Blockholder Influence and Governance Fragility

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Abstract

This paper analyzes blockholder influence in governance systems where delegation is either observable (traditional boards) or unobservable (DAOs). A blockholder benefits from rejecting proposals, while informed delegates favor acceptance and possess superior signals. Under observable delegation, the blockholder internalizes the informed delegates' strategic responses and commits to a committee design that maximizes project value: she delegates just enough to lose majority control, inducing informed delegates to adopt a more lenient cutoff which overall generates the most efficient way of aggregating aggregation. Under unobservable delegation, this commitment value disappears. Because delegates cannot observe the delegation structure, they must conjecture it. Their beliefs about how much control the blockholder retains determine their voting behavior, which in turn affects the blockholder's optimal delegation choice—producing multiple self-fulfilling equilibria. Efficient and inefficient equilibria coexist, with the latter characterized by over-delegation, weak information aggregation, and diminished governance value. This multiplicity has no counterpart in traditional governance, where observability eliminates higher-order uncertainty.

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1 Introduction

Decentralized autonomous organizations (DAOs)—blockchain-based entities governed collectively through smart contracts—have been widely celebrated for their potential to democratize corporate governance. By distributing control across token holders and enabling transparent, permissionless participation, DAOs promise to address the agency problems that are present in traditional organizations. In practice, however, the concentration of token holdings among venture capital firms and other large investors raises doubts about whether DAO governance achieves meaningful decentralization or instead replicates—and potentially exacerbates—existing agency conflicts in a new institutional form. Recent empirical evidence reinforces these concerns: Cong et al. (2025) document that the top 10% of voters control 76.2% of voting power in DAOs, Feichtinger, Fritsch, and Vonlanthen (2023) reveal that fewer than 10 addresses control most DAOs they studied.

A distinctive feature of DAO governance that sets it apart from traditional corporate boards is the fundamental *unobservability* of token ownership and delegation structures. In DAOs, governance typically operates through a delegation system where token holders can either vote directly on proposals or delegate their voting power to community delegates who vote on their behalf. These delegates—often core developers, protocol contributors, or other technical experts—accumulate voting power from multiple token holders and cast votes based on their expertise and judgment. However, while in conventional corporations the composition of the board can be observed and distinguished between inside directors, delegates of blockholders, and independent members, the DAO environment effectively removes this observability: it is often impossible to identify who controls which wallets, how tokens are delegated, or whether large tokenholders have strategically fragmented their voting rights across multiple wallets they in fact control themselves.

This opacity is not merely an incidental feature but a core architectural property of blockchain-based governance: wallet addresses are pseudonymous identifiers (strings of alphanumeric characters like "0x742d35Cc6634C0532925a3b844Bc9e7595f0bEb") that reveal nothing about the identity of the owner. A single individual or entity can control hundreds of wallets, making it impossible for other participants to determine whether an apparent "community delegate" with broad support is genuinely independent or simply another wallet directly controlled by a single large tokenholder. Even delegation patterns are obscured: observers can see that voting power has been delegated to a particular address, but cannot verify whether the delegator and delegate are controlled by the same party. As Fritsch, Müller, and Wattenhofer (2024) show for three major DAOs, voting power is highly concentrated: in each system only a small number of delegates control a majority of votes, and the authors emphasize that multiple addresses may be controlled by the same entity, making actual control opaque.

This paper develops a model of DAO governance that analyzes how this unobservability affects equilibrium outcomes and information aggregation. I examine a setting where a blockholder must decide how much voting power to assign to informed delegates—analogous community delegates in DAOs or inside board members in corporate settings—who possess superior information about the quality of a proposal but whose preferences do not align with the blockholder's objectives. Unlike in traditional corporate boards where the composition of directors is observable and verifiable, in the model the key friction is that the blockholder's choice of the number of informed delegates is unobservable to the informed delegates when voting. This unobservability can generate governance fragility: multiple equilibria emerge that support different levels of delegation, with some equilibria resulting in substantially inferior quality of decision making.

The model proceeds as follows. Informed delegates receive private signals about a project's quality and must vote on whether to accept or reject it. The blockholder cannot directly observe project quality but can either delegate part of his voting power to informed delegates or influence the voting outcome directly by appointing delegates who vote according to his own instruction. However, preferences are not aligned: informed delegates derive private benefits from project acceptance and are biased toward approval, while the blockholder obtains private benefits from rejection. This preference structure captures several realistic features of corporate and DAO governance. The informed delegates' bias toward acceptance reflects the incentives of managers or core developers who have invested effort in developing the proposal and may derive career benefits or reputation gains from its implementation. The blockholder's bias toward rejection could reflect concerns about disruption to existing operations, reluctance to cede control, or conservative attitude toward risky or uncertain ventures. Moreover, when the blockholder holds stakes in multiple projects, common ownership may further strengthen this bias: the blockholder may prefer to avoid initiatives that enhance one investment at the expense of others in its broader portfolio.[2]

A natural benchmark for the analysis is a governance system in which the blockholder's delegation choice is publicly observable. This environment corresponds to traditional corporate boards where the composition of the committee is contractible and known to all participants. Under such transparency, the blockholder chooses the number of informed delegates before voting takes place, and this choice is observed by all informed delegates when they form their strategies. As a result, the voting game is hierarchical: the blockholder acts as a Stackelberg leader, anticipating how informed delegates respond to each feasible committee structure, while informed delegates best respond to the committee composition they observe.

This benchmark yields a sharp and unique prediction. For any committee size, informed delegates adopt a cutoff rule that incorporates both their private signal and the blockholder presence on the committee. Because the blockholder's delegates vote mechanically against the proposal, the probability that an informed delegate is decisive depends on the number of blockholder delegates. When the blockholder holds more seats, the event of being pivotal is associated with more favorable signals received by other informed delegates. As in classic swing-voter's-curse logic, this increases the informed delegate's expectation of project quality in the pivotal state, raising her willingness to accept. The equilibrium cutoff is therefore a monotone function of the observable committee structure.

Taking this response into account, the blockholder delegates authority only up to the point at which her own delegates lose majority control. This minimal meaningful delegation generates the most efficient acceptance rule: the proposal passes only if all informed delegates vote in favor, even though each delegate individually is quite lenient in accepting it. This committee structure thus achieves disciplined information aggregation while limiting the influence of informed delegates' private bias toward acceptance. In equilibrium, this delegation

[2]see for a real-world example see https://tokeninsight.com/en/news/why-did-a16z-vote-against-uniswap-s-latest-expansion

policy maximizes firm value among all feasible committee compositions. The value of control in this environment reflects the blockholder's ability to commit to a governance structure that elicits conservative but informative decisions rather than a capacity to extract private rents.

The nature of equilibrium changes fundamentally once delegation becomes unobservable. This setting is motivated by decentralized autonomous organizations (DAOs), where committee composition is not verifiable. Token holders and delegates operate behind pseudonymous addresses, and control may be fragmented across wallets that cannot be linked to a common owner. Consequently, informed delegates do not observe how many seats the blockholder assigns to her own delegates and must form beliefs about committee composition when voting.

This opacity renders delegation and voting strategically simultaneous. The blockholder chooses the number of informed delegates while treating their voting cutoff as fixed, since she cannot influence their beliefs about her choice. Informed delegates choose their cutoffs based on conjectures about committee composition, since they cannot observe the true delegation level.

Because the informed delegates' optimal cutoff is decreasing in the perceived influence of the blockholder (he becomes more willing to accpet), and the blockholder's optimal delegation is decreasing in the leniency of the perceived cutoff, the mapping from conjectures to optimal actions exhibits strategic complementarities. When informed delegates believe the blockholder retains substantial control, they vote more aggressively in favor of the project. This makes low delegation optimal for the blockholder, confirming their beliefs. Conversely, when they believe the blockholder has delegated extensively, they adopt more conservative voting rules, making high delegation optimal for the blockholder. These self-reinforcing feedback give rise to *multiple self-fulfilling equilibria* whenever delegation yields a positive expected surplus.

The multiplicity is economically meaningful. One equilibrium replicates the transparent governance benchmark with minimal meaningful delegation and strict acceptance standards. Other equilibria feature excessive delegation, weak information aggregation, and substantially lower project value. In these lower-quality equilibria, the blockholder relinquishes more control than is optimal under transparency, resulting in acceptance of low-quality projects or rejection of high-quality ones. Governance outcomes therefore depend on equilibrium selection rather than fundamentals alone: identical DAOs with identical token distributions can coordinate on sharply different decision rules.

