Review of Accounting Studies (2021) 26:1587–1622
https://doi.org/10.1007/s11142-021-09586-9

The value of board commitment

Tim Baldenius[1] · **Xiaojing Meng**[2] · **Lin Qiu**[3]

Accepted: 24 February 2021 / Published online: 1 May 2021

Abstract

Boards can learn about the environment of their firms through information gathering and communicating with the CEO. In the post-Sarbanes-Oxley environment, some boards have taken steps to shape the communication more proactively by committing to decision rules, such as spending limits, before eliciting a report from the CEO. All else equal, such commitment power on the part of the board improves its communication with the CEO. However, taking into consideration the endogeneity of board composition/bias, we show that the board's commitment power may in fact impede such communication, in equilibrium, by prompting the shareholders to appoint a more antagonistic board. We identify other cases where, in equilibrium, the board's commitment power does foster communication, but ultimately reduces shareholder value, because the improved information flow dampens the board's effort incentives. We discuss applications of our model to board staggering.

Keywords Corporate governance · Board of Directors · Strategic communication

JEL Classification D21 · D86 · G34 · M41

We thank Jorg Budde, George Drymiotes, Ilan Guttman, Jack Hughes, Joshua Ronen, Tom Ruchti, Jack Stecher, Hao Xue and seminar participants at Houston, UCLA, NYU, Carnegie Mellon, Mannheim, Columbia, LMU Munich, Hamburg, HKU, EAA 2017, and ARW 2017 Basel for helpful comments.

✉ Tim Baldenius
tim.baldenius@columbia.edu

Xiaojing Meng
xmeng@stern.nyu.edu

Lin Qiu
lqiu@hku.hk

[1] Columbia Business School, New York, NY, USA

[2] NYU Stern School of Business, New York, NY, USA

[3] Faculty of Business and Economics, University of Hong Kong, Pok Fu Lam, Hong Kong

1 Introduction

Corporate directors contribute to firm value by monitoring and advising management, and by making key decisions such as whether to pursue mergers. To learn about their firms' environments, directors rely on communication with management and on their own information gathering (for example, industry or peer analysis). The communication game between managers and the board is typically studied using "cheap talk" models, assuming little structure or commitment power.[1] However, in the post-Sarbanes-Oxley environment, some firms aim to shape the conversation within the boardroom more proactively by designing formal decision protocols—for example, letting the CEO make decisions autonomously up to certain spending limits (McNulty and Pettigrew 1999; Useem and Zelleke 2006). The objective of this paper is to study the consequences of alternative modes of communication, aiming to capture different degrees of board "proactiveness."

We study boardroom communication in a setting where a pending investment decision should be tailored to the state of the world. The CEO is endowed with (noisy) information about the state but is an empire builder. The board holds the decision rights and aims to learn about the environment through two channels: costly information acquisition ("effort") and communication with the CEO. We consider two alternative modes of boardroom communication. If the board has commitment power, it can design a report-contingent decision rule (without contingent transfers) before eliciting the CEO's report. Such board commitment can be viewed as a form of *constrained delegation*: the decision is made by the CEO, but he or she can only select an entry from a menu of admissible investment levels designed by the board. A board that lacks such commitment power communicates with the CEO in the form of cheap talk: the board reacts to the CEO's report in a sequentially rational manner (as in Baldenius et al. 2019). We compare the outcomes under the communication modes—cheap talk and constrained delegation—and identify cases in which board commitment ultimately benefits or hurts shareholders.

All else equal, commitment power always improves the board's communication with the CEO. Specifically, if the CEO and board are highly misaligned, no information can be credibly conveyed with cheap talk. Yet, with constrained delegation, the CEO's signal can still be impounded into the decision, albeit at some distortion cost. That is, board commitment has an *inherent* communication advantage, but that comes at an opportunity cost: it reduces the board's incentive to exert information gathering effort.

Moreover, all else is not equal: the shareholders can adapt the composition and equity incentives of the board endogenously to the latter's commitment power. The composition determines the board's nonpecuniary incentives over the investment level—the "board bias." For instance, nominating insiders or directors socially connected to the CEO tends to result in a *friendly* board that is somewhat aligned with the

[1] See Harris and Raviv (2005, 2008), Adams and Ferreira (2007), Baldenius et al. (2014), Chakraborty and Yilmaz (2017), Baldenius et al. (2019), and Qiu (2021). For an alternative modeling approach, based on (verifiable) disclosures, see Levit (2012).

CEO (Fracassi and Tate 2012; Schmidt 2015). On the other hand, directors representing debtholders or former accounting partners/regulators may be overly concerned with avoiding high-visibility failures and thus are at times viewed as *antagonistic* by their CEOs.[2] While the determinants of board bias thus are director characteristics, the determinants of a board's commitment power tend to be firm or industry characteristics, for example, PP&E intensity (intangibles are inherently hard to verify) or board staggering (staggering extends the interaction horizon between the board, as a collective body, and the CEO).

How will the shareholders adapt the board bias (directors' characteristics) to the prevailing commitment setting (firm/industry characteristics)? Nominating a friendly board improves communication (Dessein 2002), whereas an antagonistic board tends to gather more information. Both forms of board bias come at a cost to shareholders in terms of distorted investments, as the board holds the formal decision rights. Baldenius et al. (2019) have shown that the optimal board bias under cheap talk may take either direction. For high information asymmetry, the board should be weakly friendly, because learning the CEO's private signal through communication then is very valuable. Otherwise, the board should be weakly antagonistic, focused on effort. In contrast, we show in this paper that, in firms where board staggering or a high degree of investment verifiability facilitate board commitment, the shareholders *always* assemble a weakly antagonistic board. Under constrained delegation, the CEO picks the admissible investment level closest to his preferred level. Therefore, the investment will be anchored on the preferences of the CEO, not of the board. This makes an antagonistic board a cheap instrument for shareholders to elicit board effort: it aggravates the discord between the board and the CEO, without creating additional discord between the shareholders and the *de-facto* (constrained) decision-maker—the CEO.[3]

In any strategic communication game, having commitment power generically leaves the receiver weakly better off, all else equal.[4] But it is a priori unclear, in a tripartite corporate governance setting, whether commitment power on the part of the *board* (receiver) vis-à-vis the CEO (sender) benefits the *shareholders*. Does the fact that the shareholders can tailor the board's (equity and nonpecuniary) incen-

---

[2] Deloitte's survey of Australian CEOs (2015, p.13): "The increased scrutiny has reduced the risk appetites of many companies. 'There is an element of overgovernance,' one CEO said. 'The board has taken a risk-averse view and management are reporting to it.' ... One CEO commented that a very good reason for boards to focus on risk was to avoid the stigma of becoming high-profile failures." Some directors may prefer investment levels below the NPV-maximizing level, as their equity compensation is dwarfed by their reputational capital. Boards rarely getting credit for good news, but are often blamed for bad news. Hence, by avoiding large investments that attract media attention, directors may want to "fly under the radar".

[3] An additional, but more technical, force is at work. Under cheap talk, communication deteriorates sharply from perfect to none (babbling), once the misalignment between the CEO and the board reaches a certain threshold. Then it may be worthwhile to facilitate (perfectly) communication by assigning a friendly board, because the biased cost is outweighed by the (then discrete) improvement in communication. Such jumps in communication efficiency do not occur with board commitment, though, because commitment power removes any discontinuities in the board's cost of ignorance, as our model shows: any benefits from improved communication or board effort are outweighed by the attendant bias cost.

[4] A simple revealed preference argument: with commitment power the receiver could precommit to the sequentially rational action and thus replicate the cheap talk outcome.

tives to the prevailing commitment regime imply that they ultimately stand to benefit from the board's commitment power? The answer will depend on the severity of information asymmetry and the endogenous board bias.

If the CEO has precise private information (high information asymmetry), in the cheap talk equilibrium, the shareholders will appoint a friendly board to promote communication. Such a board may communicate more efficiently with the CEO than a board that has commitment power but is optimally antagonistic. That is, the endogenous board bias may overturn the inherent communication advantage of board commitment. Yet the shareholders still benefit from the board's commitment power, because disrupted communication creates strong information gathering incentives. Put differently, under cheap talk, the friendly board is meant to improve communication; hence the cheap talk outcome could be replicated by an equally friendly board that can commit.

On the other hand, if the CEO has noisy private information, then board effort is particularly valuable, and board commitment can in fact hurt the shareholders. For moderately low CEO empire building parameters, under cheap talk, the shareholders strategically compound the communication handicap by nominating an antagonistic board. Now the board's bias is meant to *aggravate* the communication handicap under cheap talk so as to boost its effort incentives. The resulting outcome *cannot* be replicated by an equally antagonistic board that has commitment power: such a board could still learn the CEO's private information through constrained delegation—hence, the board would have reduced effort incentives.

Our results throw light on the recent debate on board staggering. While staggering primarily extends the interaction horizon between investors and the board, it also extends that between the board, as a collective body, and the CEO—and thus may confer commitment power to the board.[5] Staggering has traditionally been viewed as a value-destroying takeover defense, but recent empirical studies argue that it does not on average destroy firm value and may in fact increase value for firms with high information asymmetry.[6] This is in line with our result that board commitment adds value if the CEO's private information is sufficiently precise. Furthermore, Faleye (2007) and Gal-Or et al. (2016) find that staggered boards tend to monitor less, which is interpreted as evidence against staggering. Our model suggests an alternative interpretation: monitoring and communication are imperfect substitutes, and staggered

[5] A board is labelled "staggered" (or "classified"), if in each election term only a fraction—often a third—of directors is up for re-election. Alonso and Matouschek (2007) discuss the way repeated interactions facilitate relational delegation in general contexts. Wagner (2011) specifically considers repeated interactions between board and CEO as a way for the board to commit to take the CEO's empire-building preferences into consideration. Daines et al. (2018, p.2): "Because a staggered board protects the firm from takeovers in the short run, managers protected by a staggered board can focus on creating long-run value."

[6] For the takeover defense view, see Bebchuk and Cohen (2005) and Wang and Cohen (2017). For the opposing view, see Koppes et al. (1999), Johnson et al. (2015), and Cremers and Sepe (2016b), Cremers et al. (2016a, 2017), Ge et al. (2016), and, in particular, Daines et al. (2018). The long-term orientation argument also underlies the staggering recommendation issued by the "Focusing Capital on the Long Term" initiative, cofounded by the CPPIB and McKinsey; see https://www.fcltglobal.org/news/blog/article/2018/06/25/long-term-boards-in-a-short-term-world. Shleifer and Summers (1988) apply this argument more broadly to takeover defense instruments. Amihud and Stoyanov (2017) show that the effect of staggering on firm value is context-specific, cautioning against one-size-fits-all regulations.

boards communicate more effectively, at least for firms with moderate information asymmetry.

At a technical level, our model relates to the work of Holmstrom (1984) and Melumad and Shibano (1991), and Alonso and Matouschek (2008). While these papers allow for more general information structures, the simpler binary state space in this paper allows us to nest the board/CEO interaction in a broader contracting framework with hidden information gathering effort, where a third party (the shareholders) chooses the board's incentives.[7]

Prior literature has looked at board bias, incentives, and communication from different angles. Several studies have shown that friendly (or dependent) boards can serve as a substitute for commitment.[8] In our model, commitment power and board friendliness can emerge as substitutes or complements, depending on the ex ante information asymmetry at the CEO level. Chakraborty and Yilmaz (2017) study the optimal board bias and allocation of decision rights, but their board does not generate any new information. Drymiotes and Sivaramakrishnan (2012) examine how (short- and long-term) board compensation affects board monitoring and advising. Laux and Laux (2009) study how task separation in board committees affects board monitoring. Che and Kartik (2009) and Levit (2012) also consider information gathering and communication but, unlike in our model, it is the sender (the CEO) rather than the receiver (the board) that gathers information.[9] Closest to our paper is Baldenius et al. (2019) who consider a similar setting but model communication as cheap talk. Qiu (2021) studies the consequences of delegating CEO compensation contracting to the board, while abstracting from board bias and confining attention to cheap talk communication.

The remainder of the paper is organized as follows. Section 2 lays out the model. Section 3 shows how board commitment affects the communication subgames, for given board incentives. Section 4 compares the equilibrium outcomes for the full-fledged setting across the two commitment regimes. Section 5 assesses the value of board commitment to the shareholders. Section 6 concludes.

2 Model

The basic technology, preferences, and information endowment follow Baldenius et al. (2019), except for the mode of communication. The earlier paper assumed that

[7] A binary state space also renders trivial the issue of delegation of decision rights, as the board in our setting always wants to retain control.

[8] For example, Drymiotes (2007), Laux (2008), and Kumar and Sivaramakrishnan (2008), and Laux and Mittendorf (2011). Adams and Ferreira (2007) model (i) board friendliness not as a preference over the investment level but as the board's cost of monitoring the CEO, and (ii) monitoring not as an information technology but as a "power struggle."

[9] Moreover, Che and Kartik (2009) model communication as voluntary disclosure and focus on how differences in priors between decision-maker and expert affect communication and information acquisition, whereas we focus on the parties' preference divergence. Abstracting from communication, Li (2001) studies information acquisition by team members and shows that committing to a conservative decision rule ex ante can alleviate free-riding problems that afflict information gathering incentives.

communication between the CEO and the board takes the form of cheap talk—that is, the board acts sequentially rationally to any report received from the CEO—whereas this paper studies the consequences of the board having commitment power when dealing with the CEO.

Our model entails three risk-neutral players: shareholders, the CEO, and the board of directors. The firm faces an investment decision. The CEO is endowed with noisy private information regarding the efficient scale of the investment. The shareholders are passive; their role is confined to assembling the board and designing its compensation contract. The board holds the decision rights and aims to learn about the environment. For given economic state, ω, and scale of the investment, y, the realized firm value—or NPV—is

$$\pi(y, \omega) \equiv \omega y - \frac{y^2}{2}.$$

In our setting where an investment is to be adapted to a realized state, it is useful to restate the NPV—and, later on, the player's expected payoffs—as the net of some base profit and a quadratic (maladaptation) loss term: $\pi(y, \omega) = \frac{1}{2}\omega^2 - \frac{1}{2}(y - \omega)^2$. Hence, the NPV-maximizing investment is $y^*(\omega) = \omega$.

At the outset, the shareholders and the board only know that the state ω is either low or high, $\omega \in \{L, H\},\ H > L > 0$, with each state equally likely. Let

$$\Lambda_\emptyset \equiv Var(\omega) = \frac{(H - L)^2}{4}$$

denote the unconditional variance, or *prior information loss*. The CEO privately learns a signal s about ω. We normalize the signal space to coincide with the state space, $s \in \{L, H\}$. The signal is correct with probability $Pr(s = \omega \mid \omega) = q \in \left(\frac{1}{2}, 1\right]$. We label q the CEO's precision. Then

$$\Lambda_s \equiv \mathbb{E}_s[Var(\omega \mid s)] = q(1 - q)(H - L)^2$$

is the expected posterior variance conditional on the signal s being available, or the *expected posterior information loss*. Also, denote by

$$\Delta \equiv \mathbb{E}[\omega \mid s = H] - \mathbb{E}[\omega \mid s = L] = (2q - 1)(H - L) \tag{1}$$

the updating impact of the CEO's signal.

