\{-k_1 + 2\delta_1^+, k_1\} \\ t_i &= \max\{k_i + 2\delta_i^-, -k_i\} \end{aligned} \tag{A13}$$

We have assumed that k_i is sufficiently large, such that the equilibrium is interior: $\delta_i^+ < k_i$ and $\delta_i^- > -k_i$. Hence, $T_1 = -k_1 + 2\delta_1^+$ and $t_i = k_i + 2\delta_i^-$. The roots δ_i^-, δ_i^+ are given by

$$\begin{aligned} \delta_1^+ &= (\bar{g}_{-1} - b_1) + \sqrt{(\bar{g}_{-1} - b_1)^2 + \frac{c_1}{1 - \frac{1}{N}\frac{1}{1+Nr_1}}} \\ \delta_i^- &= (\bar{g}_{-i} - b_i) - \sqrt{(\bar{g}_{-i} - b_i)^2 + \frac{c_i}{1 - \frac{1}{N}\frac{1}{1+Nr_i}}}. \end{aligned}$$

Note that $\frac{d}{db_1}\sum_{i=1}^{N} g_i^2 = 2\sum_{i=1}^{N} g_i \frac{dg_i}{db_1}$. Because $g_i = \lambda_{i1} b_1 \to 0$ when $b_1 \to 0+$ and $\left|\frac{dg_i}{db_1}\right| \leq \max\{\lambda_{i1}\}$, then $\lim_{b_1 \to 0+} \frac{d}{db_1}\sum_{i=1}^{N} g_i^2 = 0$. Hence, using $(A12)$ and $(A13)$,

$$\begin{aligned} \lim_{b_1 \to 0+} \frac{d}{db_1} E(V) &= -\frac{1}{k_1}\left[1 - \frac{1}{N} + \frac{1}{N}(\frac{Nr_1}{1+Nr_1})^2\right](\delta_1^+)^2 \lim_{b_1 \to 0+} \frac{d\delta_1^+}{db_1} \\ &\quad + \sum_{i=2}^{N} \frac{1}{k_i}\left[1 - \frac{1}{N} + \frac{1}{N}(\frac{Nr_i}{1+Nr_i})^2\right](\delta_i^-)^2 \lim_{b_1 \to 0+} \frac{d\delta_i^-}{db_1}. \end{aligned}$$

Since $\bar{g}_{-1} - b_1 = (\frac{1}{N-1}\sum_{k\neq 1}\lambda_{k1} - 1)b_1$ and $\bar{g}_{-i} - b_i = (\frac{1}{N-1}\sum_{k\neq i}\lambda_{k1})b_1, i \geq 2$, then

$$\lim_{b_1\to 0+}\frac{d\delta_1^+}{db_1} = \frac{1}{N-1}\sum_{k\neq 1}\lambda_{k1} - 1 < 0,$$

$$\lim_{b_1\to 0+}\frac{d\delta_i^-}{db_1} = \frac{1}{N-1}\sum_{k\neq i}\lambda_{k1} \geq \frac{\lambda_{11}}{N-1} > 0.$$

Since $\lim_{b_1\to 0+}\left(\delta_1^+\right)^2 > 0$ and $\lim_{b_1\to 0+}\left(\delta_i^-\right)^2 > 0$, we conclude that $\lim_{b_1\to 0+}\frac{d}{db_1}E\left(V\right) > 0$.

(2) Consider $b_1 < 0$. Using similar arguments, it is easy to show that $\lim_{b_1\to 0-}\frac{d}{db_1}E\left(V\right) < 0$.

(3) Consider $b_1 = 0$. In that case, $g_i = 0$ for any i and hence, there are multiple equilibria at the discussion stage, characterized by the non-communication region of length $2d_i = 2\sqrt{\frac{c_i}{1-\frac{1}{N}\frac{1}{1+Nr_i}}}$. According to $(A12)$, firm value only depends on the length of the non-communication interval. Therefore, firm value is exactly the same in all these equilibria and by continuity is equal to $\lim_{b_1\to 0+}E\left(V\right) = \lim_{b_1\to 0-}E\left(V\right)$.

Combining cases (1)-(3) together, we conclude that firm value has a local minimum at the point $b_1 = 0$. Due to the symmetry of the problem, this implies that firm value is maximized at $b_1 = \pm b$, where b is strictly positive, potentially, infinitely large.

Proof of Proposition 6: Consider any possible allocation of control $(p_1, ..., p_N)$, $\sum p_i = 1$. Without loss of generality, suppose that $p_1 \geq p_2 \geq ... \geq p_N$.