This form of governance fragility has no analogue in traditional corporate settings. With observable delegation, informed delegates condition on a known committee structure, and the blockholder internalizes their response, leading to a unique equilibrium. Transparency thus acts as a coordination device that eliminates inferior equilibria. Under opacity, higher-order uncertainty about committee composition opens the door to multiple equilibria with distinct welfare and valuation consequences.

The model clarifies the valuation consequences of delegation. In the transparent benchmark, the blockholder's presence raises firm value relative to a committee composed exclusively of informed delegates. This positive control premium arises because the blockholder commits to the delegation structure that maximizes the informativeness of the vote. Under opaque governance, a control premium can still emerge, but its magnitude depends on equilibrium selection. When the system coordinates on a high-delegation equilibrium with weak information aggregation, the blockholder's presence yields a smaller premium, or even a discounted valuation if governance deteriorates sufficiently. Observed control premia in DAOs therefore do not reliably indicate governance quality: they depend on equilibrium selection rather than fundamentals.

The welfare implications parallel these valuation effects. Transparent governance uniquely implements the welfare-maximizing delegation structure. Opaque governance sustains both this efficient outcome and lower-value equilibria with weaker information aggregation. Minority investors are therefore exposed to governance fragility that cannot arise in traditional observable settings.

These findings have direct implications for the design of DAO governance systems. Because unobservable delegation exposes the system to low-value equilibria, institutions that enhance the observability of delegation — such as verified identities for delegates, persistent reputation systems, or transparent delegation registries — can improve welfare and raise the value of control. Conversely, efforts to decentralize decision-making without addressing opacity may unintentionally weaken information aggregation.

Related Literature

A large theoretical literature studies how committees aggregate dispersed private information when voters hold heterogeneous preferences or face pivotality concerns. Seminal work by Austen-Smith and Banks (1996) and Feddersen and Pesendorfer (1996, 1998) shows that rational, informed voters account for the informational content of being pivotal, giving rise to the well-known swing-voter's curse. This mechanism implies that voting is shaped not only by private signals but also by beliefs about the behavior of other voters. Subsequent contributions examine how voting rules and committee composition affect these incentives (e.g., Gerardi and Yariv (2007); Bhattacharya (2013)). A central feature of these models, however, is that the set of informed voters and the institutional environment are both common knowledge. In contrast, the present paper endogenizes the number of informed voters through the blockholder's delegation decision and shows that when this decision is unobservable, strategic voting becomes intertwined with higher-order uncertainty about committee composition. This mechanism is closely related to classic fragility in the sense of multiple self-fulfilling equilibria, as in Diamond and Dybvig (1983), where strategic complementarities cause agents' expectations about others' actions to determine whether the system coordinates on a good or a bad equilibrium. Here, the same logic applies to governance: uncertainty about delegation leads informed voters to coordinate on different self-confirming expectations regarding the likelihood of being pivotal, which in turn generates multiple equilibria in information aggregation.

This work is also related to the delegation literature beginning with Aghion and Tirole (1997) and Dessein (2002) (see Malenko (2023) for a comprehensive survey), who examine how a principal allocates authority to informed but biased agents. In their frameworks, delegation serves as a commitment device that improves decision-making when the agent's informational advantage outweighs preference misalignment. A key maintained assumption in this literature is that the principal's allocation of authority is contractible and publicly observable. The present paper departs from this assumption by analyzing governance environments—motivated by DAO structures—in which delegation is inherently unobservable due to pseudonymity. When delegation cannot be verified by the informed agents, the commitment value central to the Aghion–Tirole and Dessein insights breaks down. Delegates no longer condition their actions on a known organizational structure but instead form higher-order beliefs about committee composition, which in turn shapes their willingness to act on private information. This shift from observable to unobservable delegation overturns the standard delegation logic and gives rise to multiple equilibria in delegation and voting behavior, a phenomenon that does not appear in existing models of optimal delegation.

Work beginning with Shleifer and Vishny (1986), Admati, Pfleiderer, and Zechner (1994), Maug (1998), and Burkart, Gromb, and Panunzi (1997) studies how large shareholders monitor management, discipline insiders, and potentially extract private benefits. A broader review of blockholders is provided by Edmans and Holderness (2017). More recent theoretical work on boards (e.g., Adams and Ferreira (2007); Harris and Raviv (2008)) examines the allocation of seats between insiders and outsiders. A common feature of this literature is that control structures—ownership stakes, board seats, voting power—are observable to all participants. This assumption eliminates coordination failures based on hidden governance structures. In contrast, the central contribution of the present paper is to show that when the blockholder's delegation choice itself becomes opaque, the resulting higher-order uncertainty alters both the incentives of informed voters and the blockholder's optimal delegation policy. As a result, observable and unobservable delegation regimes are fundamentally different economic environments and cannot be treated as minor informational variants of the same governance mechanism.

Finally, the paper is motivated by governance in pseudonymous blockchain systems. The emerging theoretical literature (e.g., Cong and He (2019), Cong, Xiao, and Wang (2021), Sockin and Xiong (2023)) emphasizes that pseudonymity prevents verification of identity and voting power, creating novel forms of strategic uncertainty. This perspective complements the broader FinTech literature surveyed by Goldstein, Jiang, and Karolyi (2019) and Allen, Gu, and Jagtiani (2020), who highlight how technological innovation reshapes information structures and exacerbates governance challenges in decentralized environments. Empirical evidence likewise shows that delegation structures in DAOs are often opaque (Feichtinger, Fritsch, and Vonlanthen (2023), Fritsch, Müller, and Wattenhofer (2024)), with concentrated control masked by multiple wallet addresses. The model in this paper provides a theoretical foundation for how such unobservable delegation can endogenously generate governance fragility, even when economic fundamentals are otherwise identical to those in traditional, observable governance systems.

The remainder of the paper proceeds as follows. Section 2 presents the model environment, preferences, information structure, and equilibrium concept. Section 3 analyzes the benchmark case of observable (transparent) delegation corresponding to traditional corporate governance, characterizing the unique equilibrium and the blockholder's optimal delegation choice. Section 4 introduces unobservable (opaque) delegation as in DAOs, showing that multiple equilibria arise and characterizing their properties. Section 5 analyzes welfare implications for small shareholders, showing that transparency strictly improves outcomes by eliminating low-value equilibria. Section 6 examines control premia and valuation effects, showing how opacity can distort project value. Section 7 considers extensions including sincere voting as a benchmark. Section 11 concludes with a discussion of empirical predictions and policy implications for DAO governance design.

2 Model

An organization is presented with a proposal to implement a new project.

The project can either increase or decrease the value of the organization and is represented by a random variable $\tilde{\theta}$, which is distributed uniformly over an interval symmetric around zero,

$$\tilde{\theta} \sim \mathcal{U}\left[-\omega, \omega\right]$$

where $\omega > 0$.

A committee is appointed to decide on whether or not to implement the proposed project. The committee consists of $2n + 1$ members, who can be of two different types: *blockholder delegates*, who vote as instructed by the blockholder and have no independent decision power, and *informed delegates*, who vote independently. A blockholder holds the absolute majority of shares and can thus determine the composition of the committee. The project proposal is accepted if a simple majority of the committee members vote in favor. We denote $d = 1$ if more than n members vote in favor and $d = 0$ otherwise.

Institutional interpretation: In the context of traditional corporate boards, the blockholder is a shareholder who holds the absolute majority of shares, blockholder delegates are blockholder-appointed directors, and informed delegates are informed delegates (such as management team members). In the context of DAOs, the blockholder is a large token holder (whale), blockholder delegates are delegates who follow the whale's instructions, and informed delegates are community delegates with expertise (such as core developers or protocol specialists).

The blockholder can choose the number m of informed delegates and the remaining $2n+1-m$ committee members are consequently blockholder delegates.

2.1 Preferences

The agents' preferences are not aligned. Informed delegates derive private benefits from the acceptance of the proposal. They can be thought of as employees closely tied to the project proposal, such as members of the management team in corporations or core developers in DAOs. As they are closely related to who proposes the project, they are more favorable towards its acceptance. They value the outcome of the project by $\theta + l$ if it is accepted and 0 if it is rejected, where l is a positive constant. Their preferences can be represented by

$$u_i\left(d,\theta\right) = \mathbb{1}_{\{d=1\}}\left(\theta + l\right)$$

where $\mathbb{1}_{\{d=1\}}$ is an indicator function that equals 1 if the decision is to accept the project ($d=1$) and 0 if it is rejected ($d=0$). The blockholder, on the other hand, derives private benefits from the rejection of the proposal. She values the outcome of the project as $\theta - b$ if it is accepted and 0 if it is rejected, where b is a positive constant representing her private benefits in case of rejection. Her preferences can be represented by the utility function:

$$u_b\left(d,\theta\right) = \mathbb{1}_{\{d=1\}}\left(\theta - b\right)$$

This formulation ensures that, without delegation, the blockholder always votes against the project as the expected utility of accepting the proposal is negative (recall that the mean of $\tilde{\theta}$ is 0). The project choice is not contractible. Otherwise, the blockholder could compensate informed delegates with side payments to align incentives if feasible and worthwhile.

