Decentralized Autonomous Organizations and the Limits of Shareholder Democracy

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Using Decentralized Autonomous Organizations (DAOs) as a laboratory, I study the limits of expanding shareholder involvement in corporate decision-making. I find that low participation among small shareholders allows large shareholders to impose voting outcomes. I further show that this concentration of control is self-reinforcing. When large shareholders first impose outcomes, small shareholders learn that subsequent decisions are unlikely to reflect their preferences, share prices drop, and small shareholders further disengage from governance. I rationalize these findings with a model in which large shareholders' voting behavior signals whether their interests align with those of small shareholders. Structural estimation of the model suggests that, in expansive shareholder democracies, large shareholders extract private benefits when they impose their preferred outcomes.

Keywords: Shareholder voting, Shareholder democracy, Corporate governance, Decentralized Autonomous Organizations (DAOs), Decentralized Finance (DeFi)

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1 Introduction

How much should shareholders be involved in corporate decision-making? Corporations have traditionally delegated decisions to managers, who have been assumed to be best equipped to maximize shareholder value. Yet conflicts of interest may lead managers to pursue objectives that diverge from those of shareholders. Expanding shareholder involvement to mitigate these conflicts entails a fundamental trade-off. On the positive side, shareholder voting can ensure that decisions reflect shareholders' preferences (Bebchuk (2004)). On the negative side, participation in votes is costly for shareholders, giving rise to free-riding by small shareholders (Grossman and Hart (1980, 1988), Burkart et al. (1997)). Large shareholders and their incentives to get informed can be viewed as a solution to this free-riding problem (Shleifer and Vishny (1986), Admati et al. (1994)), but their concentrated voting power also enables them to pursue privately beneficial outcomes (Barclay and Holderness (1989)). This trade-off has gained renewed attention amid growing calls for broader shareholder involvement in firms' decision-making, particularly on climate strategy (Hart (2026), Financial Times) and, more recently, AI adoption (Financial Times). Ultimately, whether more shareholder votes can lead to decisions better tailored to shareholders' objectives remains an open question (Hart and Zingales (2022)).

To shed new light on this question, this paper uses the novel setting of Decentralized Autonomous Organizations (DAOs). DAOs are blockchain-based organizations. Prominent examples of DAOs are platforms providing financial services on blockchains (e.g., stablecoin issuers, exchanges, lending platforms). DAOs issue tokens to finance themselves. These tokens are akin to shares, as they constitute cash flow claims and grant voting rights[1]. DAOs offer two advantages relative to traditional firms for studying broad shareholder involvement in decision-making. First, unconstrained by corporate-law limitations on the scope of shareholder voting (Bainbridge (2006)) and benefiting from low-cost blockchain voting, DAOs involve shareholders in a wide range of decisions through frequent votes. These include traditional governance decisions, such as allocation of control, and decisions typically delegated to management, such as advertising budgets and business strategy. Second, DAOs provide granular voting data. For each proposal, every choice from every voter along with its exact voting power

[1]Hereafter, I use the term shareholders to refer to DAO tokenholders and the word share to refer to DAO tokens.

is recorded, providing extensive vote-level data usually unavailable in corporate governance studies. Traditional conflicts of interest also exist in DAOs' governance. Several instances of founders pursuing private benefits at the expense of shareholders have already been observed[2].

Using DAOs' extensive reliance on voting, I provide empirical evidence on the limits of implementing expansive shareholder democracies. I first document that shareholder turnout is ubiquitously low and declines as DAOs increasingly solicit shareholder votes. This low participation yields concentrated voting power, allowing large shareholders to impose outcomes against small shareholders' preferences. I then test whether, following the first such instance, small shareholders learn that their preferences are unlikely to be reflected in future decisions. I find support for this hypothesis, as these events are followed by sharp declines in share prices and further disengagement by small shareholders, highlighting that concentration of control in DAOs is self-reinforcing. I further test whether shareholders value being involved in broader decisions by looking at stock price reactions around such votes. I also find support for this hypothesis, but only in cases in which shareholders retain influence over implemented outcomes. Therefore, although there can be positives to involving shareholders over broader decisions, the self-reinforcing negative effects of concentrated control ultimately dominate.

I document that, on average, only 3.36% of DAOs' ownership is cast in proposals, with even lower participation in larger DAOs, where more dispersed ownership intensifies free-riding. Turnout is also highest in early proposals and declines thereafter. At the proposal level, shareholder turnout is negatively correlated with the number of recent proposals. This low engagement results in substantial voting power concentration in proposals.

I show that the largest voters, who have enough shares to control the outcomes of proposals, use this voting power to unilaterally impose outcomes against small shareholders' preferences. Because the conflictual aspect of proposals is unobservable, I use these vote-level patterns to infer it. Namely, I define proposals with *swaying majority voters* as proposals in which one large voter unilaterally implements an outcome against what small shareholders would have chosen[3]. Swaying majority voter instances occur across DAOs and recur within DAOs. The outcomes unilaterally chosen in those instances are often suggestive of private benefits of

[2]For example, the controversies involving Chef Nomi at SushiSwap (CoinDesk, 2020) and Rune Christensen at MakerDAO (Wired, 2022).

[3]Swaying majority voters therefore hold more than 50% of the voting power within a proposal. Section 4.1.1 discusses why, with regard to the data, 50% is the most appropriate threshold.

control (Bertrand and Mullainathan (2000, 2001), Dyck and Zingales (2004)) as they typically revolve around allocation of control (token tunneling toward DAOs' insiders) or say-on-pay (voting in favor of high salaries of DAOs' insiders).

Using an event study, I argue that first swaying majority voter instances signal to small shareholders that their preferences will not be reflected in decisions going forward. One piece of evidence supporting this information release is that first swaying majority occurrences trigger sharp declines in DAOs' share prices (weekly CARs drop by 12.7% following these instances). As the ability to sway the vote unilaterally depends on proposals' turnout, a potential concern for identification is that first swaying majority instances may occur in proposals with low shareholder engagement. I show that this is not the case. First swaying majority instances are associated with 35% higher shareholder engagement than the sample average. Despite an increase in participation, small shareholders' engagement remains too low for their preferences to be reflected in decisions, even when shareholders' preferences conflict, highlighting a fundamental limit to the effectiveness of shareholder democracy in DAOs. When I exclude proposals with the lowest shareholder engagement from the sample, I show that the effect of first swaying majority voters on returns is even more salient. Using a placebo test around the second swaying majority voter instances, I also show that the negative market reaction is uniquely concentrated around first swaying majority instances. This price reaction is also absent when large voters determine proposals' outcomes but side with small shareholders.

Beyond immediate market reactions, I find that subsequent participation by small shareholders declines following proposals with first swaying majority voters. This provides further evidence that first swaying majority voting occurrences signal to small shareholders that their preferences are unlikely to influence future decisions. Voting power concentration increases in the proposals following first swaying majority voter instances. Gini indexes rise on average by 3.84%, and this increase is driven by the decreasing voting power of small shareholders. First swaying majority voter instances thus mark a breakdown in DAOs' shareholder democracies and a shift toward a governance structure characterized by even stronger dominance of large participants.

On the positive side, I show that shareholders value having influence over a broader set of decisions. I test whether proposals in which no single shareholder controls the outcome,

allowing shareholders to retain influence over decisions, are associated with positive returns. I find that this is the case and that the effect is driven by product-design proposals (+4.34% in weekly CARs), such as technical upgrades or user-interface changes. Product-design proposals themselves are not associated with positive abnormal returns on average. This effect thus arises only when shareholders retain influence over the implemented outcomes of decisions that are typically delegated to management in corporations.

To rationalize my empirical findings, I develop a model centered on small shareholders' uncertainty about the preferences of a large blockholder who sells them the DAO's shares. When shareholders do not observe a swaying majority vote right away, they rationally update their beliefs, interpreting the absence of early swaying as a signal that the large blockholder has preferences aligned with their own, which increases the price of the token. This creates a tension for the large blockholder between swaying immediately, securing a private payoff right away, and delaying the sway to sell more tokens to small shareholders at a higher price. In this model, the price of the share drops after the large blockholder sways, rationalizing the negative CARs observed empirically. Swaying early often makes the signal of preference alignment especially strong when the large blockholder instead chooses to delay the sway, ultimately leading to a larger price drop when swaying occurs.

I further extend the baseline model to an N-voter setting in which small shareholders endogenously choose whether to participate in votes. Each shareholder optimally chooses its probability of participating in votes as a function of its token stake, cost of attention, and probability of being pivotal in preventing the large blockholder from successfully swaying. The resulting equilibrium governance participation probabilities jointly determine the realized turnout among small shareholders and the probability that an attempted sway by the large blockholder is countered by small shareholders. If a swaying attempt occurs and is successful, small shareholders rationally revise downward their beliefs about their ability to counter the large blockholder's swaying attempts, reducing future expected small shareholders' turnout and thus rationalizing the post-sway disengagement documented empirically.

The model assumes that large shareholders who eventually sway votes pool with those who do not, implying indistinguishable trading behavior before proposals. Querying large shareholders' transaction data from the Ethereum blockchain, I find that pre-proposal inflows and outflows of DAO shares do not differ between these two groups.

My results show that large shareholders reduce small shareholders' value when they first sway votes. However, whether swaying also reduces total shareholder welfare depends on the magnitude of large shareholders' private payoffs. When these private payoffs are small, swaying reduces total welfare, consistent with private benefit extraction (and aligned with anecdotal evidence). When they are sufficiently large, however, swaying can maximize welfare despite harming small shareholders. This second case is more consistent with heterogeneous shareholder preferences, where large blockholders prioritize financial payoffs, while small shareholders may also value nonfinancial benefits from the DAO.

To distinguish between these interpretations, I structurally estimate the model using the Generalized Method of Moments (GMM). I match the model's analytical moments to observed returns with and without swaying, the frequency and timing of successful sways, and the probability that small shareholders prevent attempted sways. The estimates allow me to recover aggregate shareholder welfare with and without swaying, accounting for the large shareholder's expected private payoff. I find that swaying reduces aggregate welfare, supporting the private-benefit extraction interpretation.

Overall, several insights from the DAOs' experimentation carry over to how shareholder democracy could best be implemented in corporations. First, the negative side of the trade-off is self-reinforcing. Small shareholders further disengage from votes following successful private benefit extraction. As DAO participants self-select into organizations built around expansive shareholder democracy, the resulting decline in participation may therefore represent a lower bound on what would occur in traditional corporations, where shareholders may be less inclined to participate ex ante. Second, my findings suggest that shareholder democracy may be adopted because of the normative appeal of giving shareholders greater voice, yet sustained because small shareholders' disengagement serves insiders' private interests, consistent with a "bootleggers and Baptists" mechanism (Yandle (1983)). Third, expanding shareholder voting to decisions which are traditionally delegated to management can create value for shareholders provided that they retain influence over the implemented outcomes.

1.1 Related literature

This paper relates to five strands of literature.

This paper first contributes to the emerging literature on DAOs' governance. Prior work

has documented very high voting-power concentration in DAOs[4] (Laturnus (2023), Juette (2025)), the presence in their governance of key influential addresses (Appel and Grennan (2023a,b), Fracassi et al. (2024)) and the ability of addresses putting forward proposals to profit from information in proposals (Cong et al. (2025)). My paper is the first contribution that provides vote-level evidence that shareholder conflicts influence DAOs' token prices as well as real governance outcomes, namely, subsequent turnout among small shareholders. This literature has also modeled the endogenous concentration of control in DAOs (Bakos and Halaburda (2022), Sockin and Xiong (2023a), Ferreira et al. (2023) and Ferreira and Li (2024))[5] and the possibility that token whales can seize control of DAOs (Han et al. (2026)). My paper and model contribute to this strand of literature by showing that shareholders' ubiquitous disengagement allows large voters to control DAOs' governance with ownership stakes well below the 51% threshold usually used in models.

My results also add to the literature on shareholder democracy. Broadening the scope of shareholder involvement can improve the aggregation of dispersed information (Levit and Malenko (2011), Malenko and Malenko (2023)) and better reflect heterogeneous shareholder preferences in decisions (Levit et al. (2024, 2026), Malenko et al. (2026), Barry et al. (2026))[6]. However, broader shareholder decision rights can facilitate special-interest capture as large shareholders exploit dispersed investors' free-riding (Burkart et al. (2026)), while effective preference aggregation may depend on a credible threat of exit (Heath et al. (2025)). I contribute to this literature by studying an experimental setting in which shareholder democracy has been implemented expansively and by documenting that both sides of the trade-off associated with broader shareholder involvement in decisions simultaneously materialize in the data. Another strand of this literature highlights the trade-off between the greater managerial discipline

[4]Empirical evidence from voting power concentration and networks of addresses also comes from the data analytics literature: Fritsch et al. (2022), Barbereau et al. (2022), Barbereau et al. (2022), Sun et al. (2022), Sun et al. (2022), Kitzler et al. (2023), Eisermann et al. (2025), Balietti et al. (2025), Pahari et al. (2026).

[5]Additional contributions about the challenges in designing decentralized governance include Gryglewicz et al. (2021), Cong and Zhou (2023) and Zheng (2026). Surveys of the DAO literature can be found in Han et al. (2025) and Laturnus and Lehar (2026).