According to Lemma A.4, when the distribution of all signals is uniform on $[-k, k]$, $r_i = 0$ and $c_i = c$, expected firm value is given by

$$E_{(p_1,...,p_N)}\left(V\right) = V_0 - \frac{1}{3k}\left(1-p_1\right)\min\{\sqrt{\frac{c}{1-p_1}}, k\}^3 - \frac{1}{3k}\sum_{i=2}^{N}\left(1-p_i\right)\min\{\sqrt{\frac{c}{1-p_i}}, k\}^3.$$

Note that $\sqrt{\frac{c}{1-p_i}} \geq k \Leftrightarrow p_i \geq 1 - \frac{c}{k^2}$.

First, suppose that c is sufficiently large: $c \geq k^2$. Then $\min\{\sqrt{\frac{c}{1-p_i}}, k\} = k$ for all i and hence, there is no communication regardless of $(p_1, ..., p_N)$. In this case, expected firm value is $V_0 - \frac{k^2}{3}\left(N-1\right)$, which does not depend on $(p_1, ..., p_N)$. In other words, when there is no communication between directors regardless of allocation of control, then allocation of control does not matter. In particular, the allocation $(1, 0, ..., 0)$ is optimal.

Second, suppose that $c < k^2$. When control is allocated to one director: $p_1 = 1, p_i = 0$ for $i > 1$, expected firm value is given by

$$E_{(1,0,...,0)}\left(V\right) = V_0 - \frac{1}{3k}\sum_{i=2}^{N}c^{3/2}.$$

Consider any other possible allocation of control $(p_1, ..., p_N)$, $p_1 \geq p_2 \geq ... \geq p_N$. Our goal is to show that $E_{(1,0,...,0)}(V) - E_{(p_1,...,p_N)}(V) \geq 0$, which is equivalent to

$$(1-p_1)\min\{\sqrt{\frac{c}{1-p_1}}, k\}^3 + \sum_{i=2}^{N}[(1-p_i)\min\{\sqrt{\frac{c}{1-p_i}}, k\}^3 - c^{3/2}] \geq 0. \tag{A14}$$

There are two possible cases: $p_1 \geq 1-\frac{c}{k^2}$ and $p_1 < 1-\frac{c}{k^2}$. Suppose first that $p_1 \geq 1-\frac{c}{k^2}$. Let $M \in \{1, ..., N\}$ be such that $p_i \geq 1-\frac{c}{k^2}$ for $i = 2, ..., M$ and $p_i < 1-\frac{c}{k^2}$ for $i = M+1, ..., N$. Then $(A14)$ is equivalent to

$$(1-p_1)k^3 + \sum_{i=2}^{M}\left[(1-p_i)k^3 - c^{3/2}\right] + \sum_{i=M+1}^{N}\left[(1-p_i)\sqrt{\frac{c}{1-p_i}}^3 - c^{3/2}\right] \geq 0. \tag{A15}$$

Note that $(1-p_i)\sqrt{\frac{c}{1-p_i}}^3 - c^{3/2} = c^{3/2}\left[(1-p_i)^{-1/2} - 1\right] \geq 0$ and hence, the last component is non-negative. Intuitively, when the power of director $i \in \{M+1, ..., N\}$ is reduced from $p_i \geq 0$ to $p_i = 0$, he communicates more information, and this information is efficiently used in the board's decisions. This effect dominates the negative effect that information that does not get communicated is not used in the board's decision. The sum of the first two components of $(A15)$ is also non-negative:

$$k^3(M - \sum_{i=1}^{M}p_i) - (M-1)c^{3/2} \geq (M-1)\left(k^3 - c^{3/2}\right) \geq 0.$$

Hence, all components of $(A15)$ are non-negative and thus, indeed, $(A14)$ is satisfied.

Finally, suppose that $p_1 < 1-\frac{c}{k^2}$ and hence, $p_i < 1-\frac{c}{k^2}$ for all i. Then $(A14)$ is equivalent to

$$c^{3/2}(1-p_1)^{-1/2} + c^{3/2}\sum_{i=2}^{N}\left[(1-p_i)^{-1/2} - 1\right] \geq 0,$$

which is satisfied because both components are non-negative. The intuition for directors $2, ..., N$ is the same as before: although they influence the decisions less, they communicate more information to director 1. As for director 1, although he communicates less when $p_1 = 1$, this does not play any negative role because he can efficiently incorporate his information into the outcome through his full control over the decision.