The board can engage in *information gathering effort*, $e \in [0, 1]$ at cost $C(e) = \frac{ce^2}{2},\ c > 0$. We normalize e to equal the probability that the board *perfectly* discovers the state ω. This model feature aims to capture the dual nature of information gathering by the board: to monitor and to improve on the collectively available information (value-adding activity) by removing the residual uncertainty in the CEO's information endowment. The CEO's signal precision, q, is an *ex-ante* measure of both the information asymmetry and of the relative importance of board monitoring (relative to value-adding activities).

To focus on the optimal incentive provision for the board, we suppress any explicit agency problems and compensation issues at the CEO level. Instead, we assume, in reduced form, that the CEO is an empire builder who maximizes a linear combination of NPV and investment scale:

$$\pi(y, \omega) + by. \tag{2}$$

Expressed in quadratic loss terms, we have $\pi(y, \omega)+by = \frac{1}{2}(\omega+b)^2 - \frac{1}{2}(y-\omega-b)^2$, which suggests that the CEO's preferred investment level is $\omega + b$. We refer to b as the (known) *CEO bias*, and we assume $b > 0$, without loss of generality.

The shareholders compensate the board with a fixed payment F and an equity stake $\alpha \in [0, 1]$, so their residual claim is

$$\begin{aligned} U_S &= (1-\alpha)\pi(\cdot) - F \\ &= (1-\alpha)\left[\frac{1}{2}\omega^2 - \frac{1}{2}(y-\omega)^2\right] - F. \end{aligned} \tag{3}$$

In line with compensation practice, we assume throughout that $\alpha \in [0, 1]$ and $F \geq 0$. The board values compensation, derives nonpecuniary utility of $\bar{\beta} \in \mathbb{R}$ per unit of the investment, and incurs disutility from exerting effort:

$$\begin{aligned} U_B &= \alpha\pi(\cdot) + F + \bar{\beta}y - C(e) \\ &= \alpha\left[\frac{1}{2}(\omega+\beta)^2 - \frac{1}{2}(y-\omega-\beta)^2\right] + F - \frac{ce^2}{2}, \quad \text{for } \beta \equiv \frac{\bar{\beta}}{\alpha}. \end{aligned} \tag{4}$$

It is notationally convenient to work with the *scaled* bias term $\beta \equiv \bar{\beta}/\alpha$, henceforth simply referred to as *board bias*. By individual rationality, the board's expected utility has to exceed its reservation utility, which we normalize to zero.[10]

As in Baldenius et al. (2019), we assume the shareholders can choose the board bias, β: when the shareholders assemble the board, there are observable characteristics that indicate the candidates' nonpecuniary preference over investment decisions.[11] We refer to the board as *unbiased* if $\beta = 0$, as *friendly* if $\beta > 0$ (for example, social ties, insiders, or directors who themselves are empire builders), and as *antagonistic* (to the CEO) if $\beta < 0$ (for example, directors who represent debtholders or those who are overly concerned with the reputational risk associated with large projects).

Given any available information Ω, the players' preferred investment levels are, respectively: $y_S(\Omega) = \mathbb{E}[\omega \mid \Omega]$ for the shareholders, $y_C(\Omega) = \mathbb{E}[\omega \mid \Omega] + b$ for the CEO, and $y_B(\Omega) = \mathbb{E}[\omega \mid \Omega] + \beta$ for the board. If the board uncovers ω, it will choose $y_B(\omega) = \omega + \beta$ and thus realize its bliss point. If information gathering fails, the board will choose investment level $\bar{y}$, which may depend nontrivially on the communication game played with the CEO.

The timeline is given in Fig. 1. At Date 0, the shareholders pick (α, F, β). The board chooses information gathering effort e, at Date 1, and the investment y, at Date 2. If information gathering succeeds, this results in the board's preferred investment

[10] As we show below, the board's individual rationality constraint is always slack at the optimal solution. Hence, there are no "money pump" issues in our setting. That is, the shareholders cannot extract, at the margin, any nonpecuniary benefits they endow the board with.

[11] It is a standard assumption in the literature that the owner of the firm can control some key preference parameters of the board—more generally, of some intermediary—when dealing with management, for example, Dessein (2002), Drymiotes (2007), and Chakraborty and Yilmaz (2017).

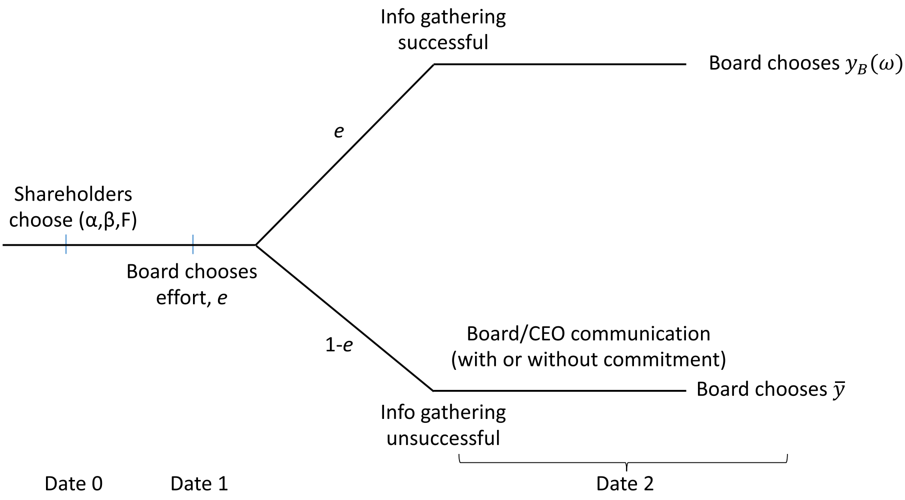


Fig. 1 Game Tree

$y_B(\omega)$; otherwise, $\bar{y}$ will be based on a report by the CEO. It is at this communication stage where board commitment matters.

We now characterize the shareholders' problem. Because our goal is to isolate the effects of board commitment on the equilibrium outcome, we begin by describing the contracting problem faced by the shareholders generically for any *commitment regime* $k \in \{c, nc\}$, as shorthand for "commitment" and "noncommitment" (cheap talk), with subscript $j \in \{S, B, C\}$ for "shareholders," "board," and "CEO," respectively. Let

$$\bar{\ell}_j^k(\beta, b) = \frac{1}{2} \sum_{s,\omega} Pr(s, \omega) \left[\bar{y}^k(r^k(s)) - \omega - x_j\right]^2, \tag{5}$$

denote player j's expected loss for commitment regime k, conditional on *unsuccessful* information gathering by the board. Here $r^k(s)$ is the CEO's equilibrium reporting strategy, as described below, and

$$x_j = \begin{cases} 0, & \text{for } j = S \\ \beta, & \text{for } j = B \\ b, & \text{for } j = C \end{cases}$$

is the player's respective bias. Denote by $\ell_j(\beta, b)$ the corresponding expected loss, conditional on *successful* information gathering, which equals the term in Eq. 5 with $y_B(\omega)$ substituted for $\bar{y}^k(r^k(s))$. Having learned the state ω, the board chooses its bliss point $y_B(\omega) = \omega + \beta$, resulting in losses of $\ell_B = 0$ for itself, $\ell_S = \frac{\beta^2}{2}$ for the shareholders, and $\ell_C = \frac{(b-\beta)^2}{2}$ for the CEO, respectively.

At Date 1, the board chooses its information gathering effort e to maximize its expected payoff as per Date 1, which by Eq. 4 reads:

$$EU_B^k(e \mid \alpha, \beta, F) = \alpha \left(\frac{1}{2}\mathbb{E}_\omega[(\omega+\beta)^2] - (1-e)\bar{\ell}_B^k(\beta, b) \right) + F - \frac{ce^2}{2}. \quad (6)$$

Thus the board's optimal effort $e^k(\alpha, \beta)$ is determined by the first-order condition

$$e^k(\alpha, \beta) = \frac{\alpha}{c}\bar{\ell}_B^k(\beta, b). \quad (7)$$

The induced effort is increasing in the board's equity stake, α, and its "cost of ignorance," $\bar{\ell}_B^k(\cdot)$. This reflects the substitutive nature of the two information channels: a board that expects to learn valuable information through communication has little incentive to exert costly effort. Moreover, the incentive constraint Eq. 7 displays *complementarity*: the greater the board's cost of ignorance, the more effectively an increase in α elicits board effort *at the margin*. Let $EU_B^k(\alpha, \beta, F) \equiv EU_B^k(e^k(\alpha, \beta) \mid \alpha, \beta, F)$ denote the board's value function under commitment regime k.

At the outset, the shareholders assemble and contract with the board. Anticipating the board's effort choice and the communication game if the board remains uninformed, for any CEO bias b, the shareholders choose (α, β, F) to maximize their expected Date-0 utility, which by Eq. 3 reads:

$$EU_S^k(\alpha, \beta, F) = (1-\alpha)\left(\frac{1}{2}\mathbb{E}_\omega[\omega^2] - e^k(\alpha, \beta)\ell_S(\beta) - [1-e^k(\alpha, \beta)]\bar{\ell}_S^k(\beta, b)\right) - F. \quad (8)$$

At Date 0, for commitment regime $k \in \{c, nc\}$, the shareholders solve the program:

$$\mathcal{P}^k : \max_{\alpha\in[0,1],\ \beta\in\mathbb{R},\ F\in\mathbb{R}_+} EU_S^k(\alpha, \beta, F),$$

$$\text{subject to:} \quad EU_B^k(\alpha, \beta, F) \geq 0. \quad \text{(IR)}$$

We denote the solution to Program $\mathcal{P}^k$ by (α^k, β^k, F^k). To ensure interior board efforts and equity shares, we assume $q < \bar{q}$, for some $\bar{q} \in \left(\frac{1}{2}, 1\right)$, and $c \in (c_1, c_2)$. See Appendix B for closed-form expressions for these bounds.

We first state a preliminary result that holds for both commitment regimes.

Lemma 1 *In the solution to Program $\mathcal{P}^k$, $F^k = 0$, and the board's individual rationality constraint is slack, for any $k \in \{c, nc\}$.*

All proofs are provided in the Appendix. As we show there, by simply choosing zero effort and an investment level that relies solely on its prior, the board could secure a nonnegative expected payoff for any $F \geq 0$. Therefore, the board's individual rationality constraint will be slack, and $F^k = 0$, in equilibrium.

When choosing the board bias, the shareholders anticipate that, by Eq. 8, β affects their expected payoff through three channels: (i) directly through the investment choice made by an informed board, which results in a loss $\ell_S(\beta)$ to the shareholders; (ii) through the board's communication with the CEO when the board is uninformed, which results in a loss $\bar{\ell}_S^k(\beta, b)$ to the shareholders; and (iii) through the board's information gathering effort, $e^k(\alpha, \beta)$ as per Eq. 7, which in turn determines the weights on (i) and (ii). Because information gathering is costly, one might expect the shareholders to give priority to channel (ii) over (iii). However, because the board earns rents in equilibrium (Lemma 1), the shareholders do not need to reimburse the board for any incremental effort cost, making information gathering free *to the shareholders*, at the margin.

These three channels by which board bias affects the outcome apply to both commitment regimes. It is at the communication stage where board commitment makes a difference.

3 Board commitment and communication

Consider the Date-2 communication game between the board and the CEO when the board is uninformed. The typical approach to modeling strategic communication in the boardroom is to assume no commitment power and to invoke techniques developed by Crawford and Sobel (1982) for cheap-talk games. The cheap-talk case was studied by Baldenius et al. (2019): With binary signals, cheap talk is "bang-bang" in nature—if the preferences of the CEO and board regarding the investment level are sufficiently misaligned (specifically, if $b - \beta > \frac{\Delta}{2}$), *babbling* is the unique equilibrium; on the other hand, for $b - \beta \leq \frac{\Delta}{2}$, the CEO reports his information s perfectly, and the board can implement its preferred investment given s. We label the latter outcome *perfect communication* (*PC*) and define

$$\beta_{PC}(b) \equiv b - \frac{\Delta}{2} \tag{9}$$

as the critical board bias level that separates babbling and perfect communication under cheap talk.

If the board has commitment power vis-à-vis the CEO, it designs a report-contingent investment "menu" before eliciting a report from the CEO. As this is equivalent to delegating the decision to the CEO subject to the constraint that he picks an investment level from the menu, we will use the terms "commitment" and "constrained delegation" interchangeably. For given (β, b):

$$\mathcal{SP}^c: \quad \min_{\{y(H), y(L)\}} \sum_{s\in\{H,L\},\omega\in\{H,L\}} Pr(s,\omega)\,(y(s) - \omega - \beta)^2,$$

s.t.:

$$\mathbb{E}_\omega\left[(y(H) - \omega - b)^2 \mid s = H\right] \leq \mathbb{E}_\omega\left[(y(L) - \omega - b)^2 \mid s = H\right], \tag{TT_H}$$

$$\mathbb{E}_\omega\left[(y(L) - \omega - b)^2 \mid s = L\right] \leq \mathbb{E}_\omega\left[(y(H) - \omega - b)^2 \mid s = L\right]. \tag{TT_L}$$

Constraint (TT_s) ensures the CEO truthfully reports his private signal $s = H, L$. If the CEO prefers a larger investment level than the board ($\beta \leq b$), he will always truthfully report if he has observed a high signal; that is, TT_H is slack. The potentially binding truthtelling constraint is TT_L, which disciplines the CEO's reporting if he has observed a low signal. To simplify the exposition, for now, we assume that $\beta \leq b$. We will show in Proposition 1 that this ranking of bias levels indeed obtains in equilibrium.

Lemma 2 (Commitment) *At Date 2, for given $\beta \leq b$, suppose the board is uninformed about ω but can precommit to a report-contingent decision rule. Then:*

(a) If $b - \beta \leq \frac{\Delta}{2}$, then $\bar{y}^c(r) = \beta + \mathbb{E}[\omega \mid r]$, and the CEO's report fully reveals s, implementing perfect communication.
(b) If $b - \beta \in \left(\frac{\Delta}{2}, \Delta\right]$, then $\bar{y}^c(r = L) = b + \mathbb{E}[\omega \mid L] - \frac{\Delta}{2}$ and $\bar{y}^c(r = H) = b + \mathbb{E}[\omega \mid L] + \frac{\Delta}{2}$, and the CEO's report fully reveals s, implementing "constrained communication" (CC).
(c) If $b - \beta > \Delta$, then the board commits to ignoring any CEO report and invests according to its prior, $\bar{y}^c(r) = \mathbb{E}[\omega] + \beta$, implementing babbling.