2.2 Information Structure

Because of their proximity to operations and expert knowledge, informed delegates possess superior information. Each informed delegate i privately observes a noisy signal about the realization of θ of $\tilde{\theta}$

$$s_i = \theta + \epsilon_i$$

where the noise term σ_i is uniformly distributed over the interval $[-\epsilon, \epsilon]$

$$\epsilon_i \sim \mathcal{U}\left[-\epsilon, \epsilon\right]$$

and ϵ represents the precision of the signal: the smaller the value of ϵ, the more precise the signal. The blockholder does not receive any signals about the project, and neither do her delegates. Informed delegates do not communicate their private signals to one another or to the blockholder. [3]

2.3 Parametric Assumptions

The noise in the signal is not too large compared to the noise in the underlying project value, specifically

$$2\epsilon < \omega$$

. This assumption is necessary for the existence of an equilibrium in the voting subgame. Furthermore, the potential upside of the project for the blockholder, represented as $\omega - b$, needs to be large relative to the difference in private benefits $b + l$ in order to allow for a positive surplus of delegation:

$$b + l < \omega - b$$

.

[3] Because informed delegates and the blockholder have misaligned preferences, there is a strong temptation for informed delegates to misrepresent or selectively disclose signals to advance their own interests. Any attempt at communication can amount to non-credible cheap talk statements with limited informational content, making truthful information transmission unlikely.

2.4 Timing and Observability

The distinction between observable and unobservable delegation is central to this analysis and maps directly to our two institutional contexts. The timing is as follows:

(i) The blockholder chooses the composition of the committee by selecting m informed delegates.

(ii) Signals realize and informed delegates observe their private signals.

(iii) Delegates vote on the proposal.

Transparent governance (Traditional Boards): In this benchmark case, informed delegates observe the committee composition m before they vote. This allows them to condition their voting strategies on the precise number of informed delegates versus blockholder delegates. The blockholder effectively commits to her delegation choice, as it is observed before voting takes place. This corresponds to traditional corporate boards where board composition and the identity of blockholder-appointed versus independent directors is publicly known.

Opaque governance (DAOs): In this case, informed delegates cannot observe the committee composition at the time they vote. They must form beliefs about m and choose voting strategies without knowing the exact delegation level. The controlling party's choice remains strategically simultaneous with the informed delegates' voting decisions, even though it occurs chronologically first. This corresponds to DAOs where the allocation of voting power among whale-controlled delegates versus independent delegates may not be transparent to delegates at the time of voting.

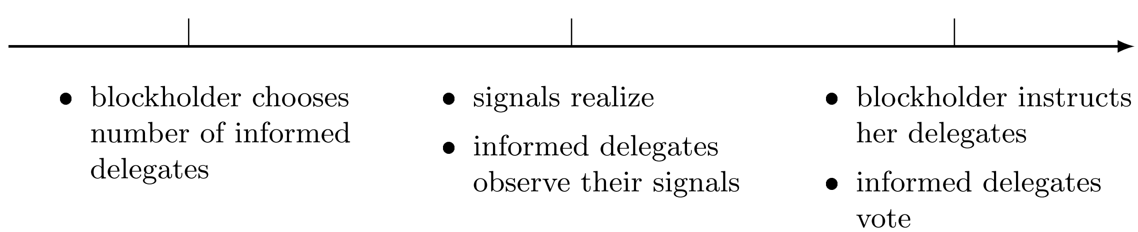

Figure 1: Timeline

2.5 Equilibrium Concept

The equilibrium concept is that of a Bayes Nash Equilibrium. An equilibrium consists of a set of informed delegates' voting decision rules and the blockholder's committee composition m^*such that

1. **Committee Composition**: Given the voting strategy of informed delegates, the blockholder chooses the number of informed delegates m^* to maximize her expected utility

$$m^* \in \arg\max_{m} \mathbb{E}_\theta \left[P\left(d = 1 \mid \theta\right) \left(\theta - b\right) \right]$$

2. **Informed Delegate Voting Decision**: Given the committee composition m^* and the voting strategy of other delegates, an informed delegate i accepts the project whenever

$$\mathbb{E}\left[\theta \mid piv_i, s_i\right] + l \geq 0$$

   where piv_i stands for the event of being pivotal

3. **Blockholder Voting Decision**: The blockholder instructs her delegates to vote to maximize

$$\max\left\{\mathbb{E}\left[\theta \mid piv_b\right] - b, 0\right\}$$

4. **Beliefs** are consistent.

I focus on symmetric equilibria in strictly monotone strategies where the likelihood of voting in favor of the project is strictly increasing both in the received signal and in the private benefits.

3 Transparent Governance: The Benchmark

Under transparent governance—corresponding to traditional corporate boards where the delegation of control is publicly observable—the committee composition m is known to all informed delegates before they vote. This setting induces a Stackelberg structure: the blockholder acts as the leader, choosing the committee structure m in Stage 1, while informed delegates act as followers, conditioning their voting strategies on the observed m in Stage 2.

The central feature of transparent governance is that the blockholder internalizes the informed delegates' voting behavior when choosing m. For any given m, informed delegates employ an equilibrium cutoff strategy characterized by $s^*(m)$ that depends on the observable committee composition. Anticipating this response function $s^*(m)$, the blockholder selects m to maximize her expected utility. In contrast, under opaque governance (see Section 5), the committee composition is unobservable at the time of voting. Informed delegates must make a conjecture about m rather than condition on it, eliminating the blockholder's commitment power and giving rise to multiple equilibria.

The equilibrium under transparency is derived by backward induction. Stage 2 derives the voting equilibrium for any given m, yielding the response function $s^*(m)$; Stage 1 then characterizes the blockholder's optimal delegation choice given this anticipated voting behavior.

3.1 Stage 2: Voting Equilibrium for Given m

Given committee composition m, all informed delegates observe m and condition their strategies accordingly.

Blockholder's voting decision. Although the blockholder receives no private signal about the project's value θ, she can extract information from the event of being pivotal. Intuitively, since informed delegates have a positive bias l toward approval, they vote in favor even for mildly negative signals. Hence, the blockholder is pivotal when θ is slightly below zero. Conditioning on this event leads her to revise expectations downward, as formally shown in the following proposition.

Proposition 1. *The blockholder revises her expectation of θ downward when conditioning on the event of being pivotal and therefore instructs all delegates to reject the proposal.*

Proof. See Appendix. □

Formally, the proof shows that $\mathbb{E}[\theta \mid \text{piv}_b]$ equals exactly the cutoff signal s^* used by informed delegates, which is negative given their positive bias l. Given her private benefit in case of rejection b, the blockholder's optimal strategy is to instruct all of her delegates to to vote against the proposal. If any delegate were to vote in favor, and the pivotal event would consist n "yes" votes from informed delegates, this would indeed result in project approval, even though his expected utility is negative.

Informed delegates' voting decision. Each informed delegate infers information not only from her private signal but also from the event of being pivotal. The presence of blockholder delegates affects this inference: it changes the likelihood of being pivotal and thus the expected θ conditional on this event. Specifically, when the blockholder controls more delegates (smaller m)—which all vote "no," as we have just seen—an informed delegate becomes pivotal when fewer of the remaining informed delegates vote "no," implying higher average signals among them. Hence, conditional on being pivotal, an informed delegate infers that θ is relatively high and therefore is more willing to accept, i.e. adopts a lower cutoff for acceptance. This effect is stronger the smaller is m, as the event of being pivotal becomes increasingly associated with fewer no votes coming from informed delegates.

In equilibrium, this updating behavior makes informed delegates appear to counterbalance the blockholder's opposition: as the number of blockholder delegates increases, each delegate becomes more willing to approve proposals, effectively lowering the collective acceptance threshold.

The following proposition formalizes this intuition and shows that there is a unique equilibrium in the voting subgame in cutoff strategies.

Proposition 2. *For $-l \in [-\omega + 2\epsilon, \omega - 2\epsilon]$ there exists a unique equilibrium in strictly monotone strategies in the voting subgame where an informed delegate accepts the proposal whenever*

$$s_i \geq s^*$$

with

$$s^* = -\frac{2n+1-m}{m+1}\epsilon - l \tag{1}$$

Proof. See Appendix. □

Uniqueness follows from strict strategic complementarities: a higher cutoff by others increases a delegate's posterior $\mathbb{E}[\theta \mid piv_i, s_i]$, inducing her to raise her own cutoff. The best-response mapping is thus strictly increasing, yielding a unique fixed point.