[6]This is the case notably for the aggregation of ESG preferences in firms' decisions. Papers on ESG preferences affecting governance include: Akey and Appel (2019), Couvert (2021), Fioretti et al. (2021), He et al. (2023), Saint-Jean (2024), Döttling et al. (2024), Bond and Levit (2024, 2025), Di Giuli et al. (2025), Fich and Xu (2025), Chebotarev and Pugachev (2025), Sautner (2025), Naaraayanan et al. (2026), Dasgupta et al. (2026).

and productive dissent associated with reduced delegation and the loss of managers' private information in decision-making (Landier et al. (2009), Harris and Raviv (2010)). My paper shows that scarce shareholder attention can hinder productive dissent. In the case of DAOs, low engagement allows large shareholders to approve decisions that reduce shareholder value, even when their adverse consequences are publicly apparent in the proposals.

This paper also contributes to the broader literature on the optimal governance structure of organizations. A foundational literature studies when the governance structure of the corporation is optimal (Jensen and Meckling (1976), Grossman and Stiglitz (1977), Grossman and Hart (1988)), how ownership and control should be allocated to mitigate agency frictions inherent to this governance structure (Fama and Jensen (1983), Shleifer and Vishny (1986, 1997), Hart (1995), Aghion and Tirole (1997), Hermalin and Weisbach (2001), Dessein (2002), Tirole (2006), Burkart et al. (2023, 2025)), and how the governance structure of the corporation might not be optimal when firms must accommodate heterogeneous objectives (Tirole (2001), Besley and Ghatak (2005), Magill et al. (2015), Broccardo et al. (2022)). Hansmann (1988, 1996) emphasizes that the optimal organizational form should minimize contracting costs with both owners and stakeholders. In a context in which direct costs of organizing governance are nearly zero, DAOs provide one answer to why organizations have not yet converged on involving shareholders in every decision. Implicit costs of participating in collective decision-making become particularly salient when the scope of decisions voted on is expanded. I show that the disengagement resulting from these indirect costs can ultimately cause decisions to backfire against small shareholders.

This paper also connects to the literature on the economics of Decentralized Finance (DeFi) platforms. Prior work documents risks in decentralized finance (Yermack (2017), Harvey et al. (2021), Makarov and Schoar (2022), Liu et al. (2023), Biais et al. (2023), Budish (2024)) and studies the optimal allocation of cash-flow and voting rights for tokens (Cong et al. (2021, 2022), Mayer (2021), Sockin and Xiong (2023b), Abadi and Brunnermeier (2024), Garratt and van Oordt (2024), Goldstein et al. (2024), Prat et al. (2025)). In this paper, I argue that DeFi's governance design would benefit from incorporating foundational insights from organizational economics. Notably, when attention is scarce, organizations should reserve collective decision-making for a limited set of decisions (Dessein and Santos (2006), Cremer et al. (2007), Dessein et al. (2016)). In my model, relying on smart contracts for routine

decisions or adopting other governance designs that reduce attention costs would sustain higher shareholder turnout and lower the likelihood of private benefit extraction.

Finally, my paper is also linked to the literature on institutional investors' role in corporate governance[7]. Informed activists can discipline management and increase firm value (Corum and Levit (2019), Levit (2019), Brav et al. (2022), Brav et al. (2018)), although competition for fund flows can weaken these benefits (Dasgupta and Piacentino (2015), Burkart and Dasgupta (2021)). Passive investors also influence governance through voting, supporting activism and the election of board members (Matvos and Ostrovsky (2010), Iliev and Lowry (2015), Appel et al. (2016, 2019), Brav et al. (2024)), but their effectiveness may be limited by decentralized voting within fund families (Michaely et al. (2026)). Increases in passive institutional ownership improve governance (Schmidt and Fahlenbrach (2017)) but only if this growth does not come from reduced opportunities for profitable active management (Corum et al. (2021), Heath et al. (2024)). Investors' additional objectives or business ties are also associated with pro-management voting (Cvijanović et al. (2016), Iliev and Lowry (2026)). Studying a counterfactual environment in which there are no institutional investors in governance, this paper provides evidence of the benefits of their participation in governance. First, unlike in DAOs, they decrease within-proposal pivotality of large shareholders and thus the likelihood of successful private benefit extraction[8]. Second, in their absence, no other voting participant naturally aims to maximize financial value.

The paper proceeds as follows. Section 2 provides background on DAOs. Section 3 describes the data and documents stylized facts on shareholder turnout. Section 4 presents empirical evidence on the trade-off associated with broad shareholder involvement and examines how small shareholders respond when their preferences are overridden. Section 5 develops a theoretical framework to rationalize these findings. Section 6 structurally estimates the model to assess whether large blockholders reduce aggregate shareholder value when they sway votes. Section 7 concludes.

[7]See Yermack (2010), Edmans (2014), Edmans and Holderness (2017) and Dasgupta et al. (2021), Brav et al. (2026) and Levit and Malenko (2026) for surveys of the literature.

[8]Papers emphasizing the role of within-proposal voter pivotality in governance include: Rydqvist (1986), Zingales (1995), Maug and Rydqvist (2009), Bach and Metzger (2018), Opp (2019), Li and Yoon (2024), Levit et al. (2026), Speit et al. (2026), Agarwal et al. (2026), Burkart et al. (2026).

2 Institutional Background

2.1 DAOs' Governance

Decentralized Autonomous Organizations (DAOs) are blockchain-based organizations designed to operate with minimal managerial delegation by implementing decisions through smart contracts that embed the outcomes of governance votes (John et al. (2023)). In these organizations, governance rights are typically tied to tokens (often called governance tokens) that simultaneously serve as cash flow claims, which DAOs mint to finance themselves. Tokens in DAOs are thus akin to shares in traditional finance and are referred to hereafter as shares.

Voting in DAOs typically follows a one-share-one-vote voting rule. Voting rights for a given proposal are assigned based on prespecified record dates that fix shareholdings prior to each proposal. This prevents trading during proposals from affecting voting outcomes. Governance proposals are most often decided through binary approval voting (For/Against), with outcomes determined by simple majority rules, sometimes complemented by partial quorum requirements that ensure a minimum level of participation for validity. Submitting proposals for voting is highly accessible, any address with an ownership stake (sometimes meeting a DAO-specific ownership threshold) may put forward proposals. Therefore, in theory, there is a total absence of formal managerial gatekeeping. In practice, proposals typically emerge from extensive off-chain discussions on public forums where ideas are debated and refined before being formally put up for vote.

Unlike traditional firms, where key decisions are concentrated around shareholder meetings and mediated by boards, DAOs rely on high-frequency (weekly) sequential proposals. These proposals span a wide range of subjects, including traditional governance decisions, such as the allocation of control and partnerships with other DAOs (akin to mergers and acquisitions), as well as more routine decisions such as advertising budgets, business strategy development, platform feature upgrades or changes to the design of the platform that would traditionally be delegated to management.

DAOs' adoption of this expansive shareholder democracy as a governance structure is driven by several factors. First, blockchain technology substantially reduces the direct costs of organizing and conducting votes compared to traditional shareholder voting (Yermack (2017)). Second, DAOs do not face the corporate-law constraints that limit the scope of shareholder

voting in traditional corporations[9]. Third, DAOs' adoption of shareholder democracy reflects an ideological commitment to decentralization and transparency in the blockchain space. This commitment is often evident in the white papers DAOs publish at launch, which emphasize governance structures that minimize managerial authority.(e.g., *"Kromatika DAO does not have a board, no CEO, no team of managers. No room for bureaucrats"* or *"HTX DAO does not function to exert centralized management"*).

2.2 DAOs' Objectives

DAOs depart from traditional corporations in their allocation of decision rights but also, in some cases, in whether they specify an objective to maximize, at all. In this paper, to retain the closest possible analogue to traditional corporations, I focus on revenue-generating Decentralized Finance (DeFi) DAOs that explicitly emphasize value accrual to shareholders as an objective[10]. What shareholder value entails in practice is then determined through the proposals shareholders approve, but the objective itself is clear and remains the maximization of shareholder value.

DeFi DAOs are mainly financial intermediation platforms primarily deployed on the Ethereum blockchain. Lending protocols such as Aave enable collateralized borrowing and lending through smart contracts and pre-coded conditions for the liquidation of positions. Decentralized exchanges such as Uniswap organize cryptoassets trading through automated market makers on the blockchain. Staking protocols such as Lido earn a share of staking rewards while yield aggregators such as Yearn provide automated portfolio strategies that transfer returns to designated addresses. Protocols such as OlympusDAO or Frax aim to create stable crypto-assets or issue stablecoins using volatile crypto-assets as collateral[11].

In terms of market capitalization, DeFi has experienced rapid but uneven growth since

[9]Corporate law limits both shareholders' decision-making authority and the scope of proposals they can bring to a vote. Notably, SEC Rule 14a-8 (i)(7) permits exclusion of proposals concerning ordinary business operations. More information on DAOs' legal status can be found in Appendix B.1.

[10]For example, OlympusDAO technical documentation states that it aims to generate value for protocol stakers and shareholders through its bonding mechanisms (Olympus documentation). Balancer's fee structures and incentives are designed to "optimize protocol revenue" (Balancer documentation).

[11]More details about DeFi can be found in John et al. (2022), Makarov and Schoar (2022), Canidio et al. (2022), John et al. (2023), Biais et al. (2023), Parlour (2023), Capponi et al. (2023), Auer et al. (2024), John et al. (2024) and Amoussou-Guenou et al. (2026).

its emergence in 2020. Following an initial expansion phase in 2020–2021, the sector reached peak valuations alongside the broader crypto market before undergoing a significant downturn in 2022–2023. Despite this contraction, DeFi has remained economically meaningful and has stabilized as a persistent segment of the digital asset ecosystem. As of October 2026, the aggregate market capitalization of DeFi tokens is approximately $90 billion[12].

2.3 Illustrative example

Olympus DAO provides a representative example of the scale and scope of platforms with DAO governance in my sample. This DAO aims to create a reserve currency protocol for digital assets. Over my sample period, the protocol has a market capitalization of approximately $300 million, with a total of 214 governance proposals and an average of 203 voters per proposal. The content of the proposals spans a wide range of decisions, including contributor funding and grants, share issuance, smart contract audits, elections of key DAO members, asset allocation and treasury composition, investments, and marketing budgets. Importantly, many of these proposal subjects correspond to operational and strategic choices that would typically be delegated to management in corporations. In contrast, in Olympus DAO, these decisions are routinely submitted to a shareholder vote[13]. A detailed description of the proposals voted on in Olympus DAO's governance can be found in Appendix H.1.

3 Data and Stylized facts

3.1 Voting data

The voting data in this paper are obtained from Snapshot, an off-chain governance platform used by DAOs to conduct shareholder votes. Each proposal has a predetermined record date and a voting period set by the address submitting the proposal. As in traditional shareholder voting, voting power is determined by shareholdings at the record date, immediately before the proposal begins. Shares acquired after this date do not confer additional voting power for that proposal.

[12]Source: CoinGecko

[13]More details about Olympus DAO can be found in Olympus documentation. Appendix H gives additional detailed examples of governance proposals for DeFi DAOs.

Because votes are cast off-chain, they do not need to be recorded on the blockchain, allowing voters to avoid the transaction fees (gas fees) associated with on-chain voting. The direct cost of casting a vote is therefore zero.[14] Importantly, Snapshot's API provides the voting power of addresses that cast a vote, but not the shareholdings of addresses that abstain.

A key advantage of these data is their granularity. For each proposal, every vote cast, its choice, and its exact voting power at the record date are observable. Such granularity is generally unavailable in traditional corporate governance, where individual votes and their associated voting power cannot typically be recovered (Brav and Li (2026)). This granularity is particularly important as it allows me to reconstruct counterfactual voting outcomes had particular shareholders abstained. Further differences between DAO and traditional corporate voting data are discussed in Appendix B.2.

DAOs such as Blockchain DAOs or NFT DAOs often do not have objectives as clearly defined as those of DeFi DAOs[15] and are excluded from the sample. Focusing on DeFi DAOs is relatively nonrestrictive, as they represent the most developed and active segment of the DAO ecosystem. One notable exception is MakerDAO, which conducts its voting entirely on-chain and does not use Snapshot. The complete list of DAOs present in the sample and their activities can be found in Appendix B.3. I filter out DAOs that have fewer than 5 voters on average and fewer than 10 governance proposals. I gather governance proposals from July 2020 (the launch of Snapshot) to September 2022. The final sample contains 5,874 proposals across 75 DeFi DAOs. This represents 1,169,717 votes cast by 214,131 different addresses.

Proposal subjects

I classify DAOs' governance proposals into five mutually exclusive categories: Governance, Partnerships, Business Strategy, Features development, and Cybersecurity. This classification is intentionally parsimonious and provides a simplified version of more detailed governance-proposal taxonomies developed in the data analytics literature (Ziegler and Welpe (2022), Ziegler et al. (2024)). Governance proposals encompass changes to voting procedures, treasury management rules, and the selection or compensation of key contributors. They are the

[14] Snapshot uses a technology called the InterPlanetary File System (IPFS), which enables off-chain recording and querying of voting data.

[15] Improvement proposals in blockchain DAOs primarily concern code improvements and are closely analogous to common-value elections. For NFT DAOs, proposals have no link to governance.

proposals that concern the allocation of control rights among the DAOs' shareholders. They also address the salaries and compensation of DAO insiders such as key developers. Partnerships refer to cross-protocol collaborations or expansions across blockchains. They are the crypto equivalent of M&A proposals. Cybersecurity proposals address smart contract audits, bug bounty programs, and responses to protocol vulnerabilities. They are the crypto equivalent of proposals appointing or reappointing the auditor in traditional finance. Business strategy proposals cover product development or marketing initiatives. Features development proposals focus on technical upgrades, including algorithmic improvements and user interface changes. Notably, Business strategy proposals and Features proposals concern decisions which would traditionally be delegated to management. Using ChatGPT-4o to classify proposals by subject,[16] I find that proposals are distributed across Governance (47%), Features Development (32%), Cybersecurity (13.5%), Business Strategy (5%), and Partnerships (2.5%).