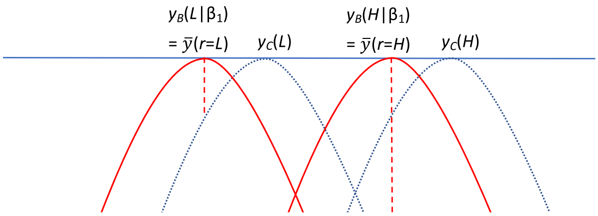
While a board with commitment power can always induce the CEO to report obediently, the players' preference alignment determines the cost of ensuring truthtelling. Figure 2 depicts the loss functions of the board (red, solid) and the CEO (blue, dashed) to illustrate the communication outcome under the two commitment regimes for decreasing board bias levels β_1 through β_3. A board that is closely aligned with the CEO (β_1 in Fig. 2a) achieves *perfect communication* even with cheap talk because, having observed a low signal, the CEO prefers the board's bliss point investment $y_B(L)$ to $y_B(H)$. Commitment trivially replicates this outcome: the board simply asks the CEO to pick from among its own (the board's) preferred investment levels. As the board bias decreases to $\beta_{PC}(b)$, TT_L becomes binding (Fig. 2b). As β decreases further to β_2 (Fig. 2c), cheap talk collapses to babbling: if the board were to believe the CEO's report, the CEO would always report H. A board that has commitment power, however, lets the CEO choose between investment levels $\{\bar{y}(r)\}$ that deviate from its (the board's) bliss points by an amount ε so as to keep the CEO indifferent upon observing a low signal—the *constrained communication* (CC) case, Lemma 2b. For very low board bias, $\beta_3 < \beta_{CC}(b)$, where

$$\beta_{CC}(b) \equiv b - \Delta, \tag{10}$$

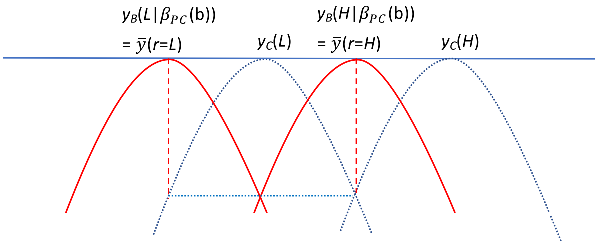
the distortions at the incentive-compatible investment levels outweigh the value of the CEO's signal. The board then is better off investing according to its prior, that is, $\bar{y} = \beta + \mathbb{E}[\omega]$, resulting in *babbling* (Fig. 2d), as under cheap talk.

By revealed preference, commitment power on the part of the receiver weakly improves information transmission, all else equal—but what is the nature of the improvement? Fig. 3a,c complements the preceding discussion by depicting the resulting investments in (β, y)-space, using the same β-levels as in Fig. 2.[12] Recall that, for intermediate alignment levels ($\beta \in (\beta_{CC}(b), \beta_{PC}(b)]$), cheap talk results in

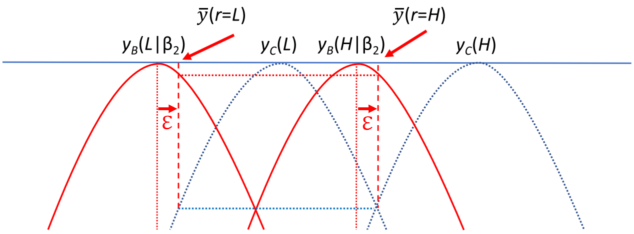
[12]For $\beta < \beta_{PC}(b)$, cheap talk collapses; for example, at β_2, the CEO prefers $y_B(H)$ to $y_B(L)$, as expressed by $\overline{AC} < \overline{CB}$ in Fig. 3a. Constrained delegation under commitment remains feasible by committing to the investment menu $\{y_C(L) - \Delta/2,\ y_C(L) + \Delta/2\}$. At $\beta_{CC}(b)$, the distortions associated with this menu, as given by ($\overline{DF}$, $\overline{EG}$) equal the value of the CEO's signal ($\overline{EF}$, $\overline{EG}$); see Fig. 3c. As β decreases further, say to β_3, the investment schedule with commitment collapses to the babbling one, as under cheap talk.



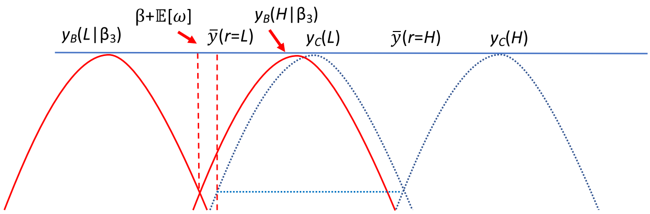
a) Perfect communication between board (solid-red) and CEO (dashed-blue) for large β



b) Knife-edge case: TT_L becomes binding at $\beta = \beta_{PC}(b)$



c) Intermediate alignment, $\beta \in (\beta_{CC}(b), \beta_{PC}(b)]$: babbling with cheap talk; constrained communication with board commitment



d) Babbling for small β, because constrained communication would be too costly

Fig. 2 Loss terms: deterioration of communication as β decreases for given b

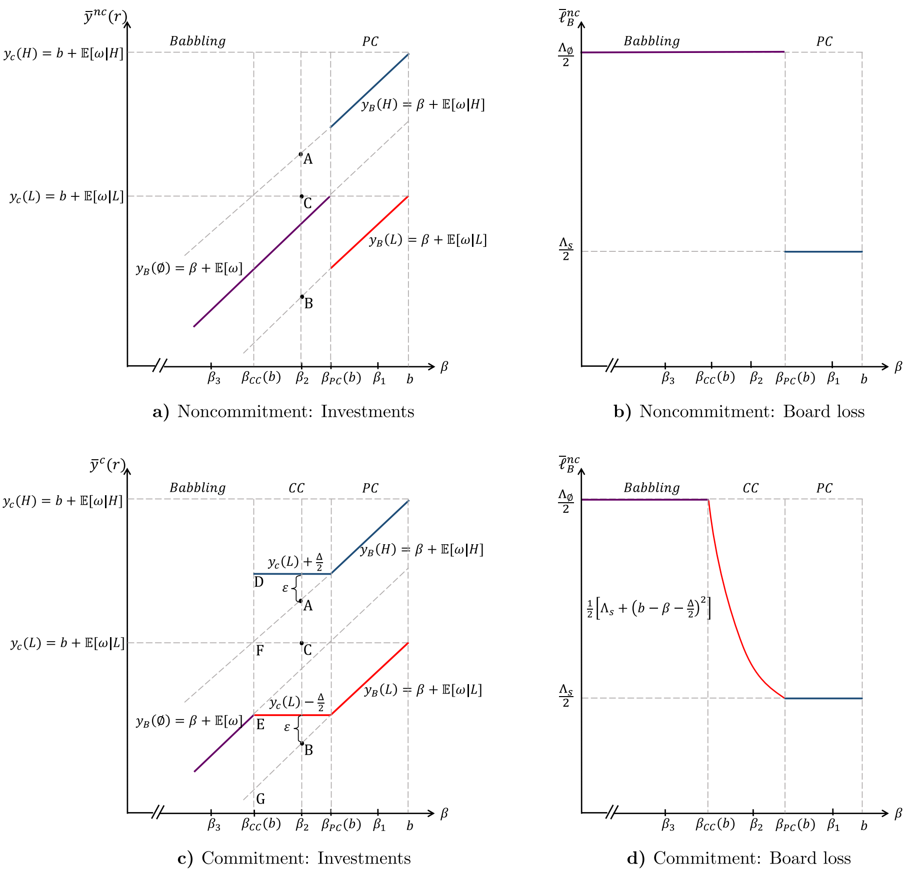


Fig. 3 The Effect of Board Commitment on Communication Outcome

babbling, whereas constrained delegation makes the investment schedule continuous. Thus, commitment replaces a discontinuous jump in the board's cost of ignorance at $\beta_{PC}(b)$ with a gradual increase in investment distortion cost as the CEO/board alignment deteriorates, that is, as β decreases (contrast Fig. 3b, d). Table 1 summarizes the investment decisions and the players' loss terms. (See the proof of Lemma 2 for derivations.)

Formal decision rights in our model rest with the board. Hence, the equilibrium investments are generally anchored on the board's preferred investment scale, given its information at Date 2. With cheap talk this is always the case; not so with commitment. Whenever constrained delegation strictly improves the information flow (that is, for $\beta \in (\beta_{CC}(b), \beta_{PC}(b)]$), the investment will be anchored on the CEO's preferred investment level, as $\bar{y}^c(\cdot)$ then is dictated by the CEO's binding truthtelling constraint. The attendant strict payoff improvement to the board, however, affects its incentive to learn about the firm's state through costly effort. We therefore return to the full-fledged model with information gathering. The feature that, for intermediate preference alignment, investments under constrained delegation reflect the CEO's

Table 1 Outcomes conditional on unsuccessful information gathering

	PC (Perfect Communication) $b-\beta \in \left[0, \frac{\Delta}{2}\right]$	*CC* (Constrained Communication) $b-\beta \in \left(\frac{\Delta}{2}, \Delta\right]$	*Babbling* $b-\beta > \Delta$
Investment, $\bar{y}^c(r^c = s)$	$\mathbb{E}[\omega \mid s] + \beta$	$b + \mathbb{E}[\omega \mid L] + \left(\mathbb{1}_{s=H} - \frac{1}{2}\right)\Delta$	$\mathbb{E}[\omega] + \beta$
Board's loss, $\bar{\ell}^c_B$	$\frac{1}{2}\Lambda_s$	$\frac{1}{2}\left[\Lambda_s + (b - \beta - \frac{\Delta}{2})^2\right]$	$\frac{1}{2}\Lambda_\emptyset$
Shareholders' loss, $\bar{\ell}^c_S$	$\frac{1}{2}(\Lambda_s + \beta^2)$	$\frac{1}{2}\left[\Lambda_s + (b - \frac{\Delta}{2})^2\right]$	$\frac{1}{2}(\Lambda_\emptyset + \beta^2)$

a) Commitment (Constrained Delegation)

	PC $b-\beta \in \left[0, \frac{\Delta}{2}\right]$	*Babbling* $b-\beta > \frac{\Delta}{2}$
Investment, $\bar{y}^{nc}(r^{nc})$	$\mathbb{E}[\omega \mid r^{nc} = s] + \beta$	$\mathbb{E}[\omega] + \beta$
Board's loss, $\bar{\ell}^{nc}_B$	$\frac{1}{2}\Lambda_s$	$\frac{1}{2}\Lambda_\emptyset$
Shareholders' loss, $\bar{\ell}^{nc}_S$	$\frac{1}{2}(\Lambda_s + \beta^2)$	$\frac{1}{2}(\Lambda_\emptyset + \beta^2)$

b) Noncommitment (Cheap Talk)

(not the board's) preference will play an important role in determining the optimal board bias.

4 Equilibrium effects of board commitment

We now turn to the shareholders' problem at Date 0, when assembling and contracting with the board, taking into account the board's information gathering incentives and the communication game that ensues if the board remains uninformed. The cheap-talk case was studied by Baldenius et al. (2019); we borrow their characterization of the outcome.

Proposition 0 (Noncommitment—the solution to Program $\mathcal{P}^{nc}$) *With cheap talk, there exists a unique CEO precision level q_o such that:*

(a) ***High-q:*** *For $q > q_o$, there exists a CEO bias level $b_o(q) \in \left(\frac{\Delta}{2}, \Delta\right)$, such that:*

(i) *The optimal board bias $\beta^{nc}(b)$ is weakly friendly:*

- *For $b < b_o(q)$, $\beta^{nc}(b) = \max\{0, b - \frac{\Delta}{2}\} \geq 0$, implementing perfect communication;*
- *For $b \geq b_o(q)$, $\beta^{nc}(b) = 0$, implementing babbling.*

(ii) *The optimal equity stake $\alpha^{nc}(b)$ is monotonically nondecreasing with a discrete jump up at $b_o(q)$.*

(b) ***Low-q:*** *For $q < q_o$, there exists a CEO bias level $b_o(q) < \frac{\Delta}{2}$, such that:*

(i) *The optimal board bias $\beta^{nc}(b)$ is weakly* <u>*antagonistic*</u>*:*

- * *For $b \leq b_o(q)$, $\beta^{nc}(b) = 0$, implementing perfect communication;*
- * *For $b > b_o(q)$, $\beta^{nc}(b) = \min\{0, b - \frac{\Delta}{2} - \delta\} \leq 0$, for some $\delta \to 0$, implementing babbling.*

(ii) *The board's equity stake $\alpha^{nc}(b)$ jumps up at $b_o(q)$, is nondecreasing for any $b \notin \left(b_o(q), \frac{\Delta}{2}\right)$, but strictly decreasing for any $b \in \left(b_o(q), \frac{\Delta}{2}\right)$.*

With cheap talk, the board makes the investment decision in a sequentially rational manner by implementing its preferred investment based on its information. Since the board's preferred investment level deviates from that of the shareholders by β, both shareholders and the board equally internalize any information loss, but the shareholders additionally face an investment distortion ("bias cost") of $\frac{1}{2}\beta^2$ (see Table 1b). While the shareholders' bias cost is minimized at $\beta = 0$, biasing the board may yield informational benefits: increasing β improves the preference alignment between the CEO and the board, and thus may enhance communication. This, however, would come at the cost of reduced effort incentives: by Eq. 7, a board that anticipates to learn the CEO's information for free has less incentive to gather information themselves. The direction of any board bias therefore trades off information gathering and communication benefits. For precise CEO signals ($q > q_o$), communication is valuable, pushing toward a weakly friendly board. Conversely, for $q < q_o$, communication is less valuable, which pushes toward a weakly antagonistic board, as a way to block communication and thus stimulate information gathering by the board.[13]

Our next result describes the solution to the board commitment case:

Proposition 1 (Commitment—the solution to Program $\mathcal{P}^c$) *If the board can commit to a report-contingent investment rule, then:*

(i) *The optimal board bias $\beta^c(b)$ is continuous, single-troughed, and always weakly* <u>*antagonistic*</u>*:*

- *For $b \leq \frac{\Delta}{2}$, $\beta^c(b) = 0$, implementing perfect communication;*
- *For $b \in (\frac{\Delta}{2}, \Delta)$, $\beta^c(b) = \max\{\beta^{int}(b), b - \Delta\} < 0$, implementing constrained communication, with $\beta^{int}(b)$ uniquely determined by*

$$\left(b - \frac{\Delta}{2} - \beta^{int}(b)\right)^2 \left(b - \frac{\Delta}{2} + 2\beta^{int}(b)\right) = -\left(b - \frac{\Delta}{2}\right) \Lambda_s. \tag{11}$$

- *For $b \geq \Delta$, $\beta^c(b) = 0$, implementing babbling.*

[13]We postpone any discussion of the board's optimal equity stake until after Proposition 1, which gives the solution for the board commitment scenario.

(ii) *The optimal equity stake $\alpha^c(b)$ is continuous and monotonically nondecreasing.*

Why should a board that has commitment power always be weakly antagonistic? This follows from a confluence of the two key ways in which board commitment affects the communication game, as developed in Section 3: (a) for intermediate CEO/board alignment, constrained delegation yields investments that are ultimately anchored on the CEO's, not the board's, preferences; (b) commitment smoothes out any discontinuity in the board's cost of ignorance.

First, note that an antagonistic board bias is optimal if and only if constrained communication obtains in equilibrium, which is the case for intermediate CEO bias. Invoking again the three generic channels by which β affects the outcome, we find that lowering β, starting from zero, then (i) yields only a second-order loss to shareholders if the board becomes informed, (ii) yields no additional loss to shareholders if the board remains uninformed (and resorts to constrained delegation), but (iii) elicits strictly greater board information gathering effort. The interior solution, $\beta^{int}(b) < 0$, trades off the three channels.[14] To understand channels (ii) and (iii), recall that the investment decision under constrained delegation is dictated by the CEO's binding truthtelling constraint and thus is anchored on the CEO's preference. Injecting an antagonistic board bias increases the preference divergence between the CEO and the board (which by Eq. 7 drives board effort), while leaving unchanged the alignment between the CEO and the shareholders (which drives $\bar{\ell}_S$). Because the board earns rents in equilibrium, the incremental board effort is free to the shareholders, at the margin.