3.2 Stage 1: The Blockholder's Delegation Decision

Anticipating the informed delegates' equilibrium cutoff $s^*(m)$, the blockholder chooses m to maximize expected utility:

$$v_b\left(m\right) = \frac{1}{2\omega}\int_{-\omega}^{\omega}\left(\theta - b\right)P_{n,m}\left(d = 1 \mid \theta; s^*\left(m\right)\right)d\theta \tag{2}$$

where $P_{n,m}\left(d = 1 \mid \theta; s^*\left(m\right)\right)$ is the probability a project of quality θ is approved by a committee of size $2n+1$ with m informed delegates who use the equilibrium cutoff strategy is $s^*\left(m\right)$.

The blockholder chooses the optimal number of informed delegates m^* to maximize her expected utility, balancing the benefit of improved decision-making through better information aggregation against the cost of informed delegates being overly optimistic in approving the proposal. By including more informed delegates, the blockholder can potentially benefit from their informational advantage, as more signals are included in the decision-making. On the other hand, informed delegates may vote to accept the proposal too readily due to their private benefits in case of acceptance. At the same time the cutoff also moves more in favor of the blockholder so that the overall effect of the previous two effects are ambiguous. The blockholder's value function can be written as follows:

Lemma 3. *The blockholder's value of delegation equals*

$$v_b(m) = \frac{1}{2\omega}\left\{\frac{2\epsilon(m-n)}{(m+1)(m+2)}[(n+1)\epsilon - (m+2)(b - s^*(m))] + \tfrac{1}{2}[(\omega - b)^2 - (b - s^*(m) - \epsilon)^2]\right\},$$

for $m \geq n+1$, *and* $v_b(m) = 0$ *otherwise.*

The first term corresponds to projects approved with positive probability ("probabilistic acceptance") and depends on both m and ϵ. The second term captures projects always approved once $\theta \geq s^*(m) + \epsilon$. From this expression the optimal delegation choice for the blockholder is readily derived.

Proposition 4. *If the difference in private benefits* $(b+l)$ *is small, signals are sufficiently precise, or*

$$(b+l)^2 + \frac{4(n+1)}{(n+2)^2(n+3)}\epsilon^2 \leq (\omega - b)^2,$$

then the optimal delegation level is

$$m^* = n + 1.$$

Otherwise, the blockholder prefers no delegation.

The corresponding equilibrium value of the project from the blockholder's perspective is

$$v_b^* = \frac{(\omega - b)^2 - (b+l)^2 - 4\frac{(n+1)}{(n+2)^2(n+3)}\epsilon^2}{4\omega}. \tag{3}$$

Intuition. With observable delegation, the blockholder acts as a Stackelberg leader. By committing to m, she disciplines informed delegates' optimism, inducing them to use the equilibrium cutoff $s^*(m)$. The trade-off is: more informed delegates increase informational precision but also the probability of approving biased projects. Optimal delegation balances these effects, at the minimal level $m = n + 1$, where information aggregation is valuable but control is not fully lost.

Remark. Transparency grants the blockholder commitment power. By making m observable, she determines the informed delegates' strategies through $s^*(m)$, internalizing their response when choosing m. This Stackelberg commitment ensures a unique equilibrium, in contrast with the multiplicity that arises under opaque governance.

4 Opaque Governance

Under opaque governance the level of delegation is not observable when voting occurs. Although the blockholder chooses m first chronologically, informed delegates do not observe it and must form beliefs about the committee composition. Strategically, all choices are therefore simultaneous: the blockholder selects m while delegates conjecture and act on consistent beliefs about it. This lack of observability removes the blockholder's commitment power and can generate multiple equilibria.

Similarly as in the observable case, the blockholder's expected utility given m informed delegates is

$$v_b\left(m\right) = \frac{1}{2\omega} \int_{-\omega}^{\omega} \left(\theta - b\right) P_{n,m}\left(d = 1 \mid \theta; s^*\right) d\theta \tag{4}$$

. The key difference is that the blockholder takes s^* as given rather than anticipating its dependence on m.

4.1 Marginal Effect of Delegation

Consider adding one more informed delegate, from m to $m+1$, with $m \geq n+1$. Because s^* is fixed, the marginal change in the blockholder's value simplifies to

$$v_b\left(m+1\right) - v_b\left(m\right) = \frac{\epsilon}{\omega} \frac{\left(n+1\right)}{\left(m+1\right)\left(m+2\right)} \left[\frac{2n+1-m}{m+3}\epsilon - \left(b - s^*\right)\right] \tag{5}$$

The first term captures the informational gain from including an additional signal; the second reflects the expected bias cost from increased delegation. If $b - s^*$ is large relative to ϵ, the extra delegate is likely to approve projects the blockholder dislikes, so the marginal value is negative. Conversely, when signals are noisy (large ϵ), adding an informed delegate improves decision quality substantially. As the number of informed delegates m increases, however, the diminishing returns from information aggregation become evident, which is captured by the factor $\frac{2n+1-m}{m+3}$.

The blockholder increases m as long as $v_b(m+1) - v_b(m) > 0$, which implies

$$m < \frac{\epsilon\left(2n+1\right) - 3\left(b - s^*\right)}{\epsilon + b - s^*}.$$

The smallest integer m for which this inequality no longer holds defines the optimal delegation level:

$$m^* \geq \frac{\epsilon\left(2n+1\right) - 3\left(b - s^*\right)}{\epsilon + b - s^*}, \qquad m^* - 1 < \frac{\epsilon\left(2n+1\right) - 3\left(b - s^*\right)}{\epsilon + b - s^*}.$$

If instead

$$n + 1 \geq \frac{\epsilon\left(2n+1\right) - 3\left(b - s^*\right)}{\epsilon + b - s^*},$$

there is a corner solution and the blockholder stops at minimal delegation $m = n+1$.

Whether even this minimal level dominates no delegation depends on the overall surplus from information aggregation, which in turn hinges on the precision of signals and the degree of preference misalignment.

Proposition 5. *If*

$$\left(b - s^* - \frac{n}{n+1}\epsilon\right)^2 + \frac{4\,(n+1)}{(n+2)^2\,(n+3)}\epsilon^2 > (\omega - b)^2\,,$$

the blockholder does not delegate ($m^* = 0$). Otherwise, the optimal level of delegation is given by

$$m^* = \begin{cases} n+1 & \text{if } b - s^* \geq \frac{n}{n+4}\epsilon \\ \left\lceil \frac{(2n+1)\epsilon - 3(b-s^*)}{\epsilon + b - s^*} \right\rceil & \text{if } b - s^* \in \left(\frac{n}{n+4}\epsilon, \frac{1}{2n+3}\epsilon\right) \\ 2n+1 & \text{if } b - s^* \leq \frac{1}{2n+3}\epsilon \end{cases}$$

Intuition. The blockholder weighs control against information aggregation. When private benefits b are large or signals precise, the loss of control dominates, making $m^* = 0$ optimal. When information is very noisy (large ϵ) or preference misalignment modest, delegation becomes valuable, and m^* rises. Hence, m^* increases in ϵ and decreases in $(b - s^*)$, reflecting the balance between precision gains and bias costs.

4.2 Equilibrium and Multiplicity

In equilibrium, informed delegates and the blockholder must have mutually consistent beliefs about m^* and s^*. From Section 4, delegates lower s^* when facing more blockholder delegates (smaller m), while the blockholder increases her delegation to blockholder delegates (smaller m) when s^* is low. This strategic complementarity supports multiple fixed points, as long as the surplus from delegation is positive. When misalignment is large or information poor, delegation fails altogether. At high levels of noise, the benefit of adding an additional informed delegate is large as we have seen in (5), which in turn allows to sustain high levels of delegation. If, on the other hand, signals are relatively precise, this benefit is too small so that large numbers of informed delegates are not sustainable.

Proposition 6. *For large misalignment or very noisy signals such that*

$$(b+l)^2 + \frac{4(n+1)}{(n+2)^2(n+3)}\epsilon^2 > (\omega - b)^2,$$

no delegation can be supported as an equilibrium. Otherwise:

- *If* $b + l \geq \frac{\epsilon}{2n+3}$*, the unique equilibrium features minimal delegation,* $m^* = n + 1$*.*
- *If* $b + l < \frac{\epsilon}{2n+3}$*, multiple equilibria arise, with any*

  $$m^* \in \{n+1, \ldots, 2n+1\}$$

  sustainable in equilibrium.