Proof of Proposition 7: Let f and c be the density of directors' signals and directors' cost of communication, respectively, and let $[-k, k]$ be the support of the distribution, where k can be infinite. If $p_i = 1$ and $p_j = 0$ for $j \neq i$, then $d_i = \min\{\sqrt{\frac{c}{1-\frac{1}{1+r_i}}}, k\}$ and $d_j = d = \min\{\sqrt{c}, k\}$ for $j \neq i$. Hence, according to Lemma A.4, expected firm value is given by

$$V_0 - (\frac{r_i}{1+r_i})^2\int_{-d_i}^{d_i}x^2 f(x)\,dx - \sum_{j\neq i}\int_{-\min\{\sqrt{c},k\}}^{\min\{\sqrt{c},k\}}x^2 f(x)\,dx. \tag{A16}$$

The first and third component of $(A16)$ do not depend on i, and the second component is a function of r_i. Consider the function

$$g(r) = (\frac{r}{1+r})^2 \int_{-d(r)}^{d(r)} x^2 f(x)\, dx,$$

where $d(r) = \min\{c^{1/2}(\frac{r}{1+r})^{-1/2}, k\}$. In the region where $d(r) = k$, $g(r)$ is proportional to $(\frac{r}{1+r})^2$ and hence, is increasing in r. In the region where $d(r) = c^{1/2}(\frac{r}{1+r})^{-1/2}$, it can be shown that $g'(r) > 0$ is equivalent to

$$-\frac{1}{2}c^{1/2}(\frac{r}{1+r})^{-3/2}(\frac{r}{1+r})^2 d^2(r) f(d(r)) + \frac{2r}{1+r}\int_0^{d(r)} x^2 f(x)\, dx > 0.$$

Because $f(x)$ is non-increasing for $x > 0$, $\int_0^{d(r)} x^2 f(x)\, dx \geq d^2(r) f(d(r)) d(r)$ and hence, it is sufficient to show that

$$-\frac{1}{2}c^{1/2}(\frac{r}{1+r})^{1/2} d^2(r) f(d(r)) + \frac{2r}{1+r} d^2(r) f(d(r)) d(r) > 0 \Leftrightarrow \frac{3}{2}c^{1/2}(\frac{r}{1+r})^{1/2} > 0,$$

which is always satisfied. Finally, $g(r)$ is continuous at the point where $d(r)$ switches from $c^{1/2}(\frac{r}{1+r})^{-1/2}$ to k. Hence, the function $g(r)$ is increasing in r, which proves that $(A16)$ is maximized when $i \in \arg\min_j\{r_j\}$.

Proof of Lemma 3: Consider each of the three cases separately.

(1) Suppose that both signals were communicated.

There is clearly an equilibrium with $a_1^* = a_2^* = x_1 + x_2$ because the utility of both directors is equal to 0, which is the global maximum, and hence no director has incentives to deviate. There also exist other equilibria. In unreported results, I prove that all possible equilibria take the form $a_1^* = a_2^* = a^*$ for some $a^* \in [x_1 + x_2, x_1 + x_2 + r]$. In the paper, I focus on the most efficient of these equilibria, $a^* = x_1 + x_2$, but this is not important for the results.

(2) Suppose that signals $x_1, x_2 \in [t, T]$ and hence, were not communicated. Denote $\gamma = 1 - \frac{r}{T-t}$ and $\beta = \frac{t+T}{2} + \frac{Tr}{T-t}$. Our goal is to show that there is a linear equilibrium $a_i = \gamma x_i + \beta$.

Consider director 1, and let $g(a_2)$ be the density function of director 2's action a_2 conditional on director 1's information. Then expected utility of director 1, up to a constant, is given by

$$U_1 = -\frac{1}{2}E(a_1 - \theta)^2 - r\int_{a_2=a_1}^{\infty} (a_2 - a_1) g(a_2)\, da_2.$$

Differentiating with respect to a_1,

$$\frac{dU_1}{da_1} = -E(a_1 - \theta) + r\int_{a_2=a_1}^{\infty} g(a_2)\, da_2 = -a_1 + E\theta + r\Pr(a_2 > a_1),$$

where the probability is taken given director 1's information. Note that $\frac{dU_1}{da_1}$ is strictly decreasing in a_1 and takes all values from $+\infty$ to $-\infty$. Therefore, the global optimum of U_1 is achieved at the point where the following first-order condition is satisfied:

$$\frac{dU_1}{da_1} = -a_1 + E\theta + r\Pr(a_2 > a_1) = 0. \tag{A17}$$

To prove that $a_1 = \gamma x_1 + \beta$ is the best response of director 1, it is therefore sufficient to prove that $a_1 = \gamma x_1 + \beta$ satisfies $(A17)$. Recall that from director 1's perspective, the distribution of x_2 conditional on it not being communicated is uniform on $[t, T]$. Therefore, $\Pr(a_2 > \gamma x_1 + \beta) = \Pr(x_2 > x_1) = \frac{T - x_1}{T - t}$ and thus,

$$\frac{dU_1}{da_1}|_{a_1=\gamma x_1+\beta} = -(\gamma x_1 + \beta) + (x_1 + \frac{T+t}{2}) + r\frac{T - x_1}{T - t} = 0.$$

Hence, $a_1 = \gamma x_1 + \beta$ is indeed the best response of director 1.