For more extreme CEO bias levels ($b < \frac{\Delta}{2}$ or $b > \Delta$), introducing a small board bias has no impact on communication or board effort, because the board's cost of ignorance $\bar{\ell}^c_B(\beta, b)$ then is independent of β (Table 1a). Hence, a small board bias fails to generate additional information for the board to act on, while causing a bias cost. The shareholders thus will assemble an unbiased board.

The preceding discussion was confined to board bias levels that are "local" in that they leave unaffected the communication case. With cheap talk, whenever the optimal board bias was nonzero, it was chosen by the shareholders for the express purpose of "jumping" between communication cases—either to facilitate perfect communication in the high-q case or to block communication (and thus foster board effort) in the low-q case. As we show in the Appendix, however, such jumps are never optimal with commitment: any potential benefits in terms of improved communication or board effort would be outweighed by the attendant bias cost. This is a direct consequence of commitment smoothing out any discontinuity in the board's cost of ignorance—and thus in board effort—that was present in the cheap talk case (Fig. 3b, d). Hence, with board commitment, it is sufficient to consider only local (within-case) changes in β.

[14] We show in the Appendix that, as the CEO bias reaches some threshold $\tilde{b}$, this interior solution would result in a preference divergence $b - \beta^{int}(b)$, exceeding the updating value of the CEO's signal, Δ—so the CEO would no longer be willing to share his information. For $b \in (\tilde{b}, \Delta)$, the shareholders thus select the board bias that just ensures constrained communication; that is, $\beta^c(b) = \beta_{CC}(b)$.

We now turn to monetary (equity) incentives for the board. Because the board's individual rationality constraint is slack at $F^k = 0$, under either commitment regime, the board's optimal equity stake trades off effort incentives and dilution concerns. In general, both forces push toward a positive relation between CEO bias and α: all else equal, more severe CEO bias (i) dampens the dilution cost of α by decreasing firm value and (ii) increases the board's cost of ignorance. The latter in turn makes equity a more powerful incentive instrument, because of the complementarity of α and $\bar{\ell}_B$ in eliciting board effort, by Eq. 7.[15]

Empirical research in corporate governance has long been plagued by endogeneity problems, especially as it has aimed to link board characteristics, such as friendliness, to economic outcomes. Our model helps illustrate some of the underlying mechanisms. A comparison of Propositions 0 and 1 sheds light on the effect of board commitment power on communication efficiency, *in equilibrium*. For given board bias, commitment power weakly improves communication. Our next result asks whether the *inherent* communication advantage of board commitment remains intact with endogenous board bias, and it addresses the implications for board equity incentives and effort, in equilibrium.

Corollary 1 (Equilibrium communication, board equity stakes and effort) *With endogenous board bias:*

(a) *For $q \geq q_o$ and $b \in \left(\frac{\Delta}{2}, b_o(q)\right)$, board commitment impedes communication in equilibrium in that $\bar{\ell}^c_B(\beta^c(b), b) > \bar{\ell}^{nc}_B(\beta^{nc}(b), b)$; moreover, $\alpha^c(b) > \alpha^{nc}(b)$ and $e^c(b) > e^{nc}(b)$.*

(b) *In all other cases, board commitment weakly improves communication in equilibrium in that $\bar{\ell}^c_B(\beta^c(b), b) \leq \bar{\ell}^{nc}_B(\beta^{nc}(b), b)$; moreover, $\alpha^c(b) \leq \alpha^{nc}(b)$ and $e^c(b) \leq e^{nc}(b)$.*

For the case of high ex-ante information asymmetry ($q \geq q_o$), the board should be weakly friendly under cheap talk, emphasizing communication, but weakly antagonistic with commitment, emphasizing board effort. The endogenous board bias then may overturn the ranking of communication efficiency. For intermediate levels of CEO bias, that is, $b \in \left(\frac{\Delta}{2}, b_o(q)\right)$, an antagonistic board with commitment power finds itself at a communication *disadvantage*, compared with a friendly board that has to rely on cheap talk. That is, the *inherent* communication advantage of board commitment does not translate into better information flow, *in equilibrium*. In all other cases, board commitment power ultimately improves communication, in that $\bar{\ell}^c_B(\beta^c(b), b) \leq \bar{\ell}^{nc}_B(\beta^{nc}(b), b)$.[16]

[15] There is one exception in which the board's equity stake is locally decreasing in CEO bias: with cheap talk, for low CEO precision and CEO bias values that call for the board to be antagonistic (Proposition 0, part b-ii), the level of board antagonism required to block communication becomes smaller in absolute terms as the CEO bias increases, which implies the investment distortion decreases in the CEO bias, locally, exacerbating the dilution concerns.

[16] As we show in Section 5, the endogeneity of the board bias can overturn the communication efficiency only if board effort is effective. If the board could learn only through communication, then board commitment would never hamper the information flow even with endogenous board bias.

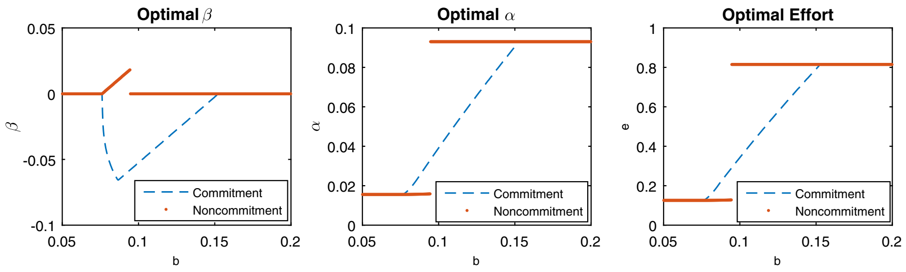
As argued above, the board's equity stake trades off information gathering effort incentives and dilution costs. Corollary 1 shows that the equilibrium equity stake and the resulting information gathering effort are determined in a one-to-one fashion by the anticipated efficiency of communication, in equilibrium. This illustrates the importance of the complementarity between cost of ignorance and equity incentives in eliciting board effort, as per the effort incentive constraint Eq. 7. The greater the cost of ignorance to the board, $\bar{\ell}_B^k(\beta^k(b), b)$, the more effective is the equity stake in eliciting board effort, at the margin, thereby calling for a higher α. Correspondingly, board effort will also be higher.

The discussion in this section sheds light on the theme of endogeneity that afflicts empirical research on boards. All else equal, a board that has commitment power indeed has weaker effort incentives. In equilibrium, however, the endogenous nature of board bias may flip this prediction in some cases. Figure 4 provides an illustration of the effects of board commitment on the key endogenous constructs, using a numerical example. Faleye (2007) and Gal-Or et al. (2016) find staggered boards to be associated with lax monitoring. Taking staggering as one mechanism that fosters board commitment, this result may reflect that staggered boards feel less need to monitor, because they can communicate more effectively with management. Our results suggest that sharper empirical results may be obtained by controlling for information asymmetry at the firm level when testing the link between staggering and monitoring intensity.[17]

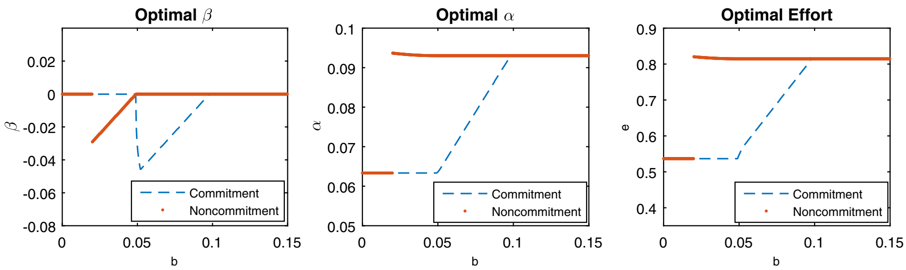
5 The value of board commitment

This section draws implications from our results and asks whether commitment power on the part of the board benefits the shareholders. In generic sender-receiver games, by revealed preference, commitment power always weakly benefits the receiver, all else equal: he can replicate the cheap talk outcome by precommitting to the sequentially optimal decision rule. In a tripartite setting, it is not generically true that a third party, such as the employer of the sender and receiver, will benefit from commitment on the part of the receiver. In our model, it is the *board* (an intermediary) that may have commitment power, whereas we are mainly concerned with the expected payoff to the *shareholders*. Nonetheless, the shareholders appoint the board and can tailor its financial and nonpecuniary incentives (α and β) to the prevailing commitment regime. Does this added degree of freedom imply that the shareholders ultimately benefit from the board's commitment power? We now show that the answer depends on the severity of underlying information asymmetry, that is, the precision of the CEO's signal. To that end, we proceed in two steps. We begin by assuming information gathering is ineffective to focus solely on the communication subgame, and then assess the effect of board commitment on shareholder value in the full-fledged model.

[17] All results derived for the scaled board bias, β, go through qualitatively also for the unscaled ("raw") board bias $\bar{\beta}^k(b) \equiv \alpha^k(b) \cdot \beta^k(b)$. Details are available upon request.



a) **"High-q"**: (β^k, α^k, e^k), $k = c, nc$, for $H = 1$, $L = 0.455$, $c = 0.00424$, $q = 0.64$.



b) **"Low-q"**: (β^k, α^k, e^k), $k = c, nc$, for $H = 1$, $L = 0.455$, $c = 0.00424$, $q = 0.59$.

Fig. 4 Illustration of Corollary 1: Solid Lines Depict Noncommitment; Dashed Lines Depict Commitment

5.1 Value of Commitment if Board Effort is Ineffective

Consider the special case where the board cannot effectively gather information, so the only channel for it to learn about the firm's environment is through communicating with the CEO. If the board were unbiased, for exogenous reasons, then the shareholders would be better off with a board that has commitment power (Table 1). Even if the shareholders can choose β in their best interest, it is easy to see that board commitment will always leave them at least weakly better off. For any optimal β^{nc} under cheap talk, by choosing the same board bias also under commitment, the shareholders can weakly improve the communication efficiency. The remaining question is: is the preference for board commitment a strict one?

If the board can commit to a report-contingent investment rule, but cannot gather information on its own, then at Date 2 the shareholders are best served by an unbiased board ($\beta^c = 0$) that fully internalizes their objective. For noncommitment, adapting arguments in Dessein (2002) and Baldenius et al. (2019) show that

$$\beta^{nc}(b) = \left\{ \begin{array}{ll} 0, & \text{for } b \notin \left(\frac{\Delta}{2}, \Delta\right) \\ \beta_{PC}(b), & \text{for } b \in \left(\frac{\Delta}{2}, \Delta\right) \end{array} \right\}, \text{ absent information gathering.} \quad (12)$$

Without board effort, the optimal board bias under cheap talk is always weakly friendly, and strictly so for intermediate CEO bias levels: the communication benefit then outweighs the attendant bias cost.[18] (Recall that the sole rationale for the shareholders ever to assemble an antagonistic board in the full-fledged model was to endow it with strong effort incentives.)

We now evaluate the value of board commitment to the shareholders in this model variant without board effort. The following result requires no proof (simply plug the optimal board bias levels $\beta^k(b),\ k = c, nc$, into the loss terms in Table 1):

Proposition 2 (Replication result) *Suppose information gathering is infeasible. Then, given the optimal board bias levels of $\beta^c(b) \equiv 0$ and $\beta^{nc}(b)$, as in Eq. 12, the resulting loss to the shareholders is the same across the commitment regimes: $\bar{\ell}_S^{nc}\left(\beta^{nc}(b), b\right) = \bar{\ell}_S^c\left(\beta^c(b) = 0, b\right)$.*

In the special case where information gathering is ineffective, board commitment is of no value to the shareholders, provided board bias can be chosen endogenously. By assembling a suitably friendly board, the shareholders can replicate the board commitment outcome with cheap talk. This replication result is surprising insofar as board commitment offers more degrees of freedom: to ensure truthtelling by the CEO, the (optimally unbiased) board, acting in the interest of shareholders, can build *state-dependent distortions* into the menu of investment levels. With cheap talk, in contrast, the shareholders have only one instrument at their disposal—the board bias—to be chosen ex ante, *independent of the state realization*. However, given the symmetric prior distribution (both states are equally likely), the distortions built into the investment menu by a board that can precommit are indeed the same for each signal, and they equal those resulting from a friendly board choosing its bliss point in a sequentially rational manner.[19] Hence a friendly board perfectly substitutes for lack of commitment in this special case.

5.2 Value of Commitment with Information Gathering

We now ask whether the shareholders benefit from the board's commitment power in the full-fledged model with information gathering. To recapitulate: for given board and CEO bias, board commitment weakly improves communication; better information flow comes at an opportunity cost of reduced effort incentives for the board; the picture is further complicated by the endogenous nature of board bias (and equity grants), which, by Corollary 1, may flip the predicted communication effect of commitment power. To evaluate the overall effect on shareholder value, we define

$$VoC(b) \equiv EU_S^c(\alpha^c(b), \beta^c(b), F^c \mid b) - EU_S^{nc}(\alpha^{nc}(b), \beta^{nc}(b), F^{nc} \mid b)$$

[18] The CEO bias threshold Δ at which the shareholders give up on communication is derived by equating the communication benefit of facilitating perfect communication of $\frac{1}{2}(\Lambda_\emptyset - \Lambda_s)$ (Table 1) with the attendant bias cost to the shareholders of $\frac{1}{2}(\beta_{PC}(b))^2$.

[19] The symmetry of the prior distribution is important for this replication argument. If the two states occurred with different probabilities, the investment distortions built into the investment menu by a board with commitment power would no longer be identical. The additional degree of freedom associated with board commitment then would have strictly positive value to the shareholders.

as the *value of board commitment* to the shareholders.

Proposition 3 (Value to shareholders of board commitment power)

(a) ***High*** q***:*** *If* $q \geq q_o$*, then* $VoC(b) > 0$ *for any* $b \in \left(\frac{\Delta}{2}, b_o(q)\right)$.
(b) ***Low*** q***:*** *If* $q < q_o$*, then* $VoC(b) < 0$ *for any* $b \in \left(b_o(q), \frac{\Delta}{2}\right)$.

Both parts of this result can be illustrated invoking simple revealed preference arguments by asking: when can board commitment replicate the cheap talk outcome, and when does the converse hold? If the shareholders assemble a friendly board under cheap talk—that is, for high CEO precision ($q \geq q_o$) and intermediate CEO bias—they do so with the sole purpose of facilitating perfect communication. This outcome can be replicated with board commitment simply by setting $\beta^c \equiv \beta^{nc}(b)$; hence, the value of commitment is weakly positive in this case. As Proposition 1 shows, the shareholders can do better still by nominating an antagonistic board and granting it more equity to compound its effort incentive.[20]

In contrast, if the shareholders assemble an antagonistic board under cheap talk—that is, for low CEO precision ($q < q_o$) and moderate CEO bias ($b \in \left(b_o(q), \frac{\Delta}{2}\right)$—they do so to block communication and stimulate board effort. This outcome *cannot* be replicated with board commitment: setting $\beta^c \equiv \beta^{nc}(b)$ would still facilitate constrained communication, thereby reducing board effort. In fact, a converse replication argument now applies in that *cheap talk can replicate (and improve upon) the commitment outcome.* With board commitment, the shareholders would assemble an unbiased board, and perfect communication would ensue. The shareholders could replicate this outcome with cheap talk by appointing an equally unbiased board, $\beta^{nc} = \beta^c(b) = 0$, and granting it the same equity stake as under commitment, $\alpha^{nc} = \alpha^c(b)$. By Proposition 0, this is suboptimal; instead the shareholders prefer an antagonistic board under cheap talk, incentivized with more equity. As a result, $VoC(b) < 0$ for CEOs endowed with noisy private information and moderate empire building bias.