Equilibrium Value. For a given equilibrium m^*, the blockholder's expected project value is

$$v_b^*(m^*) = \frac{(\omega - b)^2 - (b+l)^2 - 4\frac{(n+1)(m^*-n)}{(m^*+1)^2(m^*+2)}\epsilon^2}{4\omega} \tag{6}$$

for $m^* \in \{n+1, \ldots, 2n+1\}$ and 0 otherwise. The first term represents the maximal attainable surplus, the second the loss from preference misalignment, and the third the informational loss due to noisy signals and imperfect aggregation. Since the last term decreases with m, the information aggregation and thus the equilibrium value is highest for the smallest feasible delegation. These last two terms enter into the value in an additive way. As a consequence, the optimal level of delegation is not dependent on the level of private benefits as long as they are small enough to make delegation viable. Furthermore, we can see from this last term that the equilibrium value of delegation is decreasing in the number of informed delegates (for a sufficiently large committee size) and the highest value is obtained in case of $m^* = n + 1$. Equilibria can thus be ranked monotonically with minimum meaningful delegation ($m^* = n + 1$) delivering the highest project value. This value of this equilibrium coincides exactly with the project value under transparent governance.

5 Small Investor Welfare

We now evaluate welfare from the perspective of small (minority) shareholders, who aim to minimize decision errors—that is, the probability of accepting negative-value projects or rejecting positive-value ones without incurring any private benefits. Their preferences can be represented by

$$u_i\left(d, \theta\right) = \mathbb{1}_{\{d=1\}}\theta$$

Small-shareholder value under transparent governance. Under transparency, the value of the project from the view of small shareholders is uniquely determined as

$$v_0^{*,\mathrm{T}} = \frac{\omega^2 - l^2 - 4\frac{(n+1)}{(n+2)^2(n+3)}\epsilon^2}{4\omega}$$

Small-shareholder value under opaque governance. When delegation is unobservable, beliefs about m^* and s^* must be mutually consistent, and multiple equilibria may exist. The expected welfare of small shareholders in an equilibrium with m^* is given as

$$v_0^{*,\mathrm{O}}(m^*) = \frac{\omega^2 - l^2 - 4\frac{(n+1)(m^*-n)}{(m^*+1)(m^*+2)}\epsilon^2}{4\omega},$$

but as several m^* can be sustained, realized welfare depends on which equilibrium is selected. Since $v_0^{*,\mathrm{O}}(m^*)$ decreases in m, the equilibrium with minimal delegation again delivers the highest expected welfare, while equilibria with larger m^*—possible only under opacity—yield strictly lower welfare.

Comparison and interpretation. The contrast between governance regimes can be summarized as

$$v_0^{*,\mathrm{T}} = v_0^{*,\mathrm{O}}(n+1) > v_0^{*,\mathrm{O}}(m^*) \quad \text{for all } m^* > n+1.$$

Transparent governance therefore dominates in two dimensions. First, it ensures the system selects the welfare-maximizing equilibrium uniquely. Second, it prevents inefficient coordination on equilibria with excessive delegation that dilute information aggregation. In opaque (DAO-style) governance, the same underlying structure can produce a the full range of self-fulfilling equilibria, many of which leave minority shareholders worse off.

Proposition 7. *Transparency improves small-investor welfare by eliminating low-value equilibria. In the unique transparent-governance equilibrium, welfare equals*

$$v_0^{*,T}(n+1) = \frac{\omega^2 - l^2 - 4\frac{(n+1)}{(n+2)^2(n+3)}\epsilon^2}{4\omega},$$

whereas under opaque governance, equilibrium welfare satisfies

$$v_0^{*,O}(m) \leq v_0^{*,T}(n+1) \quad \textit{for all admissible } m \in \{n+1, \ldots, 2n+1\}.$$

Intuition. Transparent governance aligns incentives through observability and commitment: the blockholder indirectly chose the equilibrium cutoff $s^*(m)$ through her choices of m and this ensures efficient information aggregation. Under opacity, delegates and the blockholder conjecture each other's actions simultaneously, generating multiple self-consistent equilibria of not all of which are efficient. In this sense, transparency acts as a coordination device that selects the best equilibrium, protecting small shareholders from welfare losses that arise purely from strategic uncertainty.

6 Blockholder Premium

The welfare analysis above naturally gives rise to an equilibrium valuation effect for the project. Since the blockholder's delegation choice influences how projects are approved, the project's market value should reflect the governance regime in place. We therefore define the *blockholder premium* as the difference between project value with and without a blockholder.

Benchmark without a blockholder. In the absence of a blockholder, all $2n+1$ voting members are informed delegates with bias $l > 0$. They follow the same cutoff strategy as in the opaque-governance case, with $m = 2n+1$. The resulting expected project value coincides with the value expression derived for opaque governance in Section 4 evaluated at full delegation:

$$v^0 \;\equiv\; v_0^{*,\mathrm{O}}(2n{+}1) = \frac{\omega^2 - l^2 - 4\frac{(n+1)^2}{(2n+2)(2n+3)}\epsilon^2}{4\omega}.$$

Thus, the benchmark without a blockholder is equivalent to the equilibrium under *full delegation* in the opaque case.

Blockholder premium under transparent governance. Under transparent governance, the blockholder premium in the transparent regime is therefore

$$\Pi^{\mathrm{T}} \;\equiv\; v_0^{*,\mathrm{T}} - v^0 = \frac{n\left((n-1)n-4\right)\epsilon^2}{4\left(n+2\right)^2\left(n+3\right)\left(2n+3\right)\omega} > 0,$$

The strict inequality is a direct consequence from the fact that minimal delegation is optimal and improves information aggregation relative to full delegation. Transparent governance thus delivers a strictly positive blockholder premium relative to the no-blockholder (or full-delegation) benchmark.

Blockholder premium under opaque governance. Under opaque governance, multiple equilibria can arise with $m^* \in \{n{+}1, \ldots, 2n{+}1\}$. 5 establishes that $v_0^{*,\mathrm{O}}(m^*)$ is strictly decreasing in m^* , hence the blockholder premium under opacity is

$$\Pi^{\mathrm{O}}(m^*) \equiv v_0^{*,\mathrm{O}}(m^*) - v^0 > 0,$$

but it is strictly smaller than the transparent premium whenever $m^* > n{+}1$ and decreasing. Only under minimal delegation do transparent and opaque premiums coincide:

$$\Pi^{\mathrm{T}} = \Pi^{\mathrm{O}}(n{+}1) > \Pi^{\mathrm{O}}(m^*) \quad \text{for all } m^* > n{+}1.$$

Economic implication. The analysis implies a clear ranking of governance regimes. Transparency yields the highest blockholder premium because it ensures coordination on the minimal-delegation equilibrium, which maximizes information aggregation and project value. Opaque governance still generates a positive blockholder premium relative to the no-blockholder (full-delegation) benchmark, but this premium is lower whenever coordination leads to equilibria with excessive delegation. In this sense, transparent (traditional) boards support the most valuable use of blockholder control, while opaque DAO-style governance risks diluting the potential gains from blockholder discipline.

7 Extensions

7.1 Sincere Voting

As a benchmark, consider a version of the model in which informed delegates vote *sincerely* rather than strategically. Each informed delegate bases her vote solely on her private signal s_i and bias l, without conditioning on the event of being pivotal. By Bayes' rule, the posterior of θ after observing a signal s_i is uniform on the interval $[\max\{-\omega, s_i - \epsilon\}, \min\{\omega, s_i + \epsilon\}]$, with mean

$$\mathbb{E}[\theta \mid s_i] = \frac{\max\{-\omega, s_i - \epsilon\} + \min\{\omega, s_i + \epsilon\}}{2}.$$

Whenever s_i lies in the interior region $[-\omega + \epsilon, \omega - \epsilon]$, this simplifies to $\mathbb{E}[\theta \mid s_i] = s_i$. An informed delegate therefore votes in favor whenever $\mathbb{E}[\theta \mid s_i] + l \geq 0$, yielding a fixed cutoff $s^{*,\text{sinc}} = -l$. As the blockholder has no private information and is biased against accepting the proposal, she always instructs her delegates to vote against approval.

Since the informed delegates' cutoffs no longer depend on the number of blockholder delegates, changing m affects only how many independent signals are aggregated, not how informed delegates use them. This removes the self-reinforcing feedback between individual voting behavior and the number of blockholder delegates that existed under strategic voting. In this non-strategic benchmark, the collective decision is therefore determined purely by information aggregation, and the multiple equilibria of the strategic model no longer arise.