3.2 Descriptive statistics: Average DAO in the sample

The average DAO in the sample has 78.3 proposals during the sample period (approximately 18 proposals per quarter). These proposals last 4.7 days. In the average DAO, a proposal attracts 222 voting addresses. Regarding the voting concentration, the average Gini index is 0.82[17]. The average participant votes early during the proposal, with 69% of the duration of the proposal remaining[18]. The average DAO has a market capitalization of $304 million, and proposals typically pass with a margin of victory of 68%, suggesting limited effective opposition[19]. Voting power is highly concentrated. The largest voter controls, on average, 45.5% of total voting power engaged in a proposal. Proposal-level turnover in voting addresses is substantial, with a mean of 61.7%. This means that from one proposal to the next, on average, 61.7% of the voting addresses differ. Table 1 gives more detailed summary statistics for DAOs, governance proposals and voter behavior.

[16]The prompts used to generate the classification can be found in Appendix G.

[17]The Nakamoto number, the number of votes required to reach 50% of the total voting power cast on a given proposal, is 5.3 on average.

[18]Histograms of the voting speed of voters can be found in Figure C.1.

[19]This means that the average scores for a shareholder votes are 84% "For" and 16% "Against". However this margin of victory is very skewed, a lot of proposals pass without any opposition.

Table 1 – Summary Statistics for DAOs

	Obs	Mean	SD	Min	25%	50%	75%	Max
DAOs	75							
Proposals per DAO	75	78.3	269.5	4	14	25	59	2320
Average duration of proposals (days)	75	4.7	3.2	0.87	2.97	3.87	5.28	19.64
Average turnout across proposals	75	222	407	8	47	88	212	2546
Average Nakamoto number across proposals	75	5.3	6.1	1	2	2.85	5.24	34.7
Market Capitalization (average sample period, $M)	75	304	923	0.37	13	43	147	7117
Trade volume (average sample period $M)	75	36	91	6e-3	0.6	4	20	477
Proposals	5874							
Duration (days)	5874	10.5	25.5	0.007	2	3.125	7	366
Number of voters	5874	199	488	4	19.25	56	160	8888
Nakamoto number	5874	4.2	14.35	1	1	2	3	331
Margin of victory	5874	0.674	0.4	0.0	0.278	0.926	0.999	1
Maximum voting power	5737	0.455	0.259	0.0	0.254	0.407	0.637	1
Turnover	5737	0.617	0.308	0.0	0.380	0.666	0.905	1
Tokens voted / Circulating supply (%)	5737	3.36	8.79	0.0	0.003	0.4	3.47	99
Voters	214131							
Voting power across votes (% of the total voting power)	214131	0.37	2.88	0	6e-6	1e-3	0.3	100
Number of proposals voted on	214131	7.5	22.2	1	2	2	5	2195
Average voting speed	214131	0.31	0.24	0	0.11	0.27	0.45	1

3.3 Prices data

Daily price data for DAOs' shares are obtained from the CoinGecko API. Using these data, I compute weekly cumulative abnormal returns (CARs) around governance proposals. Specifically, for each DAO, I construct weekly returns and subtract the corresponding weekly return of a market portfolio composed of major cryptocurrencies, yielding a measure of abnormal performance relative to the broader crypto market[20]. Descriptive statistics on weekly cumulative abnormal returns, averaged across different subsets of DAOs following governance proposals, are provided in C.2. Restricting my sample to active large DeFi DAOs mitigates concerns related to data quality of the CoinGecko API highlighted by Schwenkler et al. (2026)[21].

[20]The list of tokens used to construct the market portfolio can be found in Appendix B.4.

[21]Only one DAO in my sample is in the category most affected by API pricing errors in Schwenkler et al. (2026), and the results are robust to excluding this DAO from the sample.

3.4 Differences with traditional shareholder voting

3.4.1 Institutional differences with traditional shareholder voting

DAO governance differs from traditional corporate governance in several respects, largely because DAOs are not subject to the same corporate-law constraints as traditional corporations (Bainbridge (2006)). For example, shareholders owning more than 5% of shares are not required to disclose their ownership, shareholder proposals are announced through social media rather than formal notice procedures, and proposal submission is governed by DAO-specific thresholds rather than Rule 14a-8. DAO votes also lack legal enforceability (although some are technically enforceable through automatic execution by smart contracts). More information on these institutional differences with traditional shareholder voting can be found in Appendix B.5.

3.4.2 Data differences with traditional shareholder voting

Unlike traditional corporate governance, voting data are linked to blockchain wallet addresses rather than identifiable individuals. This is a common limitation of blockchain data because addresses are pseudonymous and thus votes cannot be linked to individual investors. Shareholders may also split their holdings across multiple addresses which may understate voting power concentration in votes.

The public availability of transactions also raises concerns about anticipation of voting outcomes. Yet reconstructing investors' holdings and strategies from blockchain transactions entails substantial information costs, making precise anticipation difficult for small shareholders. By contrast, voting power becomes directly observable through Snapshot once votes are cast. More information on these data differences with traditional shareholder voting can be found in Appendix B.6.

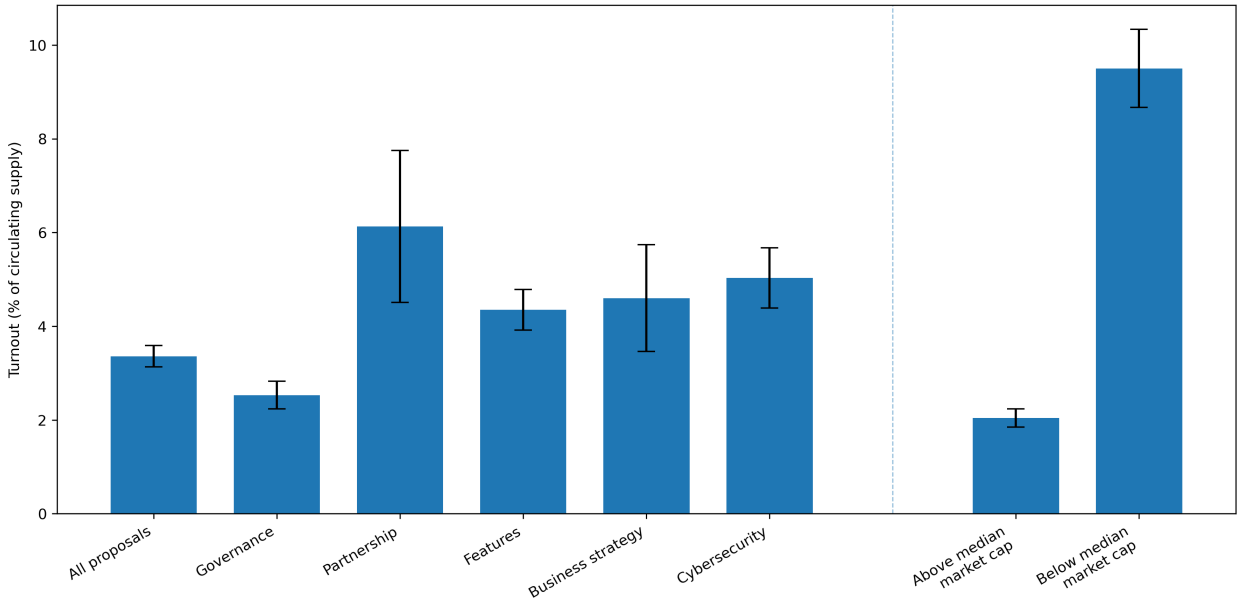
3.5 Stylized fact 1: Low Shareholder engagement

Shareholder engagement in DAOs is ubiquitously low. Figure 1 shows that, across the full sample, the average share of circulating supply voted (measured as number of shares voted in

proposals scaled by the DAO's circulating supply of shares) is only 3.36%[22].

This limited engagement is not primarily driven by the type of proposal being voted on although Governance proposals display an average engagement rate of 2.53%, while Feature, Business Strategy, Cybersecurity, and Partnership proposals have means of 4.35%, 4.60%, 5.03%, and 6.13%, respectively. Although Partnership and Cybersecurity proposals attract slightly higher participation, the broad pattern remains that shareholder engagement is persistently low across all proposal categories.

Figure 1 – Shareholder engagement across proposal subjects and DAO market capitalization



Notes: The figure reports mean shareholder engagement (measured as the percentage of the circulating token supply used in voting) with 95% confidence intervals around the sample mean.

A more salient difference emerges when proposals are split by DAO market size. For DAOs with above-median market capitalization, only 2.04% of circulating supply is voted, on average. In contrast, proposals in DAOs with below-median market capitalization involve 9.50% of

[22]Although this number is low, it should be noted that for DAOs, a substantial fraction of the outstanding shares is generally not actively available for governance participation. In particular, many shares are held by centralized exchanges or specific addresses such as the DAOs' treasury addresses. For relatively transparent DAOs such as Aave, the share of the supply unavailable for governance votes can amount to roughly 30–40% of circulating supply. Taking into account this detail, shareholders' turnout becomes comparable to the turnout from retail shareholders estimated in Brav et al. (2022).

circulating supply, on average. This gap is particularly striking because larger DAOs attract a larger number of voters in absolute terms. Proposals in larger market-cap DAOs have 219 voters on average, compared to 117 voters in lower market-cap DAOs[23].

This stylized fact contributes to the external validity of the DAO setting in several respects. First, The lower turnout observed in larger DAOs is consistent with their more dispersed ownership[24] and the greater severity of shareholder free-riding predicted by traditional corporate governance models (Shleifer and Vishny (1986), Burkart et al. (1997)). Second, although low, shareholder turnout is also persistent across proposal subjects, echoing findings from Agarwal et al. (2026) in traditional shareholder voting. Third, Governance proposals are more prevalent among DAOs with larger market capitalizations, which explains why this category exhibits the lowest turnout. The share of Governance proposals in above-median-market-capitalization DAOs is slightly above the unconditional average of close to 50% while this share remains at approximately 35% for below-median market capitalization DAOs. This suggests that, as DAOs grow, collective decision-making increasingly focuses on more consequential decisions about allocation of control, as predicted by the organizational economics literature (Dessein et al. (2016)).

3.6 Stylized fact 2: Governance activity and declining shareholder turnout

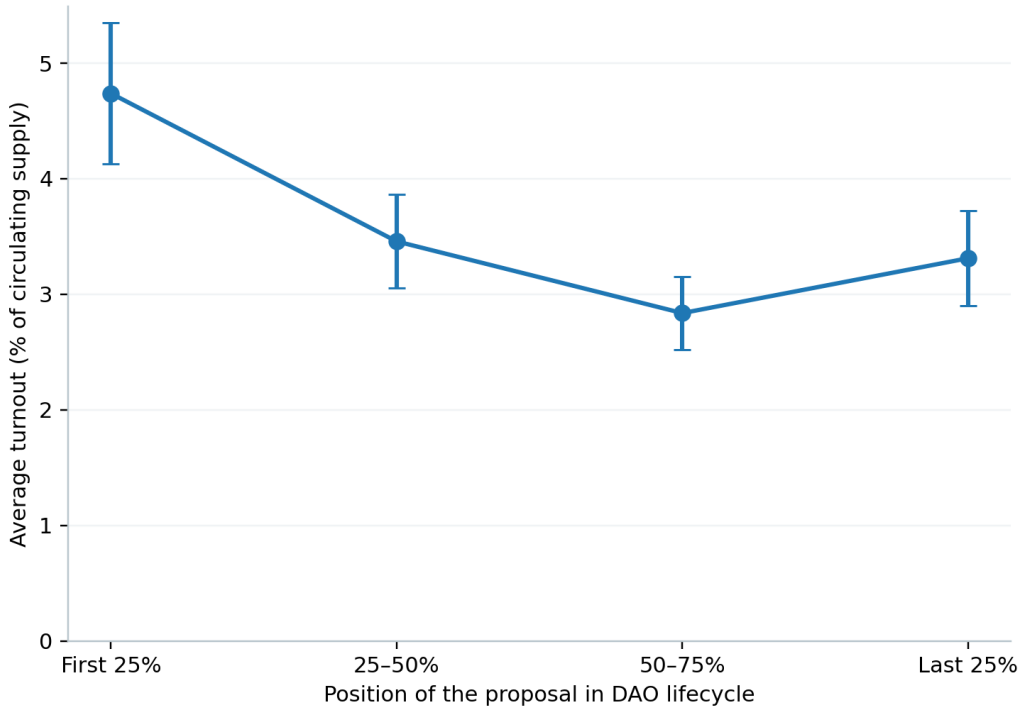
Shareholder engagement tends to decline as DAOs repeatedly ask for participation in decisions. Figure 2 plots the average turnout across successive quartiles of DAOs' "proposal lifecycle" (lifecycle here meaning starting from the first to the last proposal in the sample). Turnout is highest in the first quartile, when proposals gather, on average, 4.74% of the total ownership. It subsequently declines in the rest of the quartiles, to 3.46% in the second quartile and 2.84% in the third, and 3.31% in the final quartile[25]. This stylized fact also contributes to the external validity of the DAO setting. The decline in participation is consistent with the limited attention shareholders can devote to governance decisions (Iliev and Lowry (2015),

[23] More details about shareholder engagement can be found in Table C.1

[24] Han et al. (2026) show that large DAOs routinely use airdrops, which mechanically decrease the Herfindahl-Hirschman Index (HHI) of their ownership concentration.