Put differently, the shareholders strategically compound the communication handicap under cheap talk by creating discord between board and CEO. This is a particularly effective way to boost board effort, taking advantage of the fact that communication deteriorates rapidly under cheap talk, as the preference divergence increases. Because the board earns rents in equilibrium ($F^k = 0$), board effort is free to the shareholders at the margin. Therefore, board commitment does not necessarily benefit the shareholders, even if they can control the board's financial and nonpecuniary incentives.

[20] An alternative revealed preference argument in favor of board commitment is as follows: Instead of merely replicating the cheap talk outcome by adopting identical board incentives (that is, $\beta^c(b) \equiv \beta^{nc}(b) = \beta_{PC}(b) > 0$ and $\alpha^c_B(b) \equiv \alpha^{nc}_B(b)$), suppose the shareholders nominate an unbiased board, $\beta^c = 0$, for $b \in \left(\frac{\Delta}{2}, b_o(q)\right)$. While still suboptimal, this would leave the shareholders better off than under cheap talk because: (i) they avoid any bias cost conditional on successful information gathering; (ii) they incur the same loss as under cheap talk conditional on unsuccessful information gathering (the replication result, Proposition 2); and (iii) they benefit from greater board effort, holding α fixed (also suboptimally) at $\alpha^{nc}(b)$.

In fact, a necessary condition for commitment to harm shareholders is that the optimal board bias under cheap talk is antagonistic. A necessary condition for an antagonistic board to be optimal, in turn, is that the board may contribute decision-useful information of its own. If the board were to play a pure monitoring role (if it could only ever uncover the CEO's information), the shareholders would never want to block communication between CEO and board. This view, of course, would miss out on an important aspect of the role boards play in practice.

6 Conclusion

This paper revisits the tripartite relationship between shareholders, board, and CEO of a firm in a setting where the board monitors the CEO and may provide additional decision-useful information. While most of the antecedent literature has assumed that strategic communication between the CEO and the board takes the form of cheap talk, we ask whether more formal communication protocols that endow the board with commitment power vis-à-vis the CEO benefit the shareholders. This aims to capture the "constrained delegation" flavor of the board-CEO interaction described by McNulty and Pettigrew (1999) and Useem and Zelleke (2006), and others.

Contrasting board commitment with cheap talk, we establish qualitatively different predictions for the occurrence of friendly and antagonistic boards. All else equal, that is, for given board bias, board commitment improves CEO-board communication. At the same time, board bias has the potential to improve the board's information: a friendly board can communicate better with the CEO; an antagonistic board has stronger information gathering incentives. Acknowledging the endogenous nature of board bias, we find that in settings of high information asymmetry, shareholders tend to use board bias as a way to remedy the lack of commitment: they choose a friendlier board than under commitment to compensate for the inherent communication handicap. In settings of low information asymmetry, shareholders may assemble a more antagonistic board absent board commitment as a way to double-up on the inherent communication handicap and boost the board's incentive to gather information. In that case, lack of board commitment can benefit the shareholders in equilibrium, whereas they prefer board commitment for more severe information asymmetry. Taking staggering as one mechanism that fosters board commitment, this prediction is in line with recent evidence that staggering improves firm value in settings of high information asymmetry.

The nature of communication within the boardroom is not yet well understood. Our model pits against one another two discrete communication regimes that differ as to the commitment power on the part of the receiver of information, that is, the board. It would be desirable if future empirical research could throw further light on the degree of formal communication and decision protocols in practice, even if only in the form of descriptive evidence, and on the association between board staggering and the use of such protocols.

Appendix A: Proofs

Proof of Lemma 1. Note that the board's expected utility if it chooses effort according to Eq. 7 under the communication regime $k = c, nc$ is:

$$EU_B^k(e^k(\alpha,\beta),\alpha,F,\beta,b)=F+\alpha\left[\frac{1}{2}E_\omega[(\omega+\beta)^2]-\left(1-e^k(\alpha,\beta)\right)\bar{\ell}_B^k(\beta,b)\right]-\frac{c(e^k(\alpha,\beta))^2}{2}.$$

Even choosing zero effort would allow the board to break even for any α, F, β, b:

$$\begin{aligned} EU_B^k(e^k(\alpha,\beta),\alpha,F,\beta,b) &\geq EU_B^k(e=0,\alpha,F,\beta,b) \\ &= F+\alpha\left[\frac{1}{2}E_\omega[(\omega+\beta)^2]-\bar{\ell}_B^k(\beta,b)\right] \\ &= F+\alpha\left[\frac{1}{2}\left(\left(\frac{1}{2}+\beta\right)^2+\frac{(H-L)^2}{4}\right)-\bar{\ell}_B^k(\beta,b)\right], \end{aligned}$$

where the first inequality holds by revealed preference, and the last expression is positive for any $F \geq 0$, because $\bar{\ell}_B^k(\beta,b) \leq \frac{(H-L)^2}{8} = \frac{1}{2}\Lambda_\emptyset$. This is because, regardless of the nature of the communication, the information loss to the board is bounded by the prior information loss. Thus the IR constraint is slack at $F = 0$. As a result, the shareholders will optimally set $F^k = 0$. □

Proof of Lemma 2. In the proof, we relax the constraint imposed in the main text that $\beta \leq b$; instead we allow for $\beta \in \mathbb{R}$. With commitment, the uninformed board minimizes its expected loss subject to the CEO's truth-telling constraints.

$$\begin{aligned} \mathcal{SP}^c: \min_{\{y(H),y(L)\}} \quad & \frac{1}{2}q\,(y(H)-H-\beta)^2+\frac{1}{2}(1-q)\,(y(H)-L-\beta)^2 \\ &+\frac{1}{2}q\,(y(L)-L-\beta)^2+\frac{1}{2}(1-q)\,(y(L)-H-\beta)^2, \end{aligned}$$

subject to:

$$\begin{aligned} & Pr(\omega=H\mid s=H)\,(y(H)-H-b)^2+Pr(\omega=L\mid s=H)\,(y(H)-L-b)^2 \\ \leq\; & Pr(\omega=H\mid s=H)\,(y(L)-H-b)^2+Pr(\omega=L\mid s=H)\,(y(L)-L-b)^2, \qquad (TT_H) \\ & Pr(\omega=L\mid s=L)\,(y(L)-L-b)^2+Pr(\omega=H\mid s=L)\,(y(L)-H-b)^2 \\ \leq\; & Pr(\omega=L\mid s=L)\,(y(H)-L-b)^2+Pr(\omega=H\mid s=L)\,(y(H)-H-b)^2. \qquad (TT_L) \end{aligned}$$

We solve the optimization problem in three steps. First, we characterize the optimal separating solution, where $y(H) \neq y(L)$; then, the optimal pooling solution, where $y(H) = y(L)$; lastly, by comparing the two, we find the global optimum. □

Optimal separating solution Without loss of generality, assume $y(H) > y(L)$. Then (TT_H) and (TT_L) can be reduced to:

$$y(H)+y(L)-2b-2E(\omega\mid s=H) \leq 0, \qquad (TT'_H)$$

$$y(H)+y(L)-2b-2E(\omega\mid s=L) \geq 0, \qquad (TT'_L)$$

respectively. Clearly, it cannot be the case that (TT'_H) and (TT'_L) are both binding. Let λ_s represent the Lagrange multiplier for constraint (TT'_s). The Lagrangian then reads as follows:

$$\begin{aligned}\mathcal{L} =& \frac{1}{2}q\,(y(H)-H-\beta)^2+\frac{1}{2}(1-q)\,(y(H)-L-\beta)^2\\ &+\frac{1}{2}q\,(y(L)-L-\beta)^2+\frac{1}{2}(1-q)\,(y(L)-H-\beta)^2\\ &+\lambda_H\,[y(H)+y(L)-2b-2E(\omega\mid s=H)]\\ &+\lambda_L\,[2b-y(H)-y(L)+2E(\omega\mid s=L)]\,.\end{aligned}$$

The first-order conditions are:

$$\frac{\partial\mathcal{L}}{\partial y(H)} = q(y(H)-H-\beta)+(1-q)(y(H)-L-\beta)+\lambda_H-\lambda_L=0, \quad (13)$$

$$\frac{\partial\mathcal{L}}{\partial y(L)} = q(y(L)-L-\beta)+(1-q)(y(L)-H-\beta)+\lambda_H-\lambda_L=0. \quad (14)$$

By Eqs. 13 and 14, we get $y(H)-y(L)=(2q-1)(H-L)=\Delta$. To characterize the optimal separating solution, we prove the following three claims.

Claim 1: (TT'_H) *is always slack for* $b\geq\beta$, *and* (TT'_L) *is always slack for* $b<\beta$.

Suppose (TT'_H) were binding for $b\geq\beta$. Because (TT'_H) and (TT'_L) cannot be binding simultaneously, (TT'_L) must be slack, which, by complementary slackness, implies that $\lambda_L=0$. Then by the binding (TT'_H) constraint, Eqs. 13 and 14 and $\lambda_L=0$, we have:

$$\begin{cases} y(H)=b+E[\omega|s=H]+\frac{\Delta}{2},\\ y(L)=b+E[\omega|s=H]-\frac{\Delta}{2},\\ \lambda_H=-(b-\beta+\frac{\Delta}{2}).\end{cases} \quad (15)$$

For $b\geq\beta$, $\lambda_H=-(b-\beta+\frac{\Delta}{2})<0$, a contradiction. Therefore, for $b\geq\beta$, (TT'_H) has to be slack.

Similarly, if (TT'_L) were binding, then (TT'_H) must be slack and $\lambda_H=0$. Then, by the binding (TT'_L) constraint, Eqs. 13 and 14, and $\lambda_H=0$, we have:

$$\begin{cases} y(H)=b+E[\omega|s=L]+\frac{\Delta}{2},\\ y(L)=b+E[\omega|s=L]-\frac{\Delta}{2},\\ \lambda_L=(b-\beta-\frac{\Delta}{2}).\end{cases} \quad (16)$$

Similar arguments prove that (TT'_L) has to be slack for $b<\beta$.

Claim 2: If $|b-\beta|\leq\frac{\Delta}{2}$, *then both* (TT'_H) *and* (TT'_L) *are slack.* To prove this claim, it suffices to solve a relaxed program that has (TT_L) and (TT_H) removed from $\mathcal{SP}^c$. It is easy to verify that the solution to the relaxed program satisfies both truth telling constraints for $|b-\beta|\leq\frac{\Delta}{2}$.

Claim 3: If $b-\beta>\frac{\Delta}{2}$, *then* (TT'_L) *is binding; if* $b-\beta<-\frac{\Delta}{2}$, *then* (TT'_H) *is binding.* Suppose that (TT'_L) were slack for $b-\beta>\frac{\Delta}{2}$. Then, by complementary slackness, $\lambda_L=0$. At the same time, by Claim 1, for $b-\beta>\frac{\Delta}{2}$, (TT'_H) is also slack, which implies $\lambda_H=0$. Then, by Eqs. 13 and 14, we get $y(H)=\beta+E[\omega|s=H]$

and $y(L) = \beta + E[\omega|s = L]$. Therefore:

$$\begin{aligned} y(H) + y(L) &= 2\beta + E[\omega \mid s = H] + E[\omega \mid s = L] \\ &< 2b + 2E[\omega \mid s = L], \end{aligned} \tag{17}$$

where the inequality uses the fact that $b - \beta > \frac{\Delta}{2}$. Inequality (17) however contradicts (TT'_L). Hence, (TT'_L) is binding for $b - \beta > \frac{\Delta}{2}$, calling for investment amounts as in Eq. 16. Similar arguments show that (TT'_H) is binding for $b - \beta < -\frac{\Delta}{2}$, calling for investment amounts as in Eq. 15.

To summarize, the optimal separating solution is characterized as follows. Denote by ℓ_B^{sep} the board's value function for $y(H) \neq y(L)$. For $|b - \beta| \leq \frac{\Delta}{2}$: $y(r) = \beta + E[\omega \mid s = r]$ and $\ell_B^{sep} = \frac{1}{2}\Lambda_s$. On the other hand, for $|b - \beta| > \frac{\Delta}{2}$, by Eqs. 15 and 16: $y(H) = b + E[\omega \mid s = L] + \frac{\Delta}{2}$, $y(L) = b + E[\omega \mid s = L] - \frac{\Delta}{2}$ when $b \geq \beta$ and $y(H) = b + E[\omega \mid s = H] + \frac{\Delta}{2}$, $y(L) = b + E[\omega \mid s = H] - \frac{\Delta}{2}$ when $b < \beta$. The board's loss term is $\ell_B^{sep} = \frac{1}{2}\Lambda_s + \frac{1}{2}\left(|b - \beta| - \frac{\Delta}{2}\right)^2$.

Optimal pooling solution Under pooling the board will invest on its prior, that is, choose $y = E(\omega) + \beta = \frac{H+L}{2} + \beta$, resulting in a loss the board of $\ell_B^{pool} = \frac{1}{2}\Lambda_\emptyset$.

Compare separating solution and pooling solution For $|b - \beta| \leq \frac{\Delta}{2}$, clearly $\ell_B^{sep} < \ell_B^{pool}$. For $|b - \beta| > \frac{\Delta}{2}$, in contrast:

$$\ell_B^{sep} - \ell_B^{pool} = \frac{1}{2}\Lambda_s + \frac{1}{2}\left(|b - \beta| - \frac{\Delta}{2}\right)^2 - \frac{1}{2}\Lambda_\emptyset \begin{Bmatrix} \leq \\ > \end{Bmatrix} 0, \text{ for } |b - \beta| \begin{Bmatrix} \leq \\ > \end{Bmatrix} \Delta.$$

We can summarize now the optimal solution for Program $\mathcal{SP}^c$. The optimal investment decision and the associated loss term for board and shareholders are listed in Table 2, which generalizes Table 1 in the main text:

Proof of Proposition 1. Our proof follows the following steps: (1) we show that $\beta^c < b$; (2) we characterize the optimal (α^c, β^c).

Step 1: We first argue that the optimal board bias is bounded by the CEO bias: $\beta^c < b$. The reason is that only the *relative* preference divergence $|b - \beta|$ matters for the communication game and the board's effort incentives (recall $\bar{\ell}_B^c$ is symmetric in β around b), whereas any *absolute* board bias is costly to the shareholders, due to distorted investment decisions by the board (Table 2). This allows us to rewrite the preference divergence between the CEO and the board simply as $b - \beta$.