The comparison between strategic and sincere voting highlights the role of the swing voter's curse in generating equilibrium multiplicity. Under sincere voting, informed delegates ignore the information revealed by being pivotal, treating their vote as if it were decisive with probability one. This eliminates the strategic complementarity between the blockholder's delegation choice and informed delegates' voting behavior. With strategic voting, informed delegates rationally update their beliefs conditional on being pivotal, creating a feedback loop where beliefs about delegation affect voting behavior, which in turn validates those beliefs.

8 Empirical Implications

The model delivers several empirical implications. A first implication concerns the valuation of control. Section 6 shows that the control premium is highest under transparent governance and that opacity supports multiple equilibria with sometimes lower and dispersed premia. Consequently, control premia should be lower on average and more variable in DAOs than in traditional firms with observable boards. A second implication concerns market reactions to governance. Because opaque governance admits shifts across equilibria, DAO governance tokens should exhibit greater price volatility and more pronounced reactions around governance events than equities. Finally, the comparison of transparent and opaque regimes in Sections 5 and 6 implies that transparency-enhancing reforms—such as verifiable delegates or public delegation registries—should raise token valuations and reduce governance-related volatility, by eliminating low-value equilibria.

9 Policy Implications

The analysis carries several implications for DAO governance design and regulation: A first implication concerns transparency. Since Sections 5 and 6 show that observability of delegation selects the high-value equilibrium, DAO governance mechanisms that increase the verifiability of delegation—such as optional identity-verified delegates, transparent delegation registries, or reputation systems—can help replicate the commitment value of traditional boards while preserving pseudonymity for others. These mechanisms directly target the source of governance fragility in the model: the unobservability of who controls voting power.

A second implication concerns incentives. Since the project value is decreasing in the misalignment of preferences across all equlibria (see (6)), mechanisms that strengthen delegates' alignment with fundamental project value—such as token-based compensation, vesting schedules tied to outcomes, or "skin-in-the-game" requirements—can mitigate the adverse effect of equilibrium miscoordination even when transparency is infeasible.

A third implication concerns communication. While communication cannot make delegation observable, structured discussion channels and public reasoning can help coordination on more efficient equilibria, reducing the likelihood that DAOs drift toward low-value sceanarios.

Finally, because equilibrium shifts can produce large valuation swings, large DAOs may introduce novel systemic risks, including correlated governance failures across interconnected protocols.

10 Limitations and Future Research

The analysis abstracts from many institutional features of real-world DAOs, including variations in how voting power is allocated, how proposals are structured, and how governance is administered and empirical work is needed to assess the extent to which the governance fragility identified in the model arises in practice. Moreover, the framework focuses on a single voting decision with a fixed delegation structure. Many DAOs operate in dynamic environments in which governance choices affect future beliefs, delegate reputation, and even the distribution of voting power. Such dynamics may either dampen or amplify the multiplicity highlighted in the static setting, and understanding these forces remains an important direction for future research.

Despite these limitations, the central insight—that pseudonymity eliminates observable board composition as a coordination device and thereby introduces equilibrium multiplicity absent in traditional governance—appears robust.

11 Conclusion

This paper analyzes how the observability of delegation shapes information aggregation in committees where a blockholder trades off control against the informational advantages of informed delegates. Under transparent governance—mirroring traditional corporate boards—the blockholder's delegation choice is publicly observed and anchors the voting behavior of informed delegates. This commitment structure yields a unique equilibrium in which the blockholder delegates just enough authority to lose majority control, inducing a unanimity requirement among informed delegates and maximizing project value. In this setting, blockholder representation is strictly beneficial for all shareholders: it disciplines optimistic informed delegates while preserving the informational gains from delegation.

Under opaque governance—characteristic of DAOs—delegation decisions are not observable, and informed delegates must form beliefs about committee composition when voting. This removes the blockholder's commitment power and introduces multiple self-fulfilling equilibria with sharply different information aggregation properties. Some equilibria replicate the transparent governance outcome, while others deliver substantially lower welfare and diluted control premia. Small investors are therefore exposed to governance fragility that does not arise in traditional settings, and market valuations may fluctuate as beliefs shift across equilibria.

The analysis abstracts from communication, repeated interaction, and institutional details that may influence equilibrium selection in practice. Understanding how dynamic governance, reputation mechanisms, or partial transparency affect the prevalence of efficient versus inefficient equilibria remains an important direction for future work. Nonetheless, the central insight—that pseudonymity eliminates observable delegation as a coordination device and thereby introduces equilibrium multiplicity absent in traditional governance—offers a framework for evaluating the design and regulation of emerging blockchain-based organizations.

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Appendix

Notation $n \in \{1, 2, \ldots\}$ is fixed and the committee size is $2n+1$. There are m informed delegates and $2n+1-m$ *blockholder delegates*. Each m informed delegates receives a signal $s_i = \theta + \sigma_i$ with $\sigma_i \sim \mathcal{U}[-\epsilon, \epsilon]$; therefore $s_i \in [\theta - \epsilon,\ \theta + \epsilon]$. An informed delegate votes "yes" when $s_i > s^*$. Given θ, the probability of a "yes" vote is

$$P(v_i = 1 \mid \theta) = P(s_i > s^* \mid \theta) = \begin{cases} 1 & s^* + \epsilon \leq \theta \\ \frac{1}{2} + \frac{1}{2\epsilon}(\theta - s^*) & \theta \in (s^* - \epsilon, s^* + \epsilon) \\ 0 & s^* - \epsilon \geq \theta \end{cases} \tag{7}$$

Proof of Proposition 1

The proof proceeds by showing that the blockholder always instructs her own delegates to reject the project independently of the number of informed delegates she has chosen. This is because she is already biased against the project through her private benefits, and the more she delegates to blockholder delegates, the more she becomes pessimistic about the project by extracting information from the event of being pivotal.

In order to understand the blockholder's voting behavior, the concept of being pivotal first needs to be extended to a voter who controls multiple votes: For delegation to be meaningful, the blockholder must delegate at least $n+1$ informed delegates ($m \geq n+1$) - otherwise, her own delegates retain the majority, and she can never be pivotal. As a consequence, in all cases where $m < n+1$, the blockholder cannot extract any information from the event of being pivotal and thus votes according to her prior to reject the project with a majority, resulting in all of those choices ($m < n+1$) being outcome equivalent.

In all that follows, we thus mean by delegation that at least $m \geq n+1$ of the committee members are informed delegates. Furthermore, it is clear that it must be that $m \leq 2n$ as otherwise only informed delegates vote and the blockholder has no delegates at all. Assume now that, out of the m informed delegates, i vote in favor of the project, and $m-i$ vote against. If $i \geq n+1$, there is a majority in favor of the project among the informed delegates alone, and the blockholder cannot be pivotal, so that the project will pass regardless of the blockholder delegates' votes. Conversely, if there are $m-i \geq n+1$, there is a majority against the proposal among the informed delegates, and again the blockholder cannot be pivotal as the project will be rejected regardless of her delegates' votes. Therefore, the blockholder can be pivotal only when the number of votes in favor of the project among informed delegates satisfies $i \in \{m-n, \ldots, n\}$.

The probability that the blockholder is pivotal, given the state θ, can then be written as:

$$P\left(piv_b \mid \theta\right) = \sum_{i=m-n}^{n} \binom{m}{i} \left[P\left(v_i = 1 \mid \theta\right)\right]^i \left[P\left(v_i = 0 \mid \theta\right)\right]^{m-i} \mathbb{1}_{\{\theta \in [s^*-\epsilon, s^*+\epsilon]\}} \tag{8}$$

.Given a project value θ, inside members accept with probability

$$P\left(v_i = 1 \mid \theta\right) = \tfrac{1}{2} + \tfrac{\theta - s^*}{2\epsilon},$$

where s^* is their equilibrium cutoff. The probability of being pivotal in state θ can then be expressed as

$$P\left(piv_b \mid \theta\right) = \sum_{i=m-n}^{n} \binom{m}{i} \left[\frac{1}{2} + \frac{1}{2\epsilon}\left(\theta - s^*\right)\right]^i \left[\frac{1}{2} - \frac{1}{2\epsilon}\left(\theta - s^*\right)\right]^{m-i} \mathbb{1}_{\{\theta \in [s^*-\epsilon, s^*+\epsilon]\}}$$

. The posterior probability distribution of θ in the event of being pivotal can then be derived by Bayes' rule as

$$f\left(\theta \mid piv_b\right) = \frac{1}{2\epsilon} \frac{m+1}{2n+1-m} \sum_{i=m-n}^{n} \left(\begin{array}{c} m \\ i \end{array} \right) \left[\frac{1}{2} + \frac{1}{2\epsilon}\left(\theta - s^*\right)\right]^i \left[\frac{1}{2} - \frac{1}{2\epsilon}\left(\theta - s^*\right)\right]^{m-i} \quad \theta \in [s^* - \epsilon, s^* + \epsilon]$$