[25] This rebound may be partly attributable to some late-stage decisions in which some DAOs wind down and the proposals concern the distribution of remaining assets.

Figure 2 – Average ownership stake voted across DAO lifecycle



Notes: The figure reports proposal-weighted average ownership stake turnout, measured as the percentage of circulating token supply voted in a proposal, across four quartiles of each proposal's relative position in DAOs' proposal lifecycle. 95% confidence intervals are plotted around the mean.

Kempf et al. (2017), Iliev et al. (2021)).

The negative association between governance solicitation and turnout can also be seen at the proposal level. Table C.4 relates the percentage of shares voted in a proposal to the number of proposals completed within the same DAO over the preceding 30 days. The estimated coefficients are negative and statistically significant, indicating that a greater number of recent governance solicitations is associated with lower current shareholder participation in proposals[26].

[26]While consistent with scarce shareholder attention, these associations do not establish attention costs as the causal mechanism.

4 The shareholder involvement trade-off

4.1 Negative effect: Large shareholders imposing outcomes to small shareholders

4.1.1 Vote-level patterns to infer conflictual proposals

To isolate evidence of conflicts of interest among shareholders, I first need to isolate proposals in which shareholders conflict. However, whether a proposal is conflictual is not observable in the data. To mitigate this limitation, I infer the conflictual aspect of proposals from vote-level patterns.

I define proposals with **swaying majority voters** as proposals in which one large voter unilaterally implements an outcome against what small shareholders would have chosen. These instances capture situations in which large participants actively overturn small participants' preferences. Proposals in which there are swaying majority voters are a subset of the proposals with majority voters (i.e. proposals unilaterally determined by one large voter, irrespective of whether the outcome aligns or clashes with the outcome preferred by small shareholders).

50% of the within-proposal voting power as a threshold

Swaying majority voters therefore hold more than 50% of the total voting power engaged within a proposal. Using 50% of within-proposal voting power as a threshold is motivated by the simple majority requirement in DAOs. When a single voter holds over 50% of the voting power within a proposal, it is de facto pivotal in determining the outcome of the proposal. This means that a swaying majority voter's probability of successfully swaying votes is one.

However, one might argue that voters with slightly lower within-proposal voting power (e.g., 40–45%), although not guaranteed to be pivotal, could still convey similar information. Although their probability of successful swaying might not be exactly 1, it is very close to 1 and might similarly reveal conflicts of interest. The second reason why this is not a problem in my sample is that no voter with 30–50% within-proposal voting power overrides small shareholders' preferences. Therefore, lowering the threshold to include proposals in which large voters are highly likely to be pivotal does not change the sample of events. Furthermore, the identification strategy in Section 4.2.1 explicitly controls for other pivotal scenarios (e.g.,

voters with 10–30% power who are decisive), and shows no significant effect on returns.

4.1.2 Swaying majority voter proposals descriptive statistics

A hint towards the fact that isolating proposals through these vote-level patterns helps isolate conflictual proposals is that Governance proposals (on allocation of control and say-on-pay equivalents) are overrepresented among those with swaying majority voters. 63% of proposals with swaying majority voters concern Governance, followed by Features (25%), Cybersecurity (6%), Business Strategy (4%), and Partnerships (2%)[27].

In terms of frequency, the average DAO has 5 out of 80 proposals involving swaying majority voters. First swaying majority voter proposals occur on average after the 22nd proposal. With 18 proposals on average per quarter, this means that the first swaying majority voter occurs, on average, in the fourth month of the DAO's existence. In terms of shareholder engagement, first swaying-majority voting instances generate, on average, higher shareholder engagement. Shares voted as a percentage of total ownership represent 4.54%, compared to the sample average of 3.36%, corresponding to a 35% relative increase in shareholder engagement. Other descriptive statistics for majority voters and swaying majority voters can be found in Table C.3.

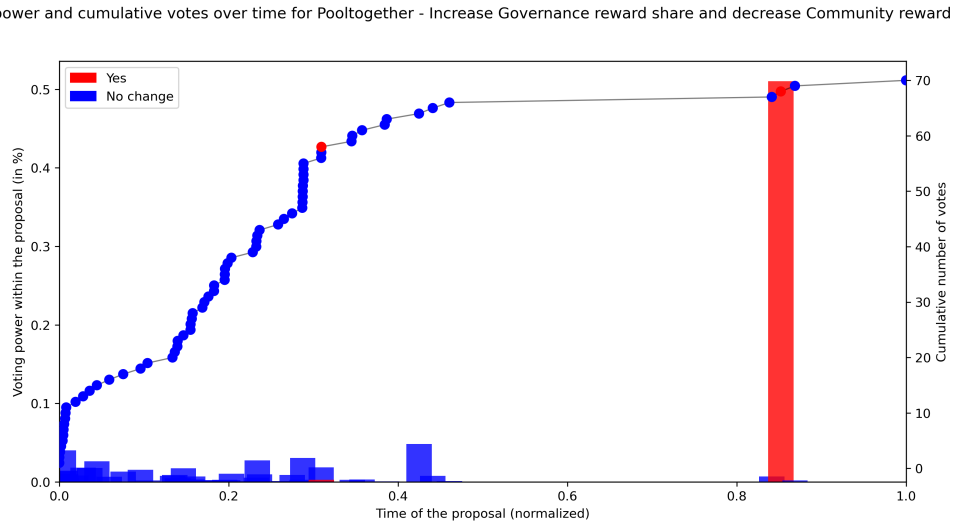
4.1.3 Example of private benefit extraction from swaying majority voters

Figure 3 provides an illustrative example proposals with swaying majority voters. In March 2021, the decentralized lending DAO PoolTogether put forward a proposal that would change the split of rewards (revenue) for the platform. The proposal asked shareholders to vote on whether the share of the rewards allocated to "governance wallet addresses" (i.e., insiders of the DAO) should be increased, thereby decreasing the share of rewards given to the community. Naturally, small shareholders voted against this change in the allocation of rewards. However, at the end of the proposal, a single address voted in favor of changing the allocation of rewards with what ultimately represented 52% of the ex post voting power engaged in the proposal, unilaterally implementing an outcome contrary to what small shareholders would have chosen.

[27]The 63% estimate is likely a lower bound, as some proposals classified as Features describe in extensive detail the technicalities of the DeFi platform through which share issuance are allocated and could therefore also be classified as Governance, which may also explain why Features account for a relatively high percentage of the swaying majority voter instances.

Additional examples of swaying majority votes in which the swaying majority voter obtains a direct unilateral gain are reported in Figures C.2 and C.3.

Figure 3 – Swaying majority voter in a PoolTogether Governance Proposal



Notes: This figure plots the timing, voting power, and cumulative number of votes for the PoolTogether proposal. The horizontal axis reports proposal time normalized between the start and the end of the proposal. Bars represent the voting power of each vote. Red bars correspond to votes for the winning outcome, "Yes", and blue bars correspond to votes for the losing outcome "No change". The colored dots show the cumulative number of votes and the outcome chosen by those votes.

4.2 Self-reinforcing negative effect: Event study on the consequences of first swaying majority voters

In this section, I show that the negative side of the shareholder involvement trade-off is self-reinforcing. First instances of proposals with swaying majority voters as defined in Section 4.1 are proposals that signal to the small shareholders that DAOs are unlikely to incorporate their preferences in decisions going forward. Learning that they will not have influence over the DAOs' future decisions, small shareholders further disengage from participating in the governance of DAOs, which leads to even higher voting power concentration for large shareholders.

4.2.1 Identification strategy

I first test whether first instances of a swaying majority voters are signals to small shareholders by looking at whether they trigger abnormal returns for the DAOs' shares. Prior to this event, small shareholders value the DAO under uncertainty about whether large shareholders' interests are aligned with their own. The first swaying majority vote reveals a conflict of interest, leading shareholders to revise downward their expectations about the DAO's future value. If this mechanism is at work, the first instance of a swaying majority voter within a DAO should be followed by negative abnormal returns.

This revision may reflect either adverse information about the DAO's future prospects or a reassessment of the alignment between large and small shareholders' preferences. To distinguish between these interpretations, I control, to the best of my ability, for the information channel by including other vote-level patterns that reveal large shareholders' ability to impose outcomes, as well as controls for repeated instances of conflicts of interest that could progressively reveal adverse information about the DAO's future prospects. If these controls have no significant effect on returns, while the first swaying majority vote does, the evidence is more consistent with a one-time revision in shareholders' beliefs about preference alignment.

To identify the effect of first swaying majority voter instances, I employ a triple-difference regression design in Equation (1). This regression design isolates the effect of first swaying majority voters and controls for alternative explanations of what may be driving the information release to small shareholders. The dependent variable used in the first regressions is the weekly cumulative abnormal return following proposal i of DAO d at time t. Because proposals differ in duration, I measure weekly CARs beginning on the day preceding the proposal's end date as it is at the end of proposals that the information of whether there has been a "First Swaying Majority voter" in proposals is revealed.

$$
\begin{aligned}
CAR_{i,d,t} = {} & \alpha_1 \cdot \mathbf{1}(\text{First Swaying Majority voter})_{i,d} + \alpha_2 \cdot \mathbf{1}(\text{First Swaying voter})_{i,d} \\
& + \alpha_3 \cdot \mathbf{1}(\text{First Majority voter})_{i,d} + \alpha_4 \cdot \mathbf{1}(\text{Swaying Majority voter})_{i,d} \\
& + \alpha_5 \cdot \mathbf{1}(\text{Swaying voter})_{i,d} + \alpha_6 \cdot \mathbf{1}(\text{Majority voter})_{i,d} \\
& + \boldsymbol{\beta}^\top \mathbf{X}_{i,d,t} + \gamma_{d \times t} + \varepsilon_{i,d,t}
\end{aligned}
\tag{1}
$$

In the regression of Equation (1), **1**(Majority voter) controls for the recurring effect on returns of proposals in which a single voter has enough voting power to determine the outcome unilaterally. **1**(Swaying voter) controls for the recurring effect on returns of proposals in which the voter with the largest voting power votes against the outcome that would otherwise have been chosen (independently of its within-proposal voting power). **1**(Swaying Majority voter) controls for the repeated effect on returns of proposals in which a large voter unilaterally overturns the preferred outcome of minority shareholders. If there was repeatedly information released about the saliency of conflicts of interests, the coefficient relative to this indicator should be negative and significant. **1**(First Majority voter) and **1**(First Swaying voter) both control for the fact that information releases about preferences aggregation may happen following other instances. **1**(First Majority voter) captures whether the information release happens following the first time the market observes a voter who unilaterally implements the outcome of a proposal, while **1**(First Swaying voter) captures the first time the market observes the voter with the largest voting power in a proposal vote against the outcome that would otherwise have been chosen (even though this voter's voting power may not unilaterally implement the outcome). If the information was release either when a large voter votes for the first time or the first time that a voter changed the outcome of a vote (irrespective of its voting power), these indicators should be negative and significant.

This specification also controls for DAO-level market characteristics at the time of the proposal, namely, market capitalization and trading volume of the DAO's shares, and age (in days) when proposals are submitted. For specifications with proposal-level controls, these controls also include the number of voters in the proposal, the rolling average number of voters within the DAO, the margin by how much the implemented outcome wins the proposal controlling for the disagreement of shareholders in proposals, the rolling average of this margin within the DAO as well as whether the proposal is the first proposal for the DAO. I use several fixed effect structures, namely DAO + Quarter of the year fixed effects, DAO x Year fixed effects and DAO x Quarter fixed effects. I use the DAO x Year and DAO x Quarter fixed effects structure to account for temporal variation in proposal activity within DAOs, as periods with heightened governance intensity, such as market downturns affect overall voting engagement.

4.2.2 Negative returns following first swaying majority voters

The estimates reported in Table 2 demonstrate large and statistically significant negative weekly cumulative abnormal returns following first swaying majority events. Across all specifications, the coefficient on the indicator for a first swaying majority voter is negative and statistically significant. First swaying majority events trigger a -12.7% drop in the DAOs' weekly cumulative abnormal returns (Column (6)). This effect is robust to a wide range of fixed effects structures as well as to the inclusion of proposal-level controls.

In contrast, the remaining coefficients for first swaying voters, first majority voters, swaying voters, and majority voters are not statistically significant at the 5% level across specifications. Negative returns are uniquely associated with first swaying-majority instances, which is crucial for the interpretation. This suggests that the only pattern that persistently holds in the data is the information release associated with the first signal that small shareholders' preferences will no longer be reflected in governance decisions.

Figure 4 shows no evidence of pre-event trends between proposals involving a first swaying majority voter and control proposals. Following the end of the proposal, however, returns diverge sharply. Within two to three days, cumulative abnormal returns decline significantly for proposals involving a first swaying majority voter, indicating that prices incorporate information about conflicts of interest in governance and their diminished influence over future decisions. There is also no evidence of an immediate reversal in the subsequent days, suggesting that the price adjustment reflects a persistent shift rather than a temporary overreaction. This pattern is consistent with a new price level that incorporates small shareholders' updated beliefs about their diminished future influence over proposals.

Additional controls

I further add proposal subjects as controls (Governance, Cybersecurity, Features, Partnerships and Business Strategy) and find in Table C.5 that the results remain unchanged. In Table D.1 and Table D.2, I show that the repeated presence of majority voters or swaying majority voters does not drive market reactions. In Table D.3, I exclude the DAO with the most proposals in the sample and show that the results also remain unchanged. In Table D.5, I also add as a control variable an indicator of whether the author of the proposal is the largest voter in that proposal and find that it does not affect the result. The evidence therefore points

to the conclusion that first instances of a swaying majority event constitute an information release to small shareholders.