Table 2 Outcome Given Unsuccessful Information Gathering: Commitment

	Case (i): PC $\lvert b - \beta\rvert \in [0, \frac{\Delta}{2}]$	Case (ii): CC $\lvert b - \beta\rvert \in (\frac{\Delta}{2}, \Delta]$	Case (iii): Babbling $\lvert b - \beta\rvert > \Delta$
Board's loss, $\bar{\ell}_B^c$	$\frac{1}{2}\Lambda_s$	$\frac{1}{2}\left[\Lambda_s + (\lvert b - \beta\rvert - \frac{\Delta}{2})^2\right]$	$\frac{1}{2}\Lambda_\emptyset$
Shareholders' loss, $\bar{\ell}_S^c$	$\frac{1}{2}(\Lambda_s + \beta^2)$	$\frac{1}{2}\left[\Lambda_s + (b - \frac{\Delta}{2})^2\right] + \mathbb{1}_{\beta > b} \cdot b\Delta$	$\frac{1}{2}(\Lambda_\emptyset + \beta^2)$

Step 2: To characterize the optimal (α^c, β^c), note that the shareholders' expected payoff is given by Eq. 8 with $F^c = 0$. It is convenient to work with the value function

$$EU_S^c(\beta \mid b) \equiv EU_S^c(\alpha^c(\beta, b), \beta \mid b), \tag{18}$$

where $\alpha^c(\beta, b) \in \arg\max_\alpha EU_S^c(\alpha, \beta \mid b)$. The solution to Program $\mathcal{P}^c$ entails $(\alpha^c(b), \beta^c(b))$ where $\alpha^c(b) = \alpha^c(\beta^c(b), b)$. Define M_n as the set of β to induce communication Case $n \in \{i, ii, iii\}$, as defined in Table 2:[21]

$$\begin{cases} M_i = [b - \frac{\Delta}{2}, b], \\ M_{ii} = [b - \Delta, b - \frac{\Delta}{2}), \\ M_{iii} = (-\infty, b - \Delta). \end{cases}$$

With slight abuse of notation, define

$$\beta_n(b) \in \arg\max_{\beta \in M_n} \; EU_S^c(\beta \mid b).$$

The proof for Step 2 proceeds as follows. First we show, in Lemma A1, that the shareholders never choose β so as to "jump" across communication cases; that is, for any b, if case n occurs "naturally" (that is, for $\beta = 0$), then it is never optimal to set β to induce Case $l \neq n$. We then characterize the optimal solution. □

Lemma A1 ***(No Jumping Cases)*** *With board commitment, the shareholders never choose β so as to switch communication cases. That is:*

- $\beta^c(b \leq \frac{\Delta}{2}) = \beta_i(b)$,
- $\beta^c(\frac{\Delta}{2} < b < \Delta) = \beta_{ii}(b)$,
- $\beta^c(b \geq \Delta) = \beta_{iii}(b)$.

We prove Lemma A1 in the following steps. Steps 2.1-2.4 show that if the shareholders were to choose β to "jump" communication cases, they would choose the adjacent boundary value of β that just suffices to induce such a jump. Formally, we show that if the shareholders want to jump from Case n to l, then the optimal way to do so is by setting $\beta = \sup M_l$ if $l > n$, or by setting $\beta = \inf M_l$ if $l < n$. In Steps 2.5-2.7, we argue that the shareholders never want to jump cases.

Taking derivative of Eq. 18, which is differentiable almost everywhere, and applying the Envelope Theorem:

$$\begin{aligned}
\frac{dEU_S^c}{d\beta} &= \frac{\partial EU_S^c(\alpha^c(\beta, b), \beta \mid b)}{\partial \beta} \\
&= [1 - \alpha^c(\beta, b)] \left[-e(\cdot)\frac{\partial \ell_S}{\partial \beta} - [1 - e(\cdot)]\frac{\partial \bar{\ell}_S^c}{\partial \beta} + \frac{\partial e(\cdot)}{\partial \beta}[\bar{\ell}_S^c(\beta, b) - \ell_S(\beta)] \right] \\
&= [1 - \alpha^c(\beta, b)] \left[-e(\cdot)\frac{\partial \ell_S}{\partial \beta} - [1 - e(\cdot)]\frac{\partial \bar{\ell}_S^c}{\partial \beta} + \frac{\alpha^c(\beta, b)}{c}\frac{\partial \bar{\ell}_B^c}{\partial \beta}[\bar{\ell}_S^c(\beta, b) - \ell_S(\beta)] \right].
\end{aligned}$$

[21] To avoid clutter we suppress the functional argument b in $M_n(b)$.

Step 2.1: If $b > \frac{\Delta}{2}$, then $\beta_i(b) = b - \frac{\Delta}{2}$.

To prove this claim, note that in Case (i) we have $\frac{\partial \ell_S}{\partial \beta} = \beta$, $\frac{\partial \bar{\ell}_S^c}{\partial \beta} = \beta$, and $\frac{\partial \bar{\ell}_B^c}{\partial \beta} = 0$. Hence:

$$\left.\frac{dEU_S^c}{d\beta}\right|_{\beta \in M_i} = -[1 - \alpha^c(\beta, b)]\beta,$$

which implies $sign(\left.\frac{dEU_S^c}{d\beta}\right|_{\beta \in M_i}) = -sign(\beta)$. For any $b > \frac{\Delta}{2}$ and $\beta \in M_i$, we have $\beta > 0$. Therefore, $\beta_i(b > \frac{\Delta}{2}) = b - \frac{\Delta}{2}$.

Step 2.2: If $b \leq \Delta$, then $\beta_{iii}(b) = b - \Delta - \varepsilon$, where $\varepsilon \to 0$.

Similar arguments as in Step 2.1 show that $\left.\frac{dEU_S^c}{d\beta}\right|_{\beta \in M_{iii}} = -[1 - \alpha^c(\beta, b)]\beta$. For any $b \leq \Delta$ and $\beta \in M_{iii}$, we have $\beta < 0$; hence, $\beta_{iii}(b \leq \Delta) = b - \Delta - \varepsilon$.

Step 2.3: If $b > \Delta$, then $\beta_{ii}(b) = b - \Delta$.

To prove this claim, note that if the shareholders were to set β to induce Case (ii), then $\beta \in M_{ii} = [b - \Delta, b - \frac{\Delta}{2})$. Also, $\frac{\partial \ell_S}{\partial \beta} = \beta$, $\frac{\partial \bar{\ell}_S^c}{\partial \beta} = 0$, and $\frac{\partial \bar{\ell}_B^c}{\partial \beta} = -(b - \beta - \frac{\Delta}{2}) < 0$. Hence:

$$\left.\frac{dEU_S^c}{d\beta}\right|_{\beta \in M_{ii}} = [1 - \alpha^c(\beta, b)] \cdot [-e(\cdot)\beta + \underbrace{\frac{\partial e}{\partial \beta}}_{<0} (\bar{\ell}_S^c - \ell_S)].$$

Note that in Case (ii), $\bar{\ell}_S^c - \ell_S = \frac{1}{2}\left[\Lambda_s + (b - \frac{\Delta}{2})^2 - \beta^2\right]$. For any $b > \Delta$ and $\beta \in M_{ii}$, we have $\beta \in (0, b - \frac{\Delta}{2})$. Hence $\bar{\ell}_S^c - \ell_S > 0$, and consequently $\left.\frac{dEU_S^c}{d\beta}\right|_{\beta \in M_{ii}} < 0$. As a result, $\beta_{ii}(b > \Delta) = b - \Delta$.

Step 2.4: If $b \leq \frac{\Delta}{2}$, then $\beta_{ii}(b) = b - \frac{\Delta}{2} - \varepsilon < 0$.

Proceeding as in Step 2.3 shows:

$$\begin{aligned}\left.\frac{dEU_S^c}{d\beta}\right|_{\beta \in M_{ii}} &= [1 - \alpha^c(\beta, b)]\left[-e(\cdot)\beta + \frac{\partial e}{\partial \beta}[\bar{\ell}_S^c - \ell_S]\right] \\ &= [1 - \alpha^c(\beta, b)]\left[-\frac{\alpha^c(\beta, b)\bar{\ell}_B^c}{c}\beta + \frac{\alpha^c(\beta, b)}{c}\frac{\partial \bar{\ell}_B^c}{\partial \beta}[\bar{\ell}_S^c - \ell_S]\right] \\ &= -\frac{\alpha^c(\beta, b)[1 - \alpha^c(\beta, b)]}{2c}\left[\underbrace{(b - \beta - \frac{\Delta}{2})^2(b - \frac{\Delta}{2} + 2\beta) + \Lambda_s(b - \frac{\Delta}{2})}_{\equiv g(\beta|b)}\right].\end{aligned} \tag{19}$$

The last equation uses the fact that in communication Case (ii), $\bar{\ell}_B^c = \frac{1}{2}\left[\Lambda_s + (b - \beta - \frac{\Delta}{2})^2\right]$ and $\bar{\ell}_S^c - \ell_S = \frac{1}{2}\left[\Lambda_s + (b - \frac{\Delta}{2})^2 - \beta^2\right]$. For any $b \leq \frac{\Delta}{2}$ and $\beta \in M_{ii}$, we have $\beta < b - \frac{\Delta}{2} \leq 0$. Therefore, $g(\beta \mid b) < 0$ and $\left.\frac{dEU_S^c}{d\beta}\right|_{\beta \in M_{ii}} > 0$. As a result, $\beta_{ii} = b - \frac{\Delta}{2} - \varepsilon$. (We will use below the $g(\cdot)$ function defined here.)

Step 2.5: The shareholders will not jump between Cases (i) and (ii); that is, $\beta^c(\frac{\Delta}{2} < b < \Delta) \neq \beta_i(b)$ and $\beta^c(b \leq \frac{\Delta}{2}) \neq \beta_{ii}(b)$.

To prove this claim, it is readily verified that $EU_S^c(\cdot)$ is continuous at $\beta = b - \frac{\Delta}{2}$, because both $\bar{\ell}_S^c$ and $\bar{\ell}_B^c$ are continuous at $\beta = b - \frac{\Delta}{2}$. Given the continuity of $EU_S^c(\cdot)$

at $\beta = b - \frac{\Delta}{2}$, it is straightforward that the shareholders will not switch between Cases (i) and (ii). As Steps 2.1 and 2.4 show, if the shareholders were to do so, they would choose $\beta = b - \frac{\Delta}{2}$, but then they can (at least) replicate such payoff by staying in the original communication case.

Step 2.6: The shareholders will not jump between Cases (ii) and (iii); that is, $\beta^c(\frac{\Delta}{2} < b < \Delta) \neq \beta_{iii}(b)$ *and* $\beta^c(b \geq \Delta) \neq \beta_{ii}(b)$.

It is readily verified that $\bar{\ell}^c_B$ is continuous at $\beta = b - \Delta$. Denote by $\bar{\ell}^c_{S_n}$ the shareholders' loss given Case n:

$$\bar{\ell}^c_{S_{ii}}(\beta = b - \Delta, b) - \lim_{\varepsilon \to 0} \bar{\ell}^c_{S_{iii}}(\beta = b - \Delta - \varepsilon, b) = \left(b - \frac{\Delta}{2} - \beta\right)\beta = \frac{\Delta}{2}(b - \Delta). \quad (20)$$

If $b \geq \Delta$, Case (iii) arises naturally, that is, for $\beta = 0$. The shareholders could jump to Case (ii) by choosing $\beta = b - \Delta$ (Step 2.3). But doing so would be suboptimal because the term in Eq. 20 is weakly positive for $b \geq \Delta$. Similar arguments show that if $\frac{\Delta}{2} < b < \Delta$, the shareholders will not jump from Case (ii) to (iii).

Step 2.7: The shareholders will not jump between Cases (i) and (iii); that is, $\beta^c(b \geq \Delta) \neq \beta_i(b)$ *and* $\beta^c(b \leq \frac{\Delta}{2}) \neq \beta_{iii}(b)$.

By Step 2.2, if the shareholders were to jump from Case (i) to (iii), they would choose $\beta = b - \Delta - \varepsilon$. By Eq. 20, for $b \leq \frac{\Delta}{2}$, jumping from Case (ii) to (iii) is suboptimal. Recall that Step 2.5 shows that the shareholders will not jump from Case (i) to (ii), and therefore the shareholders will not jump from Case (i) to (iii). Reverse arguments show that the shareholders prefer not to jump from Case (iii) to (i), completing the proof of Lemma A1. □

We now characterize the globally optimal solution. By Lemma A1, for $b \leq \frac{\Delta}{2}$, the shareholders will choose $\beta^c(b \leq \frac{\Delta}{2}) = \beta_i(b \leq \frac{\Delta}{2}) = 0$. The reason is that within Case (i) β does not affect $e^c(\cdot)$ but only introduces bias cost. Similarly, $\beta^c(b \geq \Delta) = \beta_{iii}(b \geq \Delta) = 0$.

If $b \in (\frac{\Delta}{2}, \Delta)$, communication Case (ii) arises "naturally" (for $\beta = 0$). By Lemma A1, $\beta^c(\frac{\Delta}{2} < b < \Delta) = \beta_{ii}(\frac{\Delta}{2} < b < \Delta)$. Denote by β^{int} the interior solution that satisfies the necessary first-order condition conditional on Case (ii):

$$\left.\frac{dEU^c_S(\cdot)}{d\beta}\right|_{\beta \in M_{ii}} = 0.$$

Using the $g(\cdot)$ function from Eq. 19, β^{int} is given by:

$$g(\beta^{int} \mid b) = \left(b - \frac{\Delta}{2} - \beta^{int}\right)^2 \left(b - \frac{\Delta}{2} + 2\beta^{int}\right) + \Lambda_s \left(b - \frac{\Delta}{2}\right) = 0. \quad (21)$$

By Eq. 19, if $b \in (\frac{\Delta}{2}, \Delta)$, $g(\beta \mid b) > 0$ for any $\beta \geq 0$; hence, $\beta^{int} < 0$ must hold. The second derivative at this stationary point is:

$$\left.\frac{d^2 EU_S^c}{d\beta^2}\right|_{\beta=\beta^{int}} = \frac{3\alpha^c(\cdot)[1-\alpha^c(\cdot)]}{c} \underbrace{\left(b - \beta^{int} - \frac{\Delta}{2}\right)}_{>0} \beta^{int} < 0, \tag{22}$$

making β^{int} a local maximum. This leaves one of two possibilities (see Fig. 5 for illustration): either (a) the (unique) local maximum given by $\beta^{int}(b)$ falls in the interval $\left(b - \Delta, b - \frac{\Delta}{2}\right)$ and thus is feasible so that $\beta_{ii}(b) = \beta^{int}(b)$, or (b) $\beta^{int}(b) < b - \Delta$ in which case the corner solution $\beta_{ii}(b) = b - \Delta$ obtains. Plugging the corner solution $\beta = b - \Delta$ into the $g(\cdot)$ function in Eq. 21 and setting it equal to zero yields the unique CEO bias level, $\tilde{b}$, at which the interior solution just becomes infeasible:

$$g\left(\beta = \tilde{b} - \Delta \mid \tilde{b}\right) = \frac{3}{4}\Delta^2\left(\tilde{b} - \frac{5}{6}\Delta\right) + \left(\tilde{b} - \frac{\Delta}{2}\right)\Lambda_s = 0 \iff \tilde{b} = \frac{5\Delta^3 + 4\Delta\Lambda_s}{2(3\Delta^2 + 4\Lambda_s)}.$$

Now note that, as $\lim_{b\downarrow\frac{\Delta}{2}} \beta^{int}(b) = 0 > \lim_{b\downarrow\frac{\Delta}{2}} b - \Delta$, so the interior solution is feasible and hence optimal at the lower bound of the b-interval $\left(\frac{\Delta}{2}, \Delta\right)$. Together with uniqueness of $\tilde{b}$ this implies that $\beta_{ii}(b) = \beta^{int}$ (interior solution) for any $b \in \left(\frac{\Delta}{2}, \tilde{b}\right]$, and $\beta_{ii}(b) = b - \Delta$ (corner solution) for any $b \in (\tilde{b}, \Delta)$.