(3) Suppose that signal x_1 was communicated and signal $x_2 \in [t, T]$ was not.

Our goal is to show that the equilibrium strategies stated in the lemma form an equilibrium. First, we prove that $a_1 = x_1 + A$ satisfies $(A17)$ and hence, is the best response of director 1. It can be easily shown that $A \in (t, T)$. Then, $\Pr(a_2 > x_1 + A) = \Pr(x_2 > A) = \frac{T-A}{T-t}$ and hence,

$$\frac{dU_1}{da_1}|_{a_1=x_1+A} = -(x_1 + A) + (x_1 + \frac{T+t}{2}) + r\frac{T-A}{T-t} = \frac{T+t}{2} + \frac{rT}{T-t} - A\left(1 + \frac{r}{T-t}\right) = 0.$$

Second, consider the best response of director 2, who knows x_1 and hence, knows $a_1 = x_1 + A$. Let $U_2(a_2)$ be director 2's utility as a function of his action. If he chooses $a_2 < a_1$, then U_2 is, up to a constant, equal to $-\frac{1}{2}E(a_2 - \theta)^2 - r(a_1 - a_2)$ and $\frac{dU_2}{da_2} > 0 \Leftrightarrow -a_2 + E\theta + r > 0 \Leftrightarrow a_2 < x_1 + x_2 + r$. Hence, in this region, the maximum is achieved at $x_1 + x_2 + r$, which is smaller than $a_1 = x_1 + A$ if and only if $x_2 < A - r$.

If director 2 chooses $a_2 \geq a_1$, then $\frac{dU_2}{da_2} > 0 \Leftrightarrow -a_2 + E\theta > 0 \Leftrightarrow a_2 < x_1 + x_2$. Hence, in this region, the maximum is achieved at $x_1 + x_2$, which is greater than $a_1 = x_1 + A$ if and only if $x_2 > A$. Thus, the best response of director 2 in the regions where $x_2 < A - r$ and $x_2 > A$ is $a_2 = x_1 + x_2 + r$ and $a_2 = x_1 + x_2$, respectively.

Finally, in the intermediate region, $x_2 \in [A - r, A]$, the maximum of $U_2(a_2)$ is achieved at $a_2 = a_1$ because for any $a_2 < a_1$, $\frac{dU_2}{da_2} = -a_2 + x_1 + x_2 + r > -x_1 - A + x_1 + x_2 + r \geq 0$ and for any $a_2 > a_1$, $\frac{dU_2}{da_2} = -a_2 + x_1 + x_2 < -x_1 - A + x_1 + x_2 \leq 0$.

This proves that the strategy outlined in the statement of the lemma is the best response of director 2.

Proof of Lemma 4: Let $[t, T]$ be the equilibrium non-communication region. Lemma 3 specifies the equilibrium at the decision-making stage for given t, T.

Let $U_1^C(x_1, x_2), U_1^{NC}(x_1, x_2)$ be the utility of director 1 when he communicates and does not communicate his signal, respectively, given signal x_2 of the other director. Also let $U_1^C(x_1) = E_{x_2}\left[U_1^C(x_1, x_2)\right]$ and $U_1^{NC}(x_1) = E_{x_2}\left[U_1^{NC}(x_1, x_2)\right]$ be the expected utility of director 1 from communicating and not communicating his signal, where the expectation is taken over all possible realizations of x_2. Then director 1 chooses to communicate his signal if and only if $U_1^C(x_1) - c > U_1^{NC}(x_1)$.

To prove the statement of the lemma, I first prove statements 1 and 2 below.

1. $U_1^C(x_1)$ *does not depend on* x_1.
It is easy to see that for any $x_2, U_1^C(x_1, x_2)$ does not depend on x_1 and hence, $U_1^C(x_1)$ does not depend on x_1 either.