Placebo and alternative event dates

I also run a placebo test around second swaying-majority events. Consistent with this interpretation, I find no significant effect on returns (Figure C.4), further confirming that the observed price response is driven by the initial revelation of the end of the incorporation of small shareholders' preferences into decisions

In addition, when I redefine the event date as the start of the proposal or the moment at which the swaying majority voter casts its vote, rather than the end of the proposal, Figure C.5 and C.6 show that the decline in returns occurs at the same point in time as in Figure 4[28].

Figure 4 – Cumulative abnormal returns around end of proposal dates



Notes: Figure 4 reports the estimated coefficients and 95% confidence intervals for the effect of first swaying-majority-voter events on cumulative abnormal returns (CARs) around proposal end dates. The coefficients plotted are the ones for the specification of column (6) of Table 2. The control group for the regression of Equation (1) consists of proposals with neither a majority voter nor a swaying voter that are not the DAO's first proposal. Regarding potential pre-trends, a joint Wald test of the pre-event coefficients fails to reject the null hypothesis that they are jointly equal to zero (p-value=0.561). Details of the test are provided in Appendix D.1.

[28]These alternative event dates are not used in the main specification because proposal durations vary, meaning that the post-event window does not capture all first swaying majority votes.

Table 2 – Impact of First Swaying Majority Voters on Weekly CARs

Dependent variable: Weekly Cumulative Abnormal Returns following a proposal.
***,**,* indicate significance at the 1%, 5% and 10% levels.
Standard errors are clustered at the DAO/DAO year/DAO quarter level.
Singletons are excluded from the sample of observation for DAO year/DAO quarter FE specifications.

	Weekly CARs					
	(1)	(2)	(3)	(4)	(5)	(6)
First swaying majority voter	-0.1235**	-0.1229**	-0.1221***	-0.1213***	-0.1251***	-0.1269***
	(-2.556)	(-2.490)	(-2.699)	(-2.642)	(-2.846)	(-2.889)
First swaying voter	0.0638	0.0617	0.0848	0.0852	0.0995*	0.0979*
	(1.061)	(1.016)	(1.498)	(1.494)	(1.932)	(1.897)
First majority voter	0.0005	8.93×10^{-5}	-0.0123	-0.0118	0.0144	0.0127
	(0.0121)	(0.0021)	(-0.2694)	(-0.2600)	(0.2903)	(0.2538)
Swaying majority voter	-0.0299**	-0.0328**	-0.0215	-0.0218	-0.0191	-0.0194
	(-2.093)	(-2.162)	(-1.417)	(-1.368)	(-1.111)	(-1.126)
Swaying voter	0.0138	0.0187	0.0084	0.0090	0.0065	0.0074
	(1.086)	(1.132)	(0.5836)	(0.4656)	(0.4675)	(0.4731)
Majority voter (>50%)	-0.0040	-0.0054	-0.0098	-0.0101	-0.0122	-0.0109
	(-0.5255)	(-0.7722)	(-1.617)	(-1.492)	(-1.649)	(-1.438)
Market Controls	Yes	Yes	Yes	Yes	Yes	Yes
Proposal Controls		Yes		Yes		Yes
DAO + Quarter FE	Yes	Yes				
DAO x Year FE			Yes	Yes		
DAO x Quarter FE					Yes	Yes
Observations	5874	5874	5867	5867	5820	5820
Adj R^2	0.123	0.122	0.133	0.133	0.257	0.256

Notes: Market controls include: (1) the log of the average market capitalization around the event, (2) the log of the average trading volume for the token around the event and (3) the age of the DAO at the time of the event. Proposal-level controls include: (1) Number of voters, which accounts for the number of voters in a proposal; (2) the rolling average of the Number of voters, which controls for trends in voter turnout over time; (3) margin of victory, which captures disagreement among tokenholders within a proposal; and (4) the rolling average of margin of victory, which accounts for trends in disagreement within DAOs.

4.2.3 Controlling for the saliency of proposals and shareholder engagement

A potential concern with the empirical design arises from the definition of a majority voter. Whether a voter qualifies as a majority voter, and can therefore unilaterally determine the outcome of a proposal, is defined ex-post and ultimately depends on participation in that proposal. This raises the possibility that the documented effects are driven by low-engagement proposals[29].

To address this concern, I add a comprehensive set of controls that proxy for proposal saliency and shareholder engagement. I additionally control for total voting power, the circulating supply of tokens, and the ratio of voting power to circulating supply, as well as voting concentration measures including the Gini coefficient and the number of votes it took to reach 50% of the voting power in a given proposal[30]. For all these proposal-level controls, I also add the rolling averages of these controls within the DAO to control for trends. As shown in Table C.7, the results remain robust when those controls are added.

To further address the concern about relative shareholder engagement, I also run the specification of Equation (1) in which I directly restrict the sample to proposals with higher levels of engagement within each DAO. I iteratively exclude proposals below increasingly stringent within-DAO percentiles of total voting power cast. Columns (1) through (4) progressively exclude the bottom 5%, 10%, 25%, and 50% of proposals in terms of total ownership engagement. This approach ensures that the analysis focuses on proposals that attract meaningful participation and are therefore more likely to reflect economically relevant governance outcomes. As shown in Table C.8 (and Table D.6 with a different fixed effect structure), not only do the results remain robust, but the estimated effect becomes larger in magnitude as the sample is progressively restricted to proposals with higher shareholder engagement (-19.22% weekly CARs for the top 50% of shareholder engagement within each DAO).

In Appendix I, I classify DAOs' white papers and governance texts according to whether DAOs have advertised the decentralization of their governance and show that the effect on returns following first swaying majority voter instances is more negative for DAOs which have advertised the decentralization of their governance in their white papers.

[29]This is the case even if on average the shareholder engagement in first swaying majority voter proposals is 35% higher than average shareholder engagement

[30]This is a voting power concentration metric also known as the Nakamoto number.

4.2.4 Pre-proposal share purchases by first swaying-majority voters

A natural concern is that becoming the first swaying-majority voter may itself depend on pre-proposal trading. There could be systematic differences in share accumulation prior to proposals which could inform shareholders about the voting outcome before the first swaying majority vote is actually cast. Table C.16 provides no support for this concern. Prior to the proposal, first swaying majority voters exhibit no statistically significant difference in share purchases relative to other majority voters. Their share purchases are also not statistically distinguishable from broader trading purchases by medium-sized voters who do not unilaterally shape voting outcomes. These findings support the interpretation that the relevant information becomes available during the proposal rather than through observable differences in pre-proposal accumulation.

4.2.5 Effect of first swaying majority voters on subsequent governance outcomes

To assess the broader governance implications of first-time swaying majority events, beyond their effect on share prices, I estimate a regression similar to the one in Equation (2) using a range of future governance outcomes rather than CARs, as dependent variables . The outcome variables are (i) the Gini index, which measures voting power concentration, (ii) the maximum voting-power share and (iii) the small shareholders voting power shares (calculated as one minus the voting power share of the top decile of addresses) as well as (iv) the percentage of ownership voted[31]. To capture persistent adjustments in governance rather than short-lived fluctuations, I measure each variable as its average over the five proposals following the first swaying-majority event.

[31] I measure turnout by the share of ownership voted rather than by the number of voting addresses because a larger number of addresses may represent a smaller participating ownership stake if each address holds fewer shares. It also aligns with the model, which predicts small-shareholder turnout in ownership terms.

$$\begin{aligned}\overline{Gov\ Outcome}_{i+1\to i+5,d,t} = {} & \alpha_1 \cdot \mathbf{1}(\text{First Swaying Majority voter})_{i,d} + \alpha_2 \cdot \mathbf{1}(\text{First Swaying voter})_{i,d} \\ & + \alpha_3 \cdot \mathbf{1}(\text{Swaying Majority voter})_{i,d} + \alpha_4 \cdot \mathbf{1}(\text{First Majority voter})_{i,d} \\ & + \alpha_5 \cdot \mathbf{1}(\text{Swaying voter})_{i,d} + \alpha_6 \cdot \mathbf{1}(\text{Majority voter})_{i,d} \\ & + \boldsymbol{\beta}^\top \mathbf{X}_{i,d,t} + \gamma_{d\times t} + \varepsilon_{i,d,t}\end{aligned} \tag{2}$$

The results reported in Table 3 show a consistent increase in voting-power concentration in governance following the first swaying majority event. Over the next five proposals, the Gini index increases by 0.04 points. This increase in voting-power concentration is accompanied by a 4.2-percentage-point decline in small shareholders' voting-power share and a 3.8-percentage-point increase in the largest voter's voting-power share, although the latter estimate is significant only at the 10% level. The tunneling observed in some proposals with swaying majority voters resembles equity tunneling, as evidenced in the anecdotal evidence of Section 4.1.3. This equity tunneling by large voters can explain why the total ownership share voted in proposals following first swaying-majority events remains stable.

Alternative specifications to which the results are robust are reported in Tables C.9 - C.12. Greater voting-power concentration is also associated with larger victory margins in subsequent proposals, as shown in Table C.13. The subsequent margin of victory between the winning and losing outcomes increases by 5.34% on average.

These findings are further consistent with first swaying-majority events signaling to small shareholders that, going forward, DAOs' decisions will not reflect their preferences. Small shareholders subsequently incorporate this signal first into share prices, as evidenced by the negative returns, and second into their voting behavior, as evidenced by their subsequent disengagement from governance. First swaying-majority-voter instances thus mark a transition toward proposals characterized by stronger dominance of large participants. More broadly, first swaying majority voter instances thus show that the negative side of the trade-off associated with broadening the scope of shareholder involvement is self-reinforcing. As small shareholders learn that they will not have influence over the DAOs' future decisions, they further disengage from governance, which leads to even higher voting power concentration for large shareholders and an even higher likelihood for large shareholders to impose outcomes to small shareholders.

Table 3 – Impact of First Swaying Majority Voters on Subsequent Governance Outcomes

***,**,* indicate significance at the 1%, 5% and 10% levels. Standard errors are clustered at the DAO quarter level. Singletons are excluded from the sample of observation.

	(1) Gini Index	(2) Largest Voting Power Share	(3) Small Voting Power Share	(4) Ownership Voted (%)
First swaying majority voter	0.04**	0.038*	−0.042**	0.02
	(2.066)	(1.76)	(−2.121)	(0.04)
Shareholder engagement controls	Y	Y	Y	Y
Proposal controls	Y	Y	Y	Y
Market controls	Y	Y	Y	Y
DAO × Quarter FE	Y	Y	Y	Y
Obs.	5683	5683	5683	5683
Adj. R^2	0.47	0.88	0.65	0.58

Notes: The dependent variables are the average of the outcome variables (Gini Index, Largest voting share, Voting power share of the small voters and Percentage of ownership voted in proposals) over the subsequent 5 proposals. The voting share of the small shareholders is measured as 1 minus the voting share of the top decile of addresses with the most voting power in a proposal. All specifications control for DAO-level and proposal-level characteristics, including market capitalization, trading volume, DAO age, and the rolling average turnout and margin of victory, as well as measures of token supply (log circulating supply and its rolling average) and total voting power (in logs). Additional specifications for each dependent variables are detailed in Tables C.9 - C.12.

4.3 Positive effect: Broader inclusion in decisions valued by shareholders

4.3.1 Empirical design

I then test whether the fact that shareholders have had relative influence over the implemented decision is valuable information to shareholders. I first isolate proposals in which shareholders have had relative influence over the implemented outcomes, namely proposals with no majority voter, in other words, proposals in which the outcome was not decided unilaterally by a single voter. I then test whether the information that no majority voter has imposed the outcome of the proposal is associated with abnormal returns following the proposals.

Such instances may reflect either an alignment of preferences between large blockholders and small shareholders, or a large blockholder's willingness to let shareholders determine the outcome because their participation can improve the decision. In the latter case, the benefits of shareholder influence may arise from aggregating dispersed information, leading to

better-informed decisions, from incorporating shareholders' heterogeneous preferences, leading to outcomes that better reflect their objectives, or from a combination of both. The data do not allow me to distinguish whether the absence of unilateral control reflects preference alignment or a deliberate choice to leave decisions to shareholders, nor to disentangle the information-aggregation and preference-accommodation mechanisms. My test therefore captures the overall valuation effect from these economic mechanisms.