To summarize, the optimal board bias with commitment is:

(1) For $b \leq \frac{\Delta}{2}$: $\beta^c(b) = 0$, implementing Case (i).
(2) For $b \in (\frac{\Delta}{2}, \tilde{b}]$: $\beta^c(b) = \beta^{int}$, which is determined by Eq. 21. This is the interior solution for Case (ii).
(3) For $b \in (\tilde{b}, \Delta)$: $\beta^c(b) = b - \Delta$. This is the corner solution for Case (ii).
(4) For $b \geq \Delta$: $\beta^c(b) = 0$, implementing Case (iii).

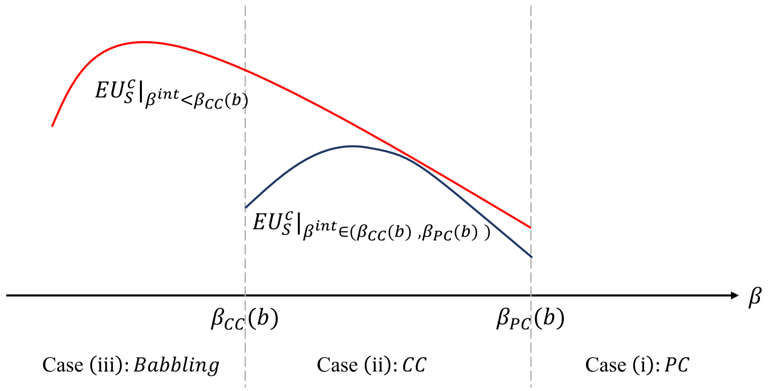


Fig. 5 Interior and Corner Solution for β_{ii}

Continuity of $\beta^c(b)$ is straightforward. We will prove single-troughedness of $\beta^c(b)$ below.

The optimal equity stake Since in Cases (i) and (iii), $\beta^c = 0$ and α^c is constant in b, it remains to show that α^c is monotonically increasing in b in Case (ii). We first show that α^c is monotonically increasing in b for $b \in [\frac{\Delta}{2}, \tilde{b}]$. In this region, the optimal solution (α^c, β^{int}) is an interior one which satisfies the following first-order conditions:

$$\left.\frac{\partial EU_S^c(\alpha, \beta \mid b)}{\partial \beta}\right|_{\beta^{int}} = 0 \quad \text{and} \quad \left.\frac{\partial EU_S^c(\alpha, \beta \mid b)}{\partial \alpha}\right|_{\alpha^c} = 0,$$

which, when differentiated with respect to b, yield:

$$EU^c_{S_{\alpha\alpha}} \cdot \frac{d\alpha^c}{db} + EU^c_{S_{\alpha\beta}} \cdot \frac{d\beta^{int}}{db} + EU^c_{S_{\alpha b}} = 0,$$
$$EU^c_{S_{\beta\beta}} \cdot \frac{d\beta^{int}}{db} + EU^c_{S_{\beta\alpha}} \cdot \frac{d\alpha^c}{db} + EU^c_{S_{\beta b}} = 0.$$

Using Cramer's rule,

$$\frac{d\alpha^c}{db} = \frac{EU^c_{S_{\beta b}} EU^c_{S_{\alpha\beta}} - EU^c_{S_{\alpha b}} EU^c_{S_{\beta\beta}}}{EU^c_{S_{\alpha\alpha}} EU^c_{S_{\beta\beta}} - (EU^c_{S_{\alpha\beta}})^2} \text{ and } \frac{d\beta^{int}}{db} = \frac{-EU^c_{S_{\alpha\alpha}} EU^c_{S_{\beta b}} + EU^c_{S_{\alpha b}} EU^c_{S_{\alpha\beta}}}{EU^c_{S_{\alpha\alpha}} EU^c_{S_{\beta\beta}} - (EU^c_{S_{\alpha\beta}})^2}. \quad (23)$$

Clearly,

$$EU^c_{S_{\alpha\alpha}} = -\frac{2\left[\bar{\ell}^c_S(\beta, b) - \ell_S(\beta)\right]\bar{\ell}^c_B(\beta, b)}{c} < 0,$$

$$EU^c_{S_{\beta\beta}} = \frac{\alpha^c(1-\alpha^c)}{c}\left[\underbrace{\frac{b-\frac{\Delta}{2}}{\beta^{int}}}_{-}\underbrace{[\bar{\ell}^c_S(\beta, b) - \ell_S(\beta)]}_{+} + 2\underbrace{\left(b - \frac{\Delta}{2} - \beta^{int}\right)}_{+}\underbrace{\beta^{int}}_{-}\right] < 0,$$

$$EU^c_{S_{\alpha\beta}} = \frac{(1-2\alpha^c)}{c} \cdot \underbrace{\frac{\partial\left[\bar{\ell}^c_B(\beta, b)[\bar{\ell}^c_S(\beta, b) - \ell_S(\beta)]\right]}{\partial\beta}}_{=0, \text{ from F.O.C. in (19)}} = 0.$$

The derivatives in Eq. 23 then reduce to

$$\frac{d\alpha^c}{db} = -\frac{EU^c_{S_{\alpha b}}}{EU^c_{S_{\alpha\alpha}}} \quad \text{and} \quad \frac{d\beta^{int}}{db} = -\frac{EU^c_{S_{\beta b}}}{EU^c_{S_{\beta\beta}}}.$$

Now note:

$$\begin{aligned} EU^c_{S_{\alpha b}} &= \left(b - \frac{\Delta}{2}\right) + \frac{1-2\alpha^c}{c} \cdot \frac{\partial\left[\bar{\ell}^c_B(\beta, b)[\bar{\ell}^c_S(\beta, b) - \ell_S(\beta)]\right]}{\partial b} \\ &= \left(b - \frac{\Delta}{2}\right) + \frac{1-2\alpha^c}{c}\left\{\left(b - \frac{\Delta}{2} - \beta^{int}\right)[\bar{\ell}^c_S(\beta, b) - \ell_S(\beta)] + \left(b - \frac{\Delta}{2}\right)\bar{\ell}^c_B(\beta, b)\right\} \\ &> 0. \end{aligned}$$

Thus, $\frac{d\alpha^c}{db} > 0$ for any $b \in (\frac{\Delta}{2}, \tilde{b}]$.

Now consider the case of $b \in (\tilde{b}, \Delta)$, resulting in the corner solution $\beta^c = b - \Delta$:

$$\begin{aligned} \alpha^c &= \frac{1}{2} - \frac{\frac{H^2+L^2}{4} - \bar{\ell}_S^c(\beta, b)}{\frac{2}{c}[\bar{\ell}_S^c(\beta, b) - \ell_S(\beta)]\bar{\ell}_B^c(\beta, b)} \\ &= \frac{1}{2} - \frac{\frac{H^2+L^2}{4} - \frac{1}{2}[\Lambda_s + (b - \frac{\Delta}{2})^2]}{\frac{1}{8c}(\Lambda_s + b\Delta - \frac{3}{4}\Delta^2)(H-L)^2}. \end{aligned} \tag{24}$$

Therefore, given $b \in (\tilde{b}, \Delta)$, $\frac{d\alpha^c}{db} > 0$.

It remains to verify the single-troughedness of $\beta^c(b)$. A sufficient condition for this is that the interior solution $\beta^{int}(b)$ is monotonically decreasing in b over the relevant range:

$$\begin{aligned} EU^c_{S_{\beta b}} &= -\frac{\alpha(1-\alpha)}{c}\left\{[\bar{\ell}_S^c(\beta, b) - \ell_S(\beta)] + \left(b - \frac{\Delta}{2} - \beta\right)\left(b - \frac{\Delta}{2} + \beta\right)\right\} \\ &= -\frac{\alpha(1-\alpha)}{2c}\left[\underbrace{3\left[\left(b - \frac{\Delta}{2}\right)^2 - \beta^2\right] + \Lambda_s}_{\phi}\right]. \end{aligned}$$

To show that $\phi > 0$, we plug in $(b - \frac{\Delta}{2})\Lambda_s = -(b - \frac{\Delta}{2} - \beta)^2(b - \frac{\Delta}{2} + 2\beta)$ from the first-order condition (19):

$$\begin{aligned} \phi &= \frac{1}{b - \frac{\Delta}{2}}\left[\left(b - \frac{\Delta}{2}\right)\Lambda_s + 3\left(b - \frac{\Delta}{2}\right)\left[\left(b - \frac{\Delta}{2}\right)^2 - \beta^2\right]\right] \\ &= \frac{1}{b - \frac{\Delta}{2}}\left[-\left(b - \frac{\Delta}{2} - \beta\right)^2\left(b - \frac{\Delta}{2} + 2\beta\right) + 3\left(b - \frac{\Delta}{2}\right)\left[\left(b - \frac{\Delta}{2}\right)^2 - \beta^2\right]\right] \\ &= \frac{2(b - \frac{\Delta}{2} - \beta)}{b - \frac{\Delta}{2}}\left[\left[\frac{1}{2}\left(b - \frac{\Delta}{2}\right) + \beta\right]^2 + \frac{3}{4}\left(b - \frac{\Delta}{2}\right)^2\right] \\ &> 0. \end{aligned}$$

Thus, $EU^c_{S_{\beta b}} < 0$. It follows that $\frac{d\beta^{int}}{db} < 0$, and $\beta^c(b)$ is single-troughed.

Proof of Corollary 1.

Part (a).

For $q \geq q_o$ and $b \in (\frac{\Delta}{2}, b_o(q))$, by Propositions 0 and 1, $\beta^{nc} = b - \frac{\Delta}{2}$ and perfect communication (Case (i)) obtains under noncommitment; $\beta^c = \beta^{int}$ or $\beta^c = b - \Delta$, and constrained communication (Case (ii)) obtains under commitment. Therefore, $\bar{\ell}_B^c(b, \beta^c) = \frac{1}{2}\left[(b - \frac{\Delta}{2} - \beta^c)^2 + \Lambda_s\right] > \frac{1}{2}\Lambda_s = \bar{\ell}_B^{nc}(b, \beta^{nc})$. To rank $\alpha^k(b)$ across the commitment settings, note that

$$\alpha^c(b) = \frac{1}{2} - \frac{\frac{H^2+L^2}{4} - \frac{1}{2}\left[\Lambda_s + (b-\frac{\Delta}{2})^2\right]}{\frac{2}{c}\left[\frac{1}{2}(\Lambda_s + (b-\frac{\Delta}{2}-\beta^c)^2)\right]\cdot\left[\frac{1}{2}(\Lambda_s + (b-\frac{\Delta}{2})^2 - \beta^{c2})\right]},$$

$$\alpha^{nc}(b) = \frac{1}{2} - \frac{\frac{H^2+L^2}{4} - \frac{1}{2}\left[\Lambda_s + (b-\frac{\Delta}{2})^2\right]}{\frac{2}{c}\left(\frac{\Lambda_s}{2}\right)^2}.$$

Note that:

$$\alpha^c(b) > \alpha^{nc}(b) \Leftrightarrow \left[\frac{1}{2}\left(\Lambda_s + (b-\frac{\Delta}{2}-\beta^c)^2\right)\right]\cdot\left[\frac{1}{2}\left(\Lambda_s + (b-\frac{\Delta}{2})^2 - \beta^{c2}\right)\right] > \left(\frac{\Lambda_s}{2}\right)^2$$
$$\Leftrightarrow \underbrace{\left(b-\frac{\Delta}{2}-\beta^c\right)^2\left(b-\frac{\Delta}{2}+\beta^c\right) + 2(b-\frac{\Delta}{2})\Lambda_s}_{G(\beta^c)} > 0.$$

Hence, to prove $\alpha^c(b) > \alpha^{nc}(b)$, it is necessary and sufficient to show that $G(\beta^c) > 0$. Depending on the ranking of $b_o(q)$ and $\tilde{b}(q)$, β^c takes different values: $\beta^c = b - \Delta$ for $b \in [\tilde{b}(q), b_o(q))$ if $b_o(q) > \tilde{b}(q)$; and $\beta^c = \beta^{int}$ otherwise. If $\beta^c = \beta^{int}$, plugging in Eq. 21, we get:

$$\begin{aligned}G(\beta^c = \beta^{int}) &= \left(b-\frac{\Delta}{2}-\beta^{int}\right)^2\left(b-\frac{\Delta}{2}+\beta^{int}\right) - 2\left(b-\frac{\Delta}{2}-\beta^{int}\right)^2\left(b-\frac{\Delta}{2}+2\beta^{int}\right)\\ &= -\left(b-\frac{\Delta}{2}-\beta^{int}\right)^2\left(b-\frac{\Delta}{2}+3\beta^{int}\right)\\ &= \left(b-\frac{\Delta}{2}\right)\Lambda_s - \left(b-\frac{\Delta}{2}-\beta^{int}\right)^2\underbrace{\beta^{int}}_{-}\\ &> 0.\end{aligned}$$

If $\beta^c = b - \Delta$, then

$$G(\beta^c = b-\Delta) = \frac{\Delta^2}{4}\left(2b - \frac{3}{2}\Delta\right) + 2\left(b-\frac{\Delta}{2}\right)\Lambda_s,$$

which is monotonically increasing in b. Therefore, for $b \in [\tilde{b}(q), b_o(q))$,

$$G(\beta^c = b-\Delta) \geq G(\beta^c = b-\Delta \mid b = \tilde{b}(q)) = G(\beta^c = \beta^{int}) > 0.$$

Combining the fact that $\alpha^c(b) > \alpha^{nc}(b)$ with $\bar{\ell}^c_B(b, \beta^c) > \bar{\ell}^{nc}_B(b, \beta^{nc})$ verifies that $e^c(\cdot) > e^{nc}(\cdot)$.

Part (b). We separate into high q and low q cases.

(i) For $q \geq q_o$ and $b \in (b_o(q), \Delta)$, by Proposition 0, $\beta^{nc} = 0$ and babbling (Case (iii)) obtains under noncommitment. Therefore, $\bar{\ell}^{nc}_B(b, \beta^{nc}) = \frac{1}{2}\Lambda_\emptyset \geq \bar{\ell}^c_B(b, \beta^c)$.