2. $U_1^{NC}(T) > U_1^{NC}(t)$ *for any* $t < T$ *and* $r > 0$.
Suppose that director 1 does not communicate his signal. Possible values of x_2 fall into 2 regions: $x_2 \notin [t, T]$ and $x_2 \in [t, T]$. I show separately that

$$\int_{x_2 \notin [t,T]} U_1^{NC}(T, x_2) f(x_2) dx_2 > \int_{x_2 \notin [t,T]} U_1^{NC}(t, x_2) f(x_2) dx_2 \tag{A18}$$

and that

$$\int_{x_2 \in [t,T]} U_1^{NC}(T, x_2) f(x_2) dx_2 > \int_{x_2 \in [t,T]} U_1^{NC}(t, x_2) f(x_2) dx_2. \tag{A19}$$

1) First, if $x_2 \notin [t, T]$, so that director 2 communicates his signal, then $a_2 = x_2 + A$, $A \in (t, T)$, and a_1 depends on how x_1 compares to $A - r$ and A. For $x_1 = T > A$, $a_1 = x_1 + x_2 > a_2$. In this case, $U_1^{NC}(T, x_2) = -\frac{1}{2}(A - T)^2$. For $x_1 = t < A$, the utility of director 1 depends on how t compares to $A - r$. If $t < A - r$, then $U_1^{NC}(t, x_2) = -\frac{1}{2}r^2 - \frac{1}{2}(A - t)^2 - r(A - t - r)$. If $t \in (A - r, A)$, then $U_1^{NC}(t, x_2) = -(A - t)^2$.

It is easy to show that $A'_r > 0$. Because $A = \frac{T+t}{2}$ when $r = 0$, then $A > \frac{T+t}{2}$ for any $r > 0$ and hence, $-\frac{1}{2}(A - T)^2 > -\frac{1}{2}(A - t)^2$. Then, regardless of whether t is smaller or greater than $A - r$, $U_1^{NC}(T, x_2) > U_1^{NC}(t, x_2)$ for all x_2 that are communicated. Hence, $(A18)$ is satisfied for $r > 0$.

2) If $x_2 \in [t, T]$, so that director 2 does not communicate his signal, then $a_i = \gamma x_i + \beta$, where $\gamma = 1 - \frac{r}{T-t}, \beta = \frac{T+t}{2} + \frac{rT}{T-t}$. In this case, $a_2 - a_1 = \gamma(x_2 - x_1)$ and

$$\int_{x_2 \in [t,T]} U_1^{NC}(x_1, x_2) f(x_2) dx_2 = \int_{x_2 \in [t,T]} -r\gamma(x_2 - x_1)^+ \frac{1}{2k} dx_2 + H(x_1), \tag{A20}$$

where

$$H(x_1) = -\frac{1}{2}\int_{x_2 \in [t,T]} \left[(\beta + x_1(\gamma - 1) - x_2)^2 + (\beta + x_2(\gamma - 1) - x_1)^2\right] \frac{1}{2k} dx_2.$$

Because $(x_2 - x_1)^+ = 0$ for $x_1 = T$ and $(x_2 - x_1)^+ > 0$ for $x_1 = t$, the first component in the right-hand side of $(A20)$ is strictly greater for $x_1 = T$ than for $x_1 = t$. Integrating $H(x_1)$ over x_2 and plugging in the values of β and γ, it is straightforward to show that

$$H(T) - H(t) = \frac{1}{4k}(T - t)^2 \left[r + \frac{r^2}{T - t}\right],$$

which is strictly positive for any $r > 0$ and $T > t$. Hence, $(A19)$ is satisfied.

The statement of the lemma follows from the two statements above. In particular, it follows that 1) there is no equilibrium where the non-communication region, $[t, T]$, is interior, i.e., when $-k < t < T < k$, and 2) there is no equilibrium where directors communicate only sufficiently high signals, i.e., when $[t, T] = [-k, T]$ for some $T < k$.

1) If $-k < t < T < k$, then each director should be indifferent between communicating and not communicating his signal at both points t and T : $U_1^{NC}(t) = U_1^C(t)$ and $U_1^{NC}(T) = U_1^C(T)$. However, this is impossible because if the director is indifferent between communicating and not communicating his signal at T, then he strictly prefers to communicate his signal at $t : U_1^{NC}(t) < U_1^{NC}(T) = U_1^C(T) = U_1^C(t)$.

2) Similarly, if $[t, T] = [-k, T]$, then each director should be indifferent between communicating and not communicating his signal at T, which implies that he should strictly prefer to communicate his signal at $t = -k$ and hence, for some t around $-k$ as well. Hence, the only possible threshold equilibrium takes the form $[t, T] = [t, k]$ for some $t \in [-k, k]$. If c is very large, then directors never communicate their signals: $t = -k$ and when c converges to zero, then there is full communication in the limit: $t \to k$.