To run this test, I estimate the regression defined in Equation (3). The dependent variable is also the weekly cumulative abnormal return following proposal i of DAO d at time t. This regression checks whether the indicator $\mathbf{1}$(No majority voter) is associated with positive weekly CARs.

$$CAR_{i,d,t} = \alpha_1 \cdot \mathbf{1}(\text{No majority voter})_{i,d} + \boldsymbol{\beta}^\top \mathbf{X}_{i,d,t} + \gamma_{d \times t} + \varepsilon_{i,d,t} \tag{3}$$

In Equation (4), I interact the indicator $\mathbf{1}$(No majority voter) with the different subjects of proposals. This makes it possible to determine whether the effect of $\mathbf{1}$(No majority voter) on returns is driven by one or more specific types of decisions. I also run the specification of Equation (4) on truncated samples of proposals in which I filter out proposals with the lowest shareholder engagement to ensure that results are not driven by proposals in which few shareholders turn out.

$$\begin{aligned} CAR_{i,d,t} = \alpha_1 \cdot \mathbf{1}(\text{No majority voter x Governance})_{i,d} \\ + \alpha_2 \cdot \mathbf{1}(\text{No majority voter x Partnership})_{i,d} \\ + \alpha_3 \cdot \mathbf{1}(\text{No majority voter x Business Strategy})_{i,d} \\ + \alpha_4 \cdot \mathbf{1}(\text{No majority voter x Features})_{i,d} \\ + \alpha_5 \cdot \mathbf{1}(\text{No majority voter x Cybersecurity})_{i,d} \\ + \boldsymbol{\beta}^\top \mathbf{X}_{i,d,t} + \gamma_{d \times t} + \varepsilon_{i,d,t} \end{aligned} \tag{4}$$

As in the main specification of Equation (1), these specifications also control for proposal subject, shareholder engagement, and DAO-level market characteristics at the time of each proposal. Shareholder engagement controls include the number of voters, the rolling average number of voters, the proposal disagreement, measured by the margin of victory (the difference in scores between the favored outcome and the losing outcome) and its rolling average, the log

of total voting power and its rolling average, the log of the circulating supply of shares and its rolling average, the ratio of shares voted to circulating supply and its rolling average, as well as the proposal-level Gini index and Nakamoto number. Market controls also include the DAO's market capitalization, trading volume, and age in days at the time of the proposal. Finally, I also use the DAO x Quarter fixed effects structure to account for temporal variation in proposal activity within DAOs.

4.3.2 Results

Table 4 provides evidence that shareholders value the fact that they have had the ability to influence DAOs' decisions, but only in specific topics. Column (1) shows that, on average, the information that there has not been a majority voter in proposals is associated with positive and statistically significant CARs of 1.59%. Columns (2)–(4) decompose this effect by proposal subject. The positive valuation effect is concentrated in proposals classified as Features, meaning proposals concerning DAO product design. In the most restrictive specification (focusing only on proposals with the highest shareholder engagement), the coefficient implies an average CAR of 4.34% when shareholders influence the outcome of a proposal shaping the design of the product of the DAO.By contrast, the estimates for Governance, Partnerships, Business Strategy, and Cybersecurity are not consistently statistically significant across specifications.

Product-design decisions are traditionally delegated to management in firms. The results therefore suggest not only that small shareholders value having an influence on proposals, but also that they value influence over decisions from which they are traditionally excluded. More broadly, this result suggests that expanding shareholder decision-making can create value for small shareholders provided that they retain some influence over the implemented decisions.

4.3.3 No value creation after first majority swaying

Table C.14 shows that the positive effect on weekly CARs associated with small shareholders' influence, particularly over Features proposals, disappears following the first swaying majority voter instance. This finding further supports the interpretation that large shareholders' first swaying votes reduce the value small shareholders derive from DAOs.

Table 4 – Impact of Shareholders' Influence over Proposals on Weekly CARs

Dependent variable: Weekly Cumulative Abnormal Returns following a proposal
***,**,* indicate significance at the 1%, 5% and 10% levels. Standard errors are clustered at the DAO quarter level. Singletons are excluded from the sample of observations for DAO × Quarter FE specifications.

	Weekly CARs			
	(1)	(2)	(3)	(4)
No majority voter	0.0159**			
	(2.073)			
No majority voter x Governance		0.0052	0.0156**	0.0115
		(0.5451)	(2.298)	(0.8226)
No majority voter x Partnership		0.0398	0.0450	0.0103
		(1.111)	(1.020)	(0.2215)
No majority voter x Business strategy		0.0197	0.0217	0.0245
		(0.7358)	(0.6592)	(0.5659)
No majority voter x Features		0.0278**	0.0383***	0.0434***
		(2.120)	(3.260)	(3.664)
No majority voter x Cybersecurity		0.0268*	0.0253	0.0120
		(1.855)	(1.489)	(0.6755)
Governance	-0.0106	-0.0023	0.0001	-0.0045
	(-0.5869)	(-0.1485)	(0.0064)	(-0.1624)
Partnership	-0.0225	-0.0376	-0.0213	-0.0192
	(-0.9110)	(-1.305)	(-0.8205)	(-0.5660)
Cybersecurity	-0.0089	-0.0135	-0.0067	-0.0197
	(-0.6702)	(-0.7131)	(-0.2852)	(-0.6293)
Features	-0.0126	-0.0179	-0.0218	-0.0400
	(-1.115)	(-0.9536)	(-1.033)	(-1.459)
Shareholder engagement controls	Yes	Yes	Yes	Yes
Market Controls	Yes	Yes	Yes	Yes
DAO x Quarter FE	Yes	Yes	Yes	Yes
Observations	5683	5683	4231	2820
Adj. R^2	0.206	0.206	0.20	0.211

Notes: Business strategy indicator not in the regression to avoid co-linearity. Shareholder engagement controls are: Number of voters, the rolling average of Number of voters, margin of victory, the rolling average of margin of victory, log of the total voting power in the proposal, rolling average of the log of the total voting power in the proposal, log of the circulating supply of tokens, rolling average of the log of the circulating supply of tokens, ratio of tokens voted to the circulating supply, rolling average of the ratio of tokens voted to the circulating supply, the gini index of the proposal and the Nakamoto number of the proposal. Market controls are: Market capitalization of the DAO, Trading volume and the age of the DAO.

5 Theoretical Framework

5.1 Baseline Model

5.1.1 Setup

To rationalize my empirical findings, I develop a stylized partial-equilibrium model. In this model, time is discrete with three periods $t \in \{0, 1, 2\}$ and future payoffs are discounted at rate $(1+r)$. A large blockholder initially holds a unit mass of shares. A continuum of competitive small investors purchases a fraction β_t of the supply of shares at competitive prices at the beginning of each period $t \geq 1$ from the large blockholder. β_t for $t \in \{1, 2\}$ are exogenous[32] and assumed such that $\beta_1+\beta_2 < \frac{1}{2}$.

At time 0, nature draws the value of a per-share private payoff for the large blockholder. With probability $\pi \in [0, 1]$, the per-share private payoff is $b = 0$, in which case the preferences of the large blockholder and the small investors are aligned. With complementary probability $1-\pi$, the per-share private payoff is $b > 0$, in which case, the preferences of the large blockholder and the small investors are not aligned. Given that, for now, $\beta_1+\beta_2 < \frac{1}{2}$, the large blockholder can always sway outcomes if it chooses to do so.

At each time t, after the large blockholder sells β_t shares, a proposal takes place. If the large blockholder does not sway during this proposal, both the small investors and the large blockholder get a constant per-share common payoff equal to δ[33]. If the large blockholder chooses to sway a proposal against the small shareholders, it gains the per-share private payoff b and the shareholders' per-share common payoff drops to 0.

Following this payoff structure, if swaying occurs at $t = 1$ the large blockholder, which retains $1-\beta_1$, obtains $(1-\beta_1)b$. Provided that no swaying occurs at $t = 1$, the game proceeds to period $t = 2$. If swaying occurs at $t = 2$, the large blockholder, which now retains $1-\beta_1-\beta_2$,

[32] β_t could be endogenized through the large blockholder's liquidity needs, as in Bolton and von Thadden (1998), Aghion et al. (2004), and Faure-Grimaud and Gromb (2004). Modeling these liquidity needs is beyond the scope of this paper.

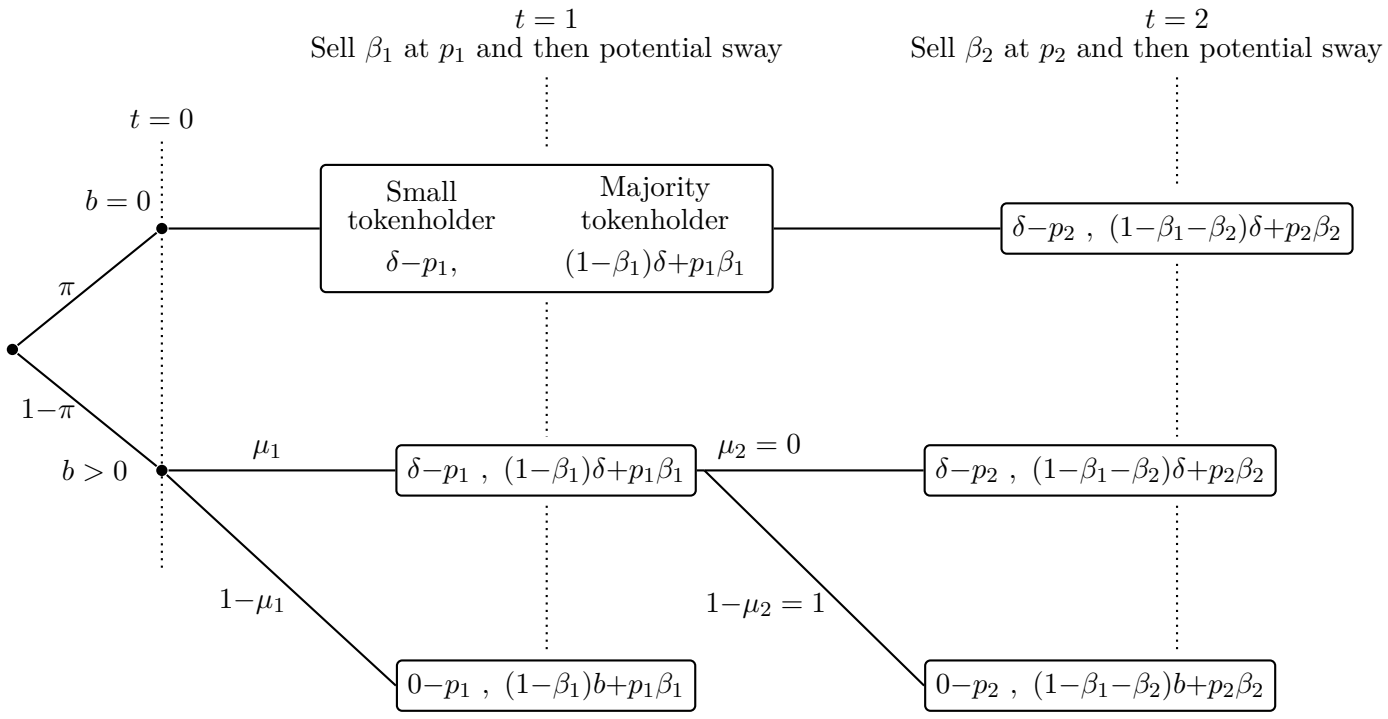
[33] This is a stylized representation summarizing the value from the token's residual cash-flow rights, voting rights, and convenience yield from using the DAO's platform. This formalization is in line with the rest of the theoretical DeFi literature (Gryglewicz et al. (2021), Cong et al. (2021), Cong et al. (2022), Abadi and Brunnermeier (2024), Goldstein et al. (2024), Prat et al. (2025), d'Avernas et al. (2026), Han et al. (2026), Fabi et al. (2026)) and is consistent with the empirical evidence in Section 4.3 that shareholders value having influence over DAO decisions.

now obtains $(1-\beta_1-\beta_2)b$. If $b > 0$, the large blockholder sways at time 2 with probability 1. If $b = 0$, the large blockholder always chooses the outcome aligned with the preferences of the small shareholders. At time $t = 1$, it receives the per-token common payoff on its retained stake $(1-\beta_1)\delta$ and at time $t = 2$, $(1-\beta_1-\beta_2)\delta$.

At time 1, small shareholders pay p_1 to purchase shares in exchange for the expected period-1 common payoff δ if no swaying occurs, plus the discounted expected resale value at $t = 2$ if the platform survives to the next period. Observing whether swaying occurs at $t = 1$ is informative. The event "no sway at $t = 1$" updates beliefs about the value of the private payoff. Shareholders price the share at p_2 based on the posterior belief formed after observing no sway at $t = 1$. Competitive pricing therefore implies that p_2 equals the posterior-weighted expected payoff with the posterior probability that the preferences between small shareholders and the large blockholder are aligned implied by Bayes' rule:

$$\Pr(b = 0 \mid \text{no sway at } 1) = \frac{\pi}{\pi+(1-\pi)\mu_1}$$

Figure 5 – Timeline of the model and payoffs



Role of β_1 in the baseline model

β_1 is introduced in order to transform the interpretation of the time 1 large blockholder's action from a pure reputation-building signal into a test of incentive compatibility after a partial exit. While β_1 and β_2 are both state variables that link trading to governance incentives, β_1 captures an incentive-distortion margin before reputation is built and β_2 is a cash-out margin after having built reputation.

5.1.2 Equilibrium

The analysis focuses on a mixed-strategy equilibrium in which the large blockholder mixes between swaying immediately at time 1 and waiting until time 2 to sway and obtain its private payoff[34].

Definition 1 (*Mixed-strategy equilibrium*)**.** Given the state variables $(\pi, \delta, b, r, \beta_1, \beta_2)$, the equilibrium is characterized by competitive prices (p_1, p_2) and a mixing probability μ_1 such that:

1. The period-2 price equals the expected common payoff:

$$p_2 = \frac{\pi}{\pi+(1-\pi)\mu_1}\delta \tag{5}$$

2. The period-1 price equals the expected sum of current and discounted common payoffs:

$$p_1 = (\pi+(1-\pi)\mu_1)\delta+\frac{\pi\delta}{1+r} \tag{6}$$

3. The mixing probability μ_1 makes the opportunistic large blockholder indifferent between swaying at $t = 1$ and delaying to $t = 2$:

$$\mu_1(\beta_1, \beta_2) = \frac{\pi}{1-\pi}\left(\frac{\delta}{b+\frac{1-\beta_1}{\beta_2}(rb-\delta(1+r))}-1\right) \tag{7}$$

Proof. See Appendix A.1.1

[34] In Appendix A.1.2, I show that neither of the two pure strategies, always swaying at time 1 or always delaying at time 2, is Nash equilibrium.