Moreover,

$$\alpha^{nc}(b) = \frac{1}{2} - \frac{\frac{H^2+L^2}{4} - \frac{\Lambda_\emptyset}{2}}{\frac{2}{c}\left(\frac{\Lambda_\emptyset}{2}\right)^2},$$

which equals $\alpha^c(b \mid b > \Delta)$. Recall that Proposition 1 shows that $\alpha^c(b)$ is monotonically increasing in b. Hence,

$$\alpha^{nc}(b \mid b \in (b_o(q), \Delta)) = \alpha^c(b \mid b > \Delta) > \alpha^c(b \mid b \in (b_o(q), \Delta)).$$

Combined with the fact that $\bar{\ell}_B^{nc}(b, \beta^{nc}) \geq \bar{\ell}_B^c(b, \beta^c)$, it is clear that $e^{nc}(\cdot) > e^c(\cdot)$ for $b \in (b_o(q), \Delta)$.

For all other b values, $\beta^k = 0$ and the same communication case is implemented under both commitment settings. Hence, $\bar{\ell}_B^{nc}(b, \beta^{nc}) = \bar{\ell}_B^c(b, \beta^c)$ and $\alpha^c(b) = \alpha^{nc}(b)$.

(ii) For $q < q_o$, first note that, for $b \notin (b_o(q), \Delta)$, $\beta^k = 0$ under both commitment settings, and the same communication case is implemented across commitment settings. Hence $\alpha^c(b) = \alpha^{nc}(b)$ for $b \notin (b_o(q), \Delta)$. For $b \in (b_o(q), \Delta)$, $\beta^{nc} = 0$ or $\beta^{nc} = b - \frac{\Delta}{2}$, Case (iii) obtains under noncommitment. Therefore,

$$\alpha^{nc}(b \mid b \in (b_o(q), \Delta)) \geq \frac{1}{2} - \frac{\frac{H^2+L^2}{4} - \frac{\Lambda_\emptyset}{2}}{\frac{2}{c}\left(\frac{\Lambda_\emptyset}{2}\right)^2} = \alpha^c(b \mid b > \Delta) > \alpha^c(b \mid b \in (b_o(q), \Delta)).$$

The last inequality holds by monotonicity of $\alpha^c(b)$ as per Proposition 1.

Hence, we have shown that $\alpha^c(b) \leq \alpha^{nc}(b)$ for any b. Combined with the fact that $\bar{\ell}_B^c(b, \beta^c) \leq \bar{\ell}_B^{nc}(b, \beta^{nc})$, we have $e^c(\cdot) \leq e^{nc}(\cdot)$. □

Proof of Proposition 3. (a) High q: If $q \geq q_o$, then $b_o(q) \geq \frac{\Delta}{2}$. By revealed preference, $EU_S^c(\alpha^c(b), \beta^c(b) \mid b) \geq EU_S^c(\alpha^{nc}(b), \beta^{nc}(b) \mid b)$. Next, we argue that, for $b \in \left(\frac{\Delta}{2}, b_o(q)\right)$, $EU_S^c(\alpha^{nc}(b), \beta^{nc}(b) \mid b) = EU_S^{nc}(\alpha^{nc}(b), \beta^{nc}(b) \mid b)$. The reason is that, for any $b \in \left(\frac{\Delta}{2}, b_o(q)\right)$, if $\beta^k = \beta^{nc}(b) = b - \frac{\Delta}{2}$, then perfect communication (Case (i)) obtains, for any commitment scenario k. Therefore, $EU_S^c(\alpha^c(b), \beta^c(b) \mid b) \geq EU_S^{nc}(\alpha^{nc}(b), \beta^{nc}(b) \mid b)$. It remains to show that this inequality holds in a strict sense. For that purpose, note that for $b \in \left(\frac{\Delta}{2}, b_o(q)\right)$, $\beta^c(b) = \beta_{ii}(b) < b - \frac{\Delta}{2} = \beta^{nc}(b)$, and for the value function $EU_S^c(\beta \mid b) \equiv EU_S^c(\alpha(\beta, b), \beta \mid b)$, by Eq. 19,

$$\left.\frac{dEU_S^c(\beta \in M_{ii})}{d\beta}\right|_{\beta=b-\frac{\Delta}{2}} = -\frac{\alpha^c(\cdot)[1-\alpha^c(\cdot)]}{2c}\left[\Lambda_s(b-\frac{\Delta}{2})\right] < 0.$$

Therefore, $VoC > 0$ for any $b \in \left(\frac{\Delta}{2}, b_o(q)\right)$, given $q \geq q_o$.

(b) Low q: If $q < q_o$, then $b_o(q) < \frac{\Delta}{2}$. Hence, for any $b \in \left(b_o(q), \frac{\Delta}{2}\right)$, by revealed preference, $EU_S^{nc}(\alpha^{nc}(b), \beta^{nc}(b) \mid b) \geq EU_S^{nc}(\alpha^c(b), \beta^c(b) \mid b)$. We first show that this inequality holds in a strict sense. To that end, note that, for $b \in \left(b_o(q), \frac{\Delta}{2}\right)$, $\beta^{nc}(b) = b - \frac{\Delta}{2} < 0$ and $\beta^c(b) = 0$. Hence $EU_S^{nc}(\alpha^{nc}(b), \beta^{nc}(b) \mid b) = EU_{S_{iii}}^{nc}(b)$

and $EU_S^{nc}(\alpha^c(b), \beta^c(b) \mid b) = EU_{S_i}^{nc}(b)$. By Proposition 0, for $b > b_o(q)$, $EU_{S_{iii}}^{nc}(b) > EU_{S_i}^{nc}(b)$. Finally, for any $b \in \left(b_o(q), \frac{\Delta}{2}\right)$, if $\beta = \beta^c(b) = 0$, perfect communication (Case (i)) obtains, so that commitment power does not make a difference. That is, $EU_S^c(\alpha^c(b), \beta^c(b) \mid b) = EU_S^{nc}(\alpha^c(b), \beta^c(b) \mid b)$. Therefore, $VoC < 0$ for any $b \in \left(b_o(q), \frac{\Delta}{2}\right)$, given $q < q_o$. □

Appendix B: Feasible Parameter Range for (*c*, *q*)

To ensure interior optimal α and e values, we impose joint parameter restrictions on c and q. We first bound c from above to ensure $\alpha^k(\cdot) > 0$. From Propositions 0 and 1, the minimal $\alpha^k(\cdot)$, denoted by $\underline{\alpha}(\cdot)$, is achieved for sufficiently small b:

$$\underline{\alpha}(\cdot) = \frac{1}{2} - \frac{\frac{H^2+L^2}{4} - \frac{\Lambda_s}{2}}{\frac{2}{c}(\frac{\Lambda_s}{2})^2}.$$

Let $Q \equiv q(1-q) \in [0, \frac{1}{4})$. Therefore, for $c < \frac{Q^2(H-L)^4}{(1-2Q)(H^2+L^2)+4HLQ} \equiv c_2$, $\alpha^k(\cdot)$ is always positive.

We now bound c from below to ensure $e^k(\cdot) \leq 1$. Equilibrium board effort $e^k(\cdot)$ achieves its maximum at $b = b_o(\cdot)$. Denote such maximum $e^k(\cdot)$ by $\bar{e}(\cdot)$:

$$\bar{e}(\cdot) = \left(\frac{1}{2} - \frac{\frac{H^2+L^2}{4} - \frac{1}{2}(b_o(\cdot) - \frac{\Delta}{2})^2 - \frac{\Lambda_\emptyset}{2}}{\frac{2}{c}(\frac{\Lambda_\emptyset}{2})^2}\right)\frac{\Lambda_\emptyset}{2c}.$$

Plugging in $b_o(\cdot) = \frac{\Delta}{2} - \frac{\sqrt{2}}{8}\sqrt{\frac{(1-4Q)[Q(H-L)^4-4c(H^2+L^2)]}{cQ}}$ (see Baldenius et al. 2019), and using the identity $(\frac{\Delta}{2})^2 \equiv (\frac{1}{4} - Q)(H-L)^2$, we derive the lower bound $c_1 \equiv \frac{Q(1-2Q)(H-L)^4}{2[(1+2Q)(H^2+L^2)-4HLQ]}$ to ensure that $e^k(\cdot) < 1$ for $c > c_1$.

Lastly, we bound q from above, that is, $q < \bar{q}$, to ensure that the parameter range of c thus derived is nonempty:

$$\begin{aligned} c_1 < c_2 &\Leftrightarrow \frac{Q(1-2Q)(H-L)^4}{2[(1+2Q)(H^2+L^2)-4HLQ]} < \frac{Q^2(H-L)^4}{(1-2Q)(H^2+L^2)+4HLQ} \\ &\Leftrightarrow Q > \frac{H^2+L^2}{2\left[2(H^2+L^2)+(H-L)^2\right]} \\ &\Leftrightarrow q < \frac{1}{2} + \frac{H-L}{2\sqrt{2(H^2+L^2)+(H-L)^2}} \equiv \bar{q}. \end{aligned}$$

Hence the joint parameter restrictions are $c_1 \leq c \leq c_2$ and $q < \bar{q}$.

References

Adams, R., and D. Ferreira. 2007. A theory of friendly boards. *Journal of Finance* 62(1): 217–250.
Alonso, R., and N. Matouschek. 2007. Relational delegation. *RAND Journal of Economics* 38(4): 1070–1089.

Alonso, R., and N. Matouschek. 2008. Optimal delegation. *Review of Economic Studies* 75: 259–293.
Amihud, Y., and S. Stoyanov. 2017. Do Staggered Boards Harm Shareholders? *Journal of Financial Economics* 123: 432–439.
Baldenius, T., N. Melumad, and X. Meng. 2014. Board composition and CEO power. *Journal of Financial Economics* 112: 53–68.
Baldenius, T., X. Meng, and L. Qiu. 2019. Biased Boards. *The Accounting Review* 94(2): 1–27.
Bebchuk, L. A., and A. Cohen. 2005. The costs of entrenched boards. *Journal of Financial Economics* 78: 409–433.
Chakraborty, A., and B. Yilmaz. 2017. Authority, consensus, and governance. *The Review of Financial Studies* 30(12): 4267–4316.
Che, Y., and N. Kartik. 2009. Opinions as incentives. *Journal of Political Economy* 117(5): 815–860.
Crawford, V. P., and J. Sobel. 1982. Strategic information transmission. *Econometrica* 50(6): 1431–1451.
Cremers, M., L. Lubomir, and S. Sepe. 2017. Staggered boards and Long–Term firm value, revisited. *Journal of Financial Economics* 126(2): 422–444.
Cremers, M., S. Masconale, and S. Sepe. 2016a. Commitment and entrenchment in corporate governance. *Northwestern University Law Review* 110(4): 727–810.
Cremers, M., and S. Sepe. 2016b. The shareholder value of empowered boards. *Stanford Law Review* 68: 67–148.
Daines, R., S. Li, and C. Wang. 2018. Can Staggered Boards Improve Value? Evidence from the Massachusetts Natural Experiment, Harvard Business School working paper #16–105.
Deloitte. 2015. Directors' Cut: Board Effectiveness.
Dessein, W. 2002. Authority and communication in organizations. *Review of Economic Studies* 69(4): 811–838.
Drymiotes, G. 2007. The monitoring role of insiders. *Journal of Accounting and Economics* 44: 359–377.
Drymiotes, G., and K. Sivaramakrishnan. 2012. Board monitoring, consulting, and reward structures. *Contemporary Accounting Research* 29(2): 453–486.
Faleye, O. 2007. Classified boards, firm value, and managerial entrenchment. *Journal of Financial Economics* 83: 501–529.
Fracassi, C., and G. Tate. 2012. External networking and internal firm governance. *Journal of Finance* 67: 153–194.
Friedman, H. 2014. Implications of power: When the CEO can pressure the CFO to bias reports. *Journal of Accounting and Economics* 58: 117–141.
Friedman, H. 2016. Implications of a Multi-Purpose reporting system on CEO and CFO incentives and risk preferences. *Journal of Management Accounting Research* 28(3): 101–132.
Gal-Or, R., R. Hoitash, and U. Hoitash. 2016. The efficacy of shareholder voting in staggered and Non-Staggered boards: The case of audit committee election. *Auditing: A Journal of Practice and Theory* 35(2): 73–95.
Ge, W., L. Tanlu, and J. L. Zhang. 2016. What Are the Consequences of Board Destaggering? *Review of Accounting Studies* 21: 808–858.
Harris, M., and A. Raviv. 2005. Allocation of Decision-Making authority. *Review of Finance* 9: 353–383.
Harris, M., and A. Raviv. 2008. A theory of board control and size. *Review of Financial Studies* 21: 1797–1832.
Harris, M., and A. Raviv. 2010. Control of Corporate Decisions: Shareholders vs. *Management. Review of Financial Studies* 23: 4115–4147.
Holmstrom, B. 1984 In eds. M. Boyer, and R. Kihlstrom, *On the Theory of Delegation*. New York: North-Holland).
Johnson, W., J. Karpoff, and S. Yi. 2015. The bonding hypothesis of takeover defenses: Evidence from IPO firms. *Journal of Financial Economics* 117: 307–332.
Koppes, R., L. Ganske, and C. Haag. 1999. Corporate governance out of focus: The debate over classified boards. *The Business Lawyer* 54(3): 1023–1055.
Kumar, P., and K. Sivaramakrishnan. 2008. Who monitors the monitor? the effect of board independence on executive compensation and firm value. *Review of Financial Studies* 21(3): 1371–1401.
Larcker, D., G. Ormazabal, and D. Taylor. 2011. The market reaction to corporate governance regulation. *Journal of Financial Economics* 101: 431–448.
Laux, V. 2008. Board independence and CEO turnover. *Journal of Accounting Research* 46: 137–171.
Laux, C., and V. Laux. 2009. Board committees, CEO compensation, and earnings management. *The Accounting Review* 84(3): 869–891.

Laux, V., and B. Mittendorf. 2011. Board independence, executive pay, and the adoption of pet projects. *Contemporary Accounting Research* 28: 1467–1483.
Levit, D. 2012. Expertise, Structure, and Reputation of Corporate Boards, working paper. University of Pennsylvania.
Li, H. 2001. A theory of conservatism. *Journal of Political Economy* 109(3): 617–636.
Li, J., L. Nan, and R. Zhao. 2018. Corporate governance roles of information quality and corporate takeovers. *Review of Accounting Studies* 23(3): 1207–1240.
McNulty, T., and A. Pettigrew. 1999. Strategists on the board. *Organizational Studies* 20(1): 47–74.
Melumad, N. D., and T. Shibano. 1991. Communication in settings with no transfers. *The RAND Journal of Economics*: 173–198.
Qiu, L. 2021. Say on Pay and the 'Quiet Life' of Boards, working paper. University of Hong Kong.
Schmidt, B. 2015. Costs and benefits of friendly boards during mergers and acquisition. *Journal of Financial Economics* 117(2): 424–447.
Shleifer, A., and L. Summers. 1988. Breach of Trust in Hostile Takeovers Corporate Takeovers: Causes and Consequences, ed. A. J. Auerbach, 33–56. Chicago: University of Chicago Press.
Useem, M., and A. Zelleke. 2006. Oversight and delegation in corporate governance: Deciding what the board should decide. *Corporate Governance: An International Review* 14(1): 2–12.
Wagner, A. 2011. Board independence and competence. *Journal of Financial Intermediation* 20: 71–93.
Wang, C., and A. Cohen. 2017. Reexamining staggered boards and shareholder value. *Journal of Financial Economics* 125(3): 637–647.