Performing a change of variable

$$p = \frac{1}{2} + \frac{1}{2\epsilon}\left(\theta - s^*\right)$$

$$\frac{dp}{d\theta} = \frac{1}{2\epsilon}$$

and noting that $\int_0^1 (p)^n (1-p)^{m-n} dp$ is the Euler integral of the first kind with the value $\frac{n!(m-n)!}{(m+1)!}$ we obtain that

$$\int_{s^*-\epsilon}^{s^*+\epsilon}\left(\frac{1}{2}+\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^n\left(\frac{1}{2}-\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{m-n}d\theta$$
$$=2\epsilon\frac{n!\,(m-n)!}{(m+1)!}$$

Using this formula iteratively for n and $n+1$ the expected conditional mean can now be derived by

$$\begin{aligned}
&2\epsilon\frac{(n+1)!\,(m-n)!}{(m+2)!}\\
&=\int_{s^*-\epsilon}^{s^*+\epsilon}\left(\frac{1}{2}+\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{n+1}\left(\frac{1}{2}-\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{m-n}d\theta\\
&=\left(\frac{1}{2}-\frac{s^*}{2\epsilon}\right)\int_{s^*-\epsilon}^{s^*+\epsilon}\left(\frac{1}{2}+\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{n}\left(\frac{1}{2}-\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{m-n}d\theta\\
&\quad+\frac{1}{2\epsilon}\int_{s^*-\epsilon}^{s^*+\epsilon}\theta\left(\frac{1}{2}+\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{n}\left(\frac{1}{2}-\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{m-n}d\theta\\
&=\left(\frac{1}{2}-\frac{s^*}{2\epsilon}\right)2\epsilon\frac{n!\,(m-n)!}{(m+1)!}+\frac{1}{2\epsilon}\int_{s^*-\epsilon}^{s^*+\epsilon}\theta\left(\frac{1}{2}+\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{n}\left(\frac{1}{2}-\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{m-n}d\theta
\end{aligned}$$

re-arraigning gives

$$\frac{1}{2\epsilon}\int_{s^*-\epsilon}^{s^*+\epsilon}\theta\left(\frac{1}{2}+\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{n}\left(\frac{1}{2}-\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{m-n}d\theta$$
$$=2\epsilon\frac{(n+1)!\,(m-n)!}{(m+2)!}-\left(\frac{1}{2}-\frac{s^*}{2\epsilon}\right)2\epsilon\frac{n!\,(m-n)!}{(m+1)!}$$

the conditional mean can then be derived as

$$
\begin{aligned}
\mathbb{E}\left[\theta \mid piv_b\right] &= \int_{-\infty}^{\infty} \theta f\left(\theta \mid piv_b\right) d\theta \\
&= \frac{m+1}{2n+1-m} \sum_{i=m-n}^{n} \begin{pmatrix} m \\ i \end{pmatrix} \frac{1}{2\epsilon} \int_{s^*-\epsilon}^{s^*+\epsilon} \theta \left(\frac{1}{2} + \frac{1}{2\epsilon}\left(\theta - s^*\right)\right)^{i} \left(\frac{1}{2} - \frac{1}{2\epsilon}\left(\theta - s^*\right)\right)^{m-i} d\theta \\
&= \frac{m+1}{2n+1-m} \sum_{i=m-n}^{n} \frac{\left(\left(2i-m\right)\epsilon + \left(m+2\right)s^*\right)}{\left(m+2\right)\left(m+1\right)} \\
&= s^* \\
&< 0
\end{aligned}
$$

The blockholder has lowered her expectations of the project's quality. This downwards revision, together with the private benefit she receives if the proposal is rejected, leads her to conclude that the proposal should be rejected. To ensure its rejection, she must instruct all her delegates to vote against it. This is necessary because she cannot tell exactly how many informed delegates voted yes or no from the pivotal event. For instance, if n out of m informed delegates have voted yes and she would be pivotal as a consequence of this configuration, she needs every one of her delegates to vote no; otherwise, the proposal would be approved.

Proof of Proposition 2

The first step of the proof proceeds by confirming that the proposed voting strategy is an equilibrium in the voting sub-game. Suppose all informed delegates vote according to the threshold strategy s^*. A informed delegate is *pivotal* if—given all other votes—their vote alone determines the outcome of the vote - which is the case when exactly n delegates vote for and against the acceptance. As $2n+1-m$ blockholder delegates already vote no, only $m-n-1$ informed delegates are required to vote not in order to obtain the required n "no" votes for pivotality.The likelihood of an informed delegate being pivotal in state θ is then the likelihood that n of the $m-1$ other informed delegates are voting in favor of the proposal.

$$P\left(piv_i \mid \theta\right) = \binom{m-1}{n}\left(\frac{1}{2}+\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^n\left(\frac{1}{2}-\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{m-n-1}\mathbb{1}_{\{\theta\in[s^*-\epsilon,s^*+\epsilon]\}}$$

The posterior probability of θ in the event of being pivotal and having observed a signal exactly equal to the cutoff value of the other informed delegates s^* can then be derived as

$$g\left(\theta \mid s^*, piv_i\right) = \frac{\left(\frac{1}{2}+\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^n\left(\frac{1}{2}-\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{m-n-1}\mathbb{1}_{\{\theta\in[s^*-\epsilon,s^*+\epsilon]\}}}{\int_{s^*-\epsilon}^{s^*+\epsilon}\left(\frac{1}{2}+\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^n\left(\frac{1}{2}-\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{m-n-1}d\theta} \quad \theta\in[s^*-\epsilon, s^*+\epsilon] \tag{9}$$

The integral in the denominator can be evaluated by change of variable again

$$p = \frac{1}{2}+\frac{1}{2\epsilon}\left(\theta-s^*\right)$$

$$\frac{dp}{d\theta} = \frac{1}{2\epsilon}$$

and noting again that $\int_0^1 p^n\left(1-p\right)^{m-n-1}dp$ is the Euler integral of the first kind with the value $\frac{n!(m-n-1)!}{m!}$, we have

$$\begin{aligned}
&\int_{s^*-\epsilon}^{s^*+\epsilon}\binom{m-1}{n}\left(\frac{1}{2}+\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^n\left(\frac{1}{2}-\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{m-n-1}d\theta\\
&=\binom{m-1}{n}2\epsilon\frac{n!\,(m-n-1)!}{m!}\\
&=\frac{2\epsilon}{m}
\end{aligned}$$

The expected conditional mean can now be derived using the fact that

$$\begin{aligned}
&\frac{1}{2\epsilon}\int_{s^*-\epsilon}^{s^*+\epsilon}\theta\left(\frac{1}{2}+\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^n\left(\frac{1}{2}-\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{m-n-1}d\theta\\
&=2\epsilon\frac{(n+1)!\,(m-n-1)!}{(m+1)!}-\left(\frac{1}{2}-\frac{s^*}{2\epsilon}\right)2\epsilon\frac{n!\,(m-n-1)!}{m!}
\end{aligned}$$

Thus

$$
\begin{aligned}
\mathbb{E}\left[\theta \mid s^*, piv_i\right] &= \int_{-\infty}^{\infty} \theta g\left(\theta \mid s^*, piv_i\right) d\theta \\
&= \frac{1}{2\epsilon} \frac{m!}{n!\,(m-n-1)!} \int_{s^*-\epsilon}^{s^*+\epsilon} \theta \left(\frac{1}{2} + \frac{1}{2\epsilon}\left(\theta - s^*\right)\right)^{n} \left(\frac{1}{2} - \frac{1}{2\epsilon}\left(\theta - s^*\right)\right)^{m-n-1} d\theta \\
&= \frac{m!}{n!\,(m-n-1)!} \left[2\epsilon \frac{(n+1)!\,(m-n-1)!}{(m+1)!} - \left(\frac{1}{2} - \frac{s^*}{2\epsilon}\right) 2\epsilon \frac{n!\,(m-n-1)!}{m!}\right] \\
&= \frac{2n+1-m}{m+1}\epsilon + s^*
\end{aligned}
$$

$$
\max_{\epsilon} \int_{s^*(\epsilon)}^{\omega+\epsilon} \mathbb{E}\left[\theta + l \mid s_i, piv_i\right] P\left(piv_i \mid s_i\right) f\left(s_i\right) ds_i - c\epsilon
$$