5.1.3 Main Empirical Prediction: Price Drop after the First Sway

When the large blockholder sways the vote, the small shareholders learn that their preferences are not aligned with those of the large blockholder and the price of the token drops from p_t to 0, thus rationalizing the main empirical finding of Section 4.2.2.

The key intuition for understanding the dynamics of the magnitude of the price drop is that when the mixing probability μ_1 is high, the blockholder often chooses not to sway at t=1. In that case, observing "no sway" is not informative about the true value of the private payoff. As a result, no swaying after t=1 does little to shift beliefs toward $b = 0$. When the mixing probability μ_1 is low, however, the large blockholder rarely refrains from swaying at time 1. In that case, observing "no sway" is a strong signal towards $b = 0$ as the large blockholder almost always reveals $b > 0$ by swaying early. Survival then sharply tilts posterior beliefs towards $b = 0$. More detailed comparative statics of the magnitude of the price drop after swaying with respect to the large blockholder's private payoff b and the large blockholder's skin in the game (β_1 and β_2) can be found in Appendix A.1.3.

5.2 Extension: Endogenous Small Shareholders' Turnout

In the baseline model, the large blockholder can always sway a vote when it chooses to do so. I now endogenize small shareholders' participation in governance, introducing a probability that an attempted sway can be countered by their votes. I therefore relax the restriction $\beta_1+\beta_2 < 1/2$. Let s_t denote the aggregate ownership stake of small shareholders at time t, with $s_1 = \beta_1$ and $s_2 = \beta_1+\beta_2$. The large blockholder retains $1-s_t$. Let $D_t = (x_{1t}, \ldots, x_{N_t t})$ denote the distribution of ownership across N_t small shareholders, where $\sum_i x_{it} = s_t$. As in the baseline model, shareholders' ownership is taken to be exogenous. Each small shareholder i now privately observes a cost parameter $c_i \sim F_i$, which remains fixed across periods. Shareholders know the distributions of others' participation costs but not their realizations.

At each time t, each shareholder chooses an attention probability $a_{it} \in [0, 1]$, which determines the probability of participating in the proposal. While casting a vote is costless, attention entails a strictly convex cost $\Psi_i(a_{it}, c_i)$. A small shareholder benefits from participating only when its vote is pivotal in preventing the large blockholder from swaying. In that event, the shareholder preserves the per-token common payoff δ, obtaining a payoff proportional to its

stake x_{it}.

Let $Y_{-i,t} = \sum_{j \neq i} x_{jt} A_{jt}$ denote the realized shareholder turnout excluding shareholder i, where $A_{jt} \sim \text{Bernoulli}(a_{jt})$ indicates whether shareholder j participates, with participation probability a_{jt}. Each small shareholder solves

$$a^*_{it}(c_i; D_t) = \arg\max_{a \in [0,1]} \left\{ a x_{it} \delta \, \phi_{it}(D_t, \bar{a}^*_{-i,t}) - \Psi_i(a, c_i) \right\}$$

where $\phi_{it}(D_t, \bar{a}_{-i,t}) = \Pr\left(1 - s_t - x_{it} \leq Y_{-i,t} < 1 - s_t \mid D_t, \bar{a}_{-i,t}\right)$ is the probability that shareholder i is pivotal in preventing swaying.

The equilibrium vector $\bar{a}^*_t(D_t)$ is a fixed point in which each shareholder optimizes against the participation probabilities of all others. Appendix A.2.1 establishes the existence of this equilibrium. These equilibrium participation decisions determine realized and expected small shareholders' voting power. The realized small shareholders' turnout is $X^*_t(D_t) = \sum_{i=1}^{N_t} x_{it} A^*_{it}$, while expected small shareholders' turnout is

$$M_t = \mathbb{E}\left[X^*_t(D_t) \mid D_t, \bar{a}^*_t(D_t)\right] = \sum_{i=1}^{N_t} x_{it} \bar{a}^*_{it}(D_t)$$

An attempted sway is prevented whenever realized small shareholders' voting power exceeds the large blockholder's stake. The equilibrium counter-swaying probability is therefore

$$Q_t = \Pr\left(X^*_t(D_t) \geq 1 - s_t \mid D_t, \bar{a}^*_t(D_t)\right)$$

Thus, both expected turnout M_t and the probability Q_t that small shareholders can counter a swaying attempt are endogenous to the ownership distribution and individual participation costs. Because participation costs are privately observed but persistent across periods, a successful sway can now also reveal information about small shareholders' willingness to participate.

New role of β_1

β_1 now affects the entire participation game. D_1 affects small shareholders' equilibrium attention $\bar{\boldsymbol{a}}^*$ which in turn affects Q_1. If $\beta_1 < 1/2$, small shareholders' voting power is mechanically insufficient and $Q_1 = 0$. If $\beta_1 > 1/2$, countering the sway becomes feasible, but whether it is likely depends on how the sold stake is dispersed.

5.2.1 Equilibrium

I focus again on a mixed-strategy equilibrium in which the majority blockholder mixes between swaying immediately at time 1 and waiting until time 2 to implement its private payoff. Prices are assumed to be competitively determined by an atomistic marginal buyer of the share who is indifferent between buying and not buying. As this buyer is atomistic, its individual purchase decision does not affect small shareholders' participation and leaves the equilibrium counter-swaying probabilities Q_1 and Q_2 unchanged.

Definition 2 (*Mixed-strategy Equilibrium with stochastic turnout*)**.**

Given the baseline primitives $(\pi, \delta, b, r, \beta_1, \beta_2)$, ownership structures of small shareholders (D_1, D_2) and endogenous counter-swaying probabilities (Q_1, Q_2)[35], the equilibrium is characterized by competitive prices (p_1, p_2) and a mixing probability μ_1 such that:

1. The period-2 price equals the expected payoff of small shareholders:

$$p_2 = \delta \left[Q_2 + (1-Q_2) \frac{\pi}{\pi + (1-\pi)\mu_1} \right]$$

2. The period-1 price equals the expected sum of current and discounted payoffs of small shareholders across three possibilities: (1) preferences are aligned; (2) preferences are not aligned, but the large blockholder delays swaying; or (3) preferences are not aligned, the large blockholder attempts to sway immediately, and the attempt is countered.

$$p_1 = \delta \left[\pi + (1-\pi)\mu_1 + (1-\pi)(1-\mu_1)Q_1 \right] + \frac{\delta}{1+r} \left[\pi + (1-\pi)\mu_1 Q_2 \right]$$

3. The mixing probability μ_1 makes the opportunistic large blockholder indifferent between swaying at $t = 1$ and delaying to $t = 2$:

$$\mu_1 = \frac{\pi}{1-\pi} \left[\frac{\beta_2 \delta (1-Q_2)}{A(Q_1, Q_2) - \beta_2 \delta Q_2} - 1 \right]$$

with $A(Q_1, Q_2) = (1+r)(1-\beta_1)(1-Q_1)(b-\delta)(1-\beta_1-\beta_2)\left[(1-Q_2)b + Q_2\delta\right]$

[35] Derived from the participation primitives $\{F_i, \Psi_i\}_i$ defined in Appendix A.2.1 and with participation-equilibrium selection satisfying Equation (21) yielding existing $\bar{\boldsymbol{a}}_t^*(D_t)$ and $X_t^*(D_t)$.

Proof. See Appendix A.2.2

In this equilibrium, p_2 is higher than in the baseline as Q_2 adds a possibility that the swaying attempt is blocked. Even if the large blockholder's preferences are opposed to those of small shareholders, small shareholders may still receive δ if they defeat the swaying vote.

Also, as small shareholders' ownership converges to a continuum, the counter-swaying probabilities of stopping the large blockholder's attempted sway collapse, $Q_t \to 0$, and the equilibrium quantities of the model's extension converge to the baseline defined in Section 5.1.2. This result is detailed in Appendix A.2.3.

5.2.2 Small shareholders' disengagement following first successful majority swaying

Proposition 1 (*Small Shareholders' Disengagement Following a Belief Update About Their Counter-Swaying Ability*)**.**

For a fixed small shareholders' ownership structure D_t, if the large blockholder attempts to sway and succeeds, then the updated expected turnout $M_t^{Post\ Sway}$ and the updated expected counter-swaying probability $Q_t^{Post\ Sway}$ satisfy

$$M_t^{Post\ Sway} < M_t \qquad \text{and} \qquad Q_t^{Post\ Sway} < Q_t$$

Proof. See Appendix A.2.4

A successful sway is rationally interpreted as evidence that the endogenous small token-holders' participation profile is weak. Small shareholders therefore learn, in addition to the large blockholder's type, that participation by other small shareholders is endogenously low. Consequently, this predicts lower small shareholder turnout in subsequent proposals (and a lower probability that the small shareholders can discipline the blockholder) as evidenced empirically in Section 4.2.5.

5.3 Empirical support for the pooling assumption

A central feature of the model is that it assumes that, before the first swaying majority vote, large shareholders with misaligned preferences ($b > 0$) pool with those whose preferences align with small shareholders ($b = 0$), making their pre-vote trading behavior indistinguishable. Otherwise, small shareholders could infer preference misalignment from large shareholders' trading behavior and update their beliefs before observing a swaying vote. I therefore examine whether this pooling assumption is consistent with the data.

I query transaction histories directly from majority voters' Ethereum addresses (both from those who swayed votes and those who did not sway votes). Table C.15 shows no statistically significant differences in pre-proposal selling behavior between first swaying majority voters and majority voters who do not sway, consistent with the model's pooling assumption. I also find no significantly higher outflows following the first swaying majority vote. This further supports the interpretation that large shareholders use swaying votes to maintain control over small shareholders rather than immediately extract value and exit. This further supports the interpretation of the governance effects documented in Section 4.1 that majority voters appear to use first swaying majority votes to gain prolonged control over small shareholders rather than extracting value and selling their holdings.

6 Structural estimation: Shareholder welfare and private benefit extractions

6.1 Motivation and main intuition

The reduced-form evidence points to conflicts of interest among shareholders but does not establish whether these conflicts reduce aggregate shareholder welfare. First swaying-majority events are followed by negative returns and a decline in subsequent small shareholders' participation, yet these findings are consistent with two interpretations. First, a large blockholder may impose an outcome that generates private benefits at the expense of aggregate shareholder welfare, consistent with the anecdotal evidence in Section 4.1.3. Alternatively, if the blockholder's private payoff is sufficiently large, imposing its preferred outcome may maximize aggregate

shareholder welfare despite reducing small shareholders' value[36]. Under both interpretations, the first swaying-majority event signals that small shareholders' preferences may no longer be reflected in subsequent decisions. When small shareholders are the marginal buyers of shares, this new information leads to a drop in share prices as in Section 4.2.5.

To distinguish between these interpretations, I structurally estimate the large blockholder's private payoff, b, and the common payoff accruing to shareholders, δ, and use these estimates to assess whether swaying by the large blockholder reduces aggregate shareholder welfare. The relevant object is not either parameter in isolation. Although b must exceed δ for swaying to occur in the model, this condition does not establish whether swaying is welfare-reducing. Instead, I compare aggregate shareholder welfare along the no-sway path with aggregate welfare when the large blockholder sways, accounting for both the loss of common payoffs and the blockholder's private payoff. If the estimated private payoff is insufficient to offset the forgone continuation value of common payoffs, swaying reduces aggregate welfare, supporting the private-benefit extraction interpretation. Conversely, if the private payoff exceeds the combined common payoff loss, swaying maximizes aggregate shareholder welfare despite harming shareholders.

I recover δ and b by jointly exploiting four margins in the data. First, the average return along the no-sway path, when all shareholders receive the common payoff, disciplines the value shareholders attach to preference alignment (or the absence of conflicts of interest). Second, the frequency of successful sways informs the prevalence of opportunistic large blockholders. Third, the timing of successful sways disciplines the large blockholder's incentives to delay swaying. I distinguish early sways, occurring on the large blockholder's first vote, from late sways, occurring on subsequent votes. Fourth, the frequency with which small shareholders' participation could have prevented an attempted sway disciplines their ability to counter large blockholders. Importantly, δ and b are identified jointly rather than from separate samples of sway and no-sway observations. Although no-sway returns primarily discipline δ, they also reflect shareholders' beliefs about the blockholder's type and the likelihood of future swaying. Similarly, b is recovered from the private payoff required to rationalize the observed frequency and timing of sways, given the estimated continuation value, prevalence

[36]For example, this could be a situation in which a financially motivated large blockholder may vote against users extracting rents from the DAO.

of opportunistic blockholders, incentives to delay, probabilities of successful counter-swaying, and resale parameters.

These moments jointly determine whether swaying reduces aggregate shareholder welfare. A larger δ implies a greater continuation value from common payoffs that is sacrificed when a blockholder successfully sways, favoring the private-benefit extraction interpretation. Conversely, a smaller continuation value or a sufficiently large estimated private payoff b makes welfare-maximizing swaying more likely. The timing of sways is particularly informative about the magnitude of b. Conditional on the overall frequency of successful sways, a greater proportion of early sways indicates stronger incentives to sway immediately rather than delay, pushing the estimated private payoff upward. Thus, whether swaying reduces aggregate welfare cannot be inferred from the negative market reaction to first swaying-majority events alone. Instead, it is determined by the joint information contained in no-sway returns, the frequency and timing of successful sways, and small shareholders' ability to counter swaying attempts.

6.2 GMM with analytical equilibrium moments

To estimate the model, I use a generalized method of moments (GMM) estimator that recovers the parameters of a representative DAO. Step-by-step details of the implementation can be found in Appendix E.