An informed delegate who observes exactly s^* has to be indifferent between accepting and rejecting, so

$$
\frac{2n+1-m}{m+1}\epsilon + s^* + l = 0
$$

or

$$
s^* = -\frac{2n+1-m}{m+1}\epsilon - l
$$

To show uniqueness, I proceed to show that the best response is strictly increasing. Let $s^{*,-i}$ denote the cutoff signal of all other informed delegates. Then, the conditional expectation of an informed delegate who observes a signal s_i in the event of being pivotal is given by

$$
\mathbb{E}\left[\theta \mid s_i, piv; s^{*,-i}\right] = \frac{1}{2\epsilon} \frac{m!}{n!\,(m-n-1)!} \int_{\max\{s_i,s^*\}-\epsilon}^{\min\{s_i,s^*\}+\epsilon} \theta \left(\frac{1}{2} + \frac{1}{2\epsilon}\left(\theta - s^*\right)\right)^{n} \left(\frac{1}{2} - \frac{1}{2\epsilon}\left(\theta - s^*\right)\right)^{m-n-1} d\theta
$$

Suppose the other informed delegates increase their cutoff from s^* to $\hat{s}^*$, then

$$
\begin{aligned}
\min\left\{s^*, \hat{s}^*\right\} + \epsilon &= s^* + \epsilon \\
\max\left\{s^*, \hat{s}^*\right\} - \epsilon &= \hat{s}^* - \epsilon
\end{aligned}
$$

Thus,

$$\mathbb{E}\left[\theta \mid s^*, piv; \hat{s}^*\right] = \frac{1}{2\epsilon}\frac{m!}{n!\,(m-n-1)!}\int_{\hat{s}^*-\epsilon}^{s^*+\epsilon} \theta\left(\frac{1}{2}+\frac{1}{2\epsilon}\left(\theta-\hat{s}^*\right)\right)^{n}\left(\frac{1}{2}-\frac{1}{2\epsilon}\left(\theta-\hat{s}^*\right)\right)^{m-n-1} d\theta$$

Using the Leibniz rule, we get the derivative with respect to $\hat{s}^*$

$$\begin{aligned}
&\frac{\partial}{\partial \hat{s}^*}\mathbb{E}\left[\theta \mid s^*, piv; \hat{s}^*\right] \\
&= \frac{1}{2\epsilon}\frac{m!}{n!\,(m-n-1)!}\int_{\hat{s}^*-\epsilon}^{s^*+\epsilon} \left[\frac{1}{2\epsilon}\theta\left(\frac{1}{2}+\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{n-1}\right. \\
&\left.\left(\frac{1}{2}-\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)^{m-n-2}\left(\frac{1}{2}+\frac{1}{2\epsilon}\left(\theta-s^*\right)\right)\left(\underbrace{m-n-1}_{\geq 0}\right)\right] d\theta \\
&> 0
\end{aligned}$$

Thus, after an increase in $\hat{s}^*$,

$$\mathbb{E}\left[\theta \mid s^*, piv; \hat{s}^*\right] + l > 0$$

and the informed delegate will strictly increase her cutoff point at which she is indifferent. The best response is thus strictly increasing.

Proof of Lemma 3

The proof consists of integrating over each summand and then adding up the sum. The proof uses the result that

$$\sum_{i=n+1}^{m}\binom{m}{i}\left[\underbrace{\frac{1}{2}+\frac{1}{2\epsilon}\left(\theta-s^*\right)}_{P(v_i=1|\theta)}\right]^{i}\left[\underbrace{\frac{1}{2}-\frac{1}{2\epsilon}\left(\theta-s^*\right)}_{P(v_i=0|\theta)}\right]^{m-i}$$

$$\begin{aligned}
&\int_{s^*-\epsilon}^{s^*+\epsilon}\left(\theta-b\right)\begin{pmatrix} m \\ i \end{pmatrix}\left[\frac{1}{2}+\frac{1}{2\epsilon}\left(\theta-s^*\right)\right]^{m-i}\left[\frac{1}{2}-\frac{1}{2\epsilon}\left(\theta-s^*\right)\right]^{i} d\theta \\
=&\frac{\epsilon\left(m-2i\right)+\left(s^*-b\right)\left(m+2\right)}{\left(m+1\right)\left(m+2\right)}2\epsilon
\end{aligned}$$

$$
\begin{aligned}
&v(m)\\
&= \frac{1}{2\omega}\int_{-\omega}^{\omega}(\theta-b)\,P_{n,m}(d=1\mid\theta)\,d\theta\\
&= \frac{1}{2\omega}\left\{\sum_{i=n+1}^{m}\int_{s^*-\epsilon}^{s^*+\epsilon}(\theta-b)\binom{m}{i}\left[\frac{1}{2}+\frac{1}{2\epsilon}(\theta-s^*)\right]^{i}\left[\frac{1}{2}-\frac{1}{2\epsilon}(\theta-s^*)\right]^{m-i}d\theta+\int_{s^*+\epsilon}^{\omega}(\theta-b)\,d\theta\right\}\\
&= \frac{1}{2\omega}\left\{\sum_{i=0}^{m-n-1}\frac{\epsilon(m-2i)+(s^*-b)(m+2)}{(m+1)(m+2)}2\epsilon+\frac{1}{2}\left(\omega^2-(s^*+\epsilon)^2\right)+b\left((s^*+\epsilon)-\omega\right)\right\}\\
&= \frac{1}{2\omega}\left[\frac{2\epsilon(m-n)}{(m+1)(m+2)}\left[(n+1)\epsilon-(m+2)(b-s^*)\right]+\frac{1}{2}\left[(\omega-b)^2-(b-s^*-\epsilon)^2\right]\right]
\end{aligned}
$$

Proof of Proposition5

Recall from Lemma 3 that, for $m \geq n+1$, the blockholder's expected utility is

$$v_b(m) = \frac{1}{2\omega}\left\{\frac{2\epsilon(m-n)}{(m+1)(m+2)}\left[(n+1)\epsilon-(m+2)(b-s^*)\right]+\frac{1}{2}\left[(\omega-b)^2-(b-s^*-\epsilon)^2\right]\right\}$$

(i) Interior optimum. Recall from (5) that the marginal gain of adding one more insider:

$$\Delta v_b(m) = v_b(m+1) - v_b(m).$$

can be expressed as

$$v_b(m+1)-v_b(m) = \frac{\epsilon}{\omega}\frac{(n+1)}{(m+1)(m+2)}\left[\frac{2n+1-m}{m+3}\epsilon-(b-s^*)\right]$$

. Hence

$$\Delta v_b(m) > 0 \iff \tfrac{2n+1-m}{m+3}\epsilon > b-s^* \iff m < \frac{(2n+1)\epsilon-3(b-s^*)}{\epsilon+b-s^*}.$$

The blockholder will increase m as long as $\Delta v_b(m) > 0$, and stops at the smallest integer m for which

$$m \geq \frac{(2n+1)\epsilon-3(b-s^*)}{\epsilon+(b-s^*)}.$$

(ii) Boundary checks.

1. *No delegation is optimal,* $m^* = 0$. Even minimal meaningful delegation $m = n+1$

must be worse than no rejecting the proposal and receiving 0. That is,

$$v_b\left(n+1\right) \leq 0 \Longleftrightarrow \left(\omega-b\right)^2 < \frac{4\left(n+1\right)}{\left(n+2\right)^2\left(n+3\right)}\epsilon^2 \text{ or } b-s^* \geq \frac{n}{n+1}\epsilon+\sqrt{\left(\omega-b\right)^2-\frac{4\left(n+1\right)}{\left(n+2\right)^2\left(n+3\right)}\epsilon^2}.$$

In either case, the cost of losing control outweighs any information benefit, so $m^* = 0$.

2. *Full delegation is optimal,* $m^* = 2n+1$. Even at $m = 2n$, the increment must remain profitable:

$$v_b\left(n+1\right) > 0 \Longleftrightarrow b-s^* \leq \frac{1}{2n+3}\epsilon.$$

Whenever $b - s^* \leq \frac{\epsilon}{2n+3}$, the blockholder continues to add insiders up to $2n+1$.

3. *Minimal delegation is optimal,* $m^* = n+1$. If $v_b\left(n+1\right) > 0$ but the next increment fails, i.e. $\Delta v_b\left(n+1\right) \leq 0$, then

$$b-s^* \geq \frac{n}{n+4}\epsilon \Longrightarrow \frac{\left(2n+1\right)\epsilon-3\left(b-s^*\right)}{\epsilon+\left(b-s^*\right)} \leq n+1.$$

In this case the blockholder stops exactly at the smallest meaningful delegation, $m = n+1$. This completes the proof.