The model has 8 parameters. Three are calibrated externally: r the discount rate, β_1, the fraction of shares sold early by the large blockholder and β_2, the fraction sold later. The calibrated parameters are denoted $\gamma = (\beta_1, \beta_2, r)$. The vector of the five remaining parameters to be estimated is

$$\theta = (\pi, \delta, b, Q_1, Q_2)$$

where π is the prior probability that the large blockholder is benevolent, δ is the common shareholder payoff, b is the large blockholder's private payoff, and Q_t is the probability that small shareholders block the attempted sway at date $t \in \{1, 2\}$.

6.2.1 Analytical moments

Given γ, the model delivers a vector of six analytical moments

$$m(\theta;\gamma) = (m_A(\theta;\gamma), m_E(\theta;\gamma), m_N(\theta;\gamma), m_S(\theta;\gamma), m_{Q1}(\theta;\gamma), m_{Q2}(\theta;\gamma))$$

where $m_A(\theta;\gamma)$ is the successful swaying frequency, $m_E(\theta;\gamma)$ is the early successful swaying frequency (i.e. when the successful sway of the large blockholder is also the large blockholder's first vote), $m_N(\theta;\gamma)$ is the mean return when small shareholders get their payoffs (i.e. no swaying occurs), $m_S(\theta;\gamma)$ is the mean return after the first successful swaying attempt from the large blockholder, $m_{Q1}(\theta;\gamma)$ is the early counter-sway frequency representing the frequency of swaying attempts that are stopped by small shareholders when the first attempted sway occurs on the large blockholder's first vote, and $m_{Q2}(\theta;\gamma)$ is the late counter-sway frequency representing the frequency of swaying attempts that are stopped by small shareholders when the attempted sway occurs on a later vote of the large blockholder. Appendix E.3 details how each analytical moment can be expressed as a function of the parameters in θ, γ, together with quantities determined by the equilibrium conditions.

Although all moments in $m(\theta;\gamma)$ jointly pin down all parameters in θ, certain moments are particularly informative about specific model parameters. First, the early (late) counter-sway frequency m_{Q_1} (m_{Q_2}) directly disciplines the model-implied counterpart, namely the early (late) probability Q_1 (Q_2).

Then, the no-sway return moment $m_N(\theta;\gamma)$ especially disciplines the continuation payoff δ. $m_N(\theta;\gamma)$ is not directly equal to δ, as prices incorporate beliefs about the blockholder's type and future swaying risk. However, $m_N(\theta;\gamma)$ varies monotonically with δ. A larger positive no-sway return requires a larger continuation payoff, holding fixed the belief and stopping probabilities of the model. $m_N(\theta;\gamma)$ therefore pins down the scale of total shareholder welfare on the no-sway path.

The total successful-sway frequency $m_A(\theta;\gamma)$ disciplines the prevalence of opportunistic large blockholders. Holding fixed the counter-sway probabilities Q_1 and Q_2 and the delay probability μ_1, a higher π lowers both early and delayed successful sways as fewer large blockholders are opportunistic.

The early successful-sway frequency $m_E(\theta;\gamma)$ disciplines the timing of opportunistic

behavior. Holding fixed the total successful-sway frequency, a higher early-sway frequency requires a lower delay probability μ_1, while a higher delayed-sway frequency requires a higher μ_1. The two sway-frequency moments, $m_A(\theta;\gamma)$ and $m_E(\theta;\gamma)$, jointly discipline the sway-now-versus-delay margin. This timing margin is the key input into the identification of the large blockholder's private payoff b. If b is high, immediate extraction is more attractive and the model generates many early sways. If b is low, delay becomes more attractive relative to extraction. The observed split between early and delayed sways disciplines μ_1, while the equilibrium indifference condition determines the value of b required to rationalize that split.

The mean return following the first successful sway, $m_S(\theta;\gamma)$, provides an additional restriction on equilibrium share prices. While the five preceding moments recover the five structural parameters $(\pi, \delta, b, Q_1, Q_2)$, this sixth moment requires these recovered parameters to also rationalize the magnitude of the price decline following the first successful sway. Thus, the sixth moment overidentifies the model by testing whether the parameters recovered from governance outcomes and no-sway returns also explain the market's response to the revelation of preference misalignment.

I then look for parameters θ that minimize the distance between the analytical moments in $m(\theta,\gamma)$ and empirical target moments $\hat{m}$. Using a weighting matrix W constructed from the bootstrap covariance matrix of the empirical moment vector, the problem can be written as

$$\widehat{\theta} = \arg\min_{\theta\in\Theta} \left[m(\theta;\gamma) - \widehat{m}\right]' W \left[m(\theta;\gamma) - \widehat{m}\right] \tag{8}$$

6.2.2 Empirical moments

The empirical target vector used in the GMM objective to fit the model-implied moments is

$$\widehat{m} = (\widehat{m}_A, \widehat{m}_E, \widehat{m}_N, \widehat{m}_S, \widehat{m}_{Q1}, \widehat{m}_{Q2})$$

$\widehat{m}_A$ and $\widehat{m}_E$: the share of DAOs with (early) swaying

I match the total successful-sway frequency $m_A(\theta;\gamma)$ to $\widehat{m}_A$, which is the share of DAOs in my sample that experience swaying majority voters. $m_E(\theta;\gamma)$ the early-sway frequency is matched to $\widehat{m}_E$, the share of DAOs where the first swaying majority instance of a large blockholder imposing an outcome against small shareholders' preferences was also the first

instance that a majority voter unilaterally controlled the outcome of the proposal.

$\widehat{m}_N$: small shareholders' valuation of influencing proposals.

I match the model-implied no-sway return, $m_N(\theta;\gamma)$, to $\widehat{m}_N$, which is the coefficient of the indicator $\mathbf{1}$(No Majority×Features) in the regression of Equation (4). In the model, $m_N(\theta;\gamma)$ is the return realized when a governance outcome is not overturned by a large blockholder sway and shareholders retain their common payoff. The matched reduced-form coefficient captures the value increase associated with shareholders having influence over decisions. In the bootstrap implementation, I estimate the regression on the high-turnout subsample used in Column (4) of Table 4 because this subsample most directly captures the value increase that shareholders associate with governance influence.

$\widehat{m}_S$: Average price drop after first successful sway.

I match the model-implied return following the first successful sway, $m_S(\theta;\gamma)$, to $\widehat{m}_S$, measured by the coefficient on the indicator $\mathbf{1}$(First Swaying Majority Voter) in the main event-study regression of Equation 1, reported in Column (4) of Table C.7 which includes all engagement controls. Matching this moment disciplines the parameters governing these valuations by requiring that the model reproduce the observed market reaction to the first successful sways.

$\widehat{m}_{Q_1}$ and $\widehat{m}_{Q_2}$: Frequency with which prior minority turnout exceeds the first swaying-majority voter's voting power.

The early and late counter-swaying moments m_{Q_1} and m_{Q_2} are matched with the empirical frequencies $\widehat{m}_{Q1}$ and $\widehat{m}_{Q2}$. These frequencies measure the share of pre-sway proposals where small shareholders' turnout (as a percentage of ownership) would have exceeded the voting power of the first swaying-majority voter. The frequency $\widehat{m}_{Q1}$ is computed for DAOs where the first successful majority sway is also the first occurrence of a majority voter. The frequency $\widehat{m}_{Q2}$ is computed for DAOs where the first successful majority sway occurs after an earlier majority-voter occurrence.

6.2.3 Calibration of β_1, β_2 and r

The early sale parameter β_1 is calibrated to $\beta_1 = 0.54$ from Howell et al. (2020) and Barth et al. (2023), which show that the amount of ownership sold in initial coin offerings (ICOs) on average is 54%. As there is no clear estimate of β_2 in the literature, I derive a plausible range of estimates from Fahlenbrach and Frattaroli (2021). Studying ICOs, they document that 59% of founders have lockup periods and cannot sell tokens for an average of one year post-ICO. For investors without lockups, they find that, within 90 days of the ICO, tokenholders sell 42.3% of their initial allocation on average. Using these estimates,I calculate the share of retained tokens subsequently sold as $0.41 \times 0.423 = 0.173$ or 17.3%. On average, the first majority swaying happens on the 22nd proposal. Given an average proposal duration of approximately one week, 22 proposals correspond to more than 90 days. Thus, I use 17.3% as a lower bound and test for values of $\beta_2 \in [0.15, 0.35]$ in Appendix F. The discount rate is calibrated using the cryptocurrency market return documented by Liu et al. (2022). They construct a value-weighted cryptocurrency market index and report an average cryptocurrency market return of approximately 1.3% per week. The average interval between the first vote from a majority voter and the first vote from a swaying majority voter is 13 proposals, each lasting around one week. The discount rate is obtained by compounding the weekly return $r = (1+0.013)^{13} - 1 \simeq 0.183$. This calibration sets the discount rate as the opportunity cost of investing in one DAO token rather than a cryptocurrency market index over this 13-week interval[37].

6.3 Results

6.3.1 Estimates and fit

Table 5 reports the structural parameter estimates and assesses the model's ability to reproduce the empirical moments. The specification estimates five structural parameters using six targeted moments. Panel B shows that the model-implied moments closely match their empirical counterparts. Consistent with this fit, the Hansen J-statistic is small, and the

[37]The empirical return moments matched in the structural estimation are based on cumulative abnormal returns measured relative to a cryptocurrency market portfolio. I therefore use a broad cryptocurrency market index as the outside investment opportunity when discounting future payoffs, similar to what is used in Korteweg and Nagel (2016) and Gourier et al. (2024).

overidentifying restrictions cannot be rejected, providing no evidence against the model's joint moment restrictions.

Beyond the fitting the targeted moments, I assess the model's ability to reproduce two additional untargeted return moments reported in Panel C. These untargeted moments are average returns following early and delayed first successful sways. Early sways correspond to instances in which the first swaying-majority voter occurrence coincides with the first majority-voter occurrence, whereas delayed sways correspond to instances in which the first successful sway follows an earlier majority-voter occurrence. Unlike the average first-sway return, which enters the six-moment estimation, these two conditional returns are not targeted. They therefore provide an additional validation of the model's equilibrium pricing mechanism. Tests of equality between the model-implied and empirical returns reveal no statistically significant differences, indicating that the model reproduces not only the targeted average price decline following the first successful sway but also its variation across early and delayed sways, which is not used in estimation[38]. This result is robust to several calibrations of β_2, as illustrated in Figures F.1 and F.2.

6.3.2 Aggregate shareholder welfare

Using the structural estimates reported in Table 5, I test whether swaying by the large blockholder reduces aggregate shareholder welfare, accounting for both the common payoffs to shareholders on the no-sway path and the common payoffs and the private benefits retained by the large blockholder when there is swaying. I therefore compare the aggregate shareholder welfare along the no-sway path, given by

$$\left(1+\frac{1}{1+r}\right)\delta$$

with the expected aggregate shareholder welfare when the large blockholder's preferences are misaligned

$$(1-\mu_1)\left[Q_1\delta+(1-Q_1)(1-\beta_1)b\right]+\mu_1\left[\delta+\frac{Q_2\delta+(1-Q_2)(1-\beta_1-\beta_2)b}{1+r}\right]$$

[38]The regressions used to estimate the empirical mean early and delayed first sway returns are described in Appendix E.10.

Table 5 – Structural estimates and model fit

	Symbol	Model	S.E.	Data/Target
Panel A. Estimated parameters				
Prior probability of benevolent type	π	0.4038	0.073	–
Shareholders' payoff	δ	0.1452	0.04	–
Large blockholder's private payoff	b	0.3988	0.134	–
Early counter-sway probability (time 1)	Q_1	0.1702	0.109	–
Late counter-sway probability (time 2)	Q_2	0.2024	0.052	–
Delay probability	μ_1	0.721	Estimated via eq.	–
Panel B. Targeted moments				
Successful sway frequency	-	0.481	0.056	0.479
Early successful sway frequency	-	0.138	0.038	0.137
Mean no-sway return	-	0.042	0.012	0.043
Mean first sway return	-	-0.114	0.033	-0.113
Early counter-sway frequency (time 1)	-	0.17	0.109	0.168
Late counter-sway frequency (time 2)	-	0.202	0.052	0.201
Panel C. Untargeted moments				
Mean early first-sway return	-	-0.185	0.054	-0.177
Mean early first-sway return	-	-0.085	0.025	-0.093

Notes. Panel A reports the estimated structural parameters. Panel B reports the model-implied targeted moments and their empirical counterparts, together with standard errors. Panel C reports the corresponding untargeted moments. The Hansen J-statistic is 0.004, with a p-value of 0.94, indicating that the overidentifying restrictions cannot be rejected. The joint Wald test of the null hypothesis that both untargeted moments equal zero yields a p-value of 0.958. Two-sided tests of equality between the model-implied and empirical untargeted moments yield p-values of 0.93 for mean returns following early swaying and 0.77 for mean returns following late swaying. Neither difference is statistically significant at conventional levels, suggesting that the model also reproduces these untargeted moments. Standard errors of model-implied moments are computed using the delta method, as detailed in Appendix E.9.

The latter expression accounts for the endogenous probability of delaying swaying, the probability that small shareholders prevent swaying in each period, and the private benefits retained by the large blockholder following a successful sway. Using the estimated structural parameters and calibrated values of β_1 and β_2, the estimated difference in aggregate shareholder welfare is

$$\left(1+\frac{1}{1+r}\right)\delta-(1-\mu_1)\left[Q_1\delta+(1-Q_1)(1-\beta_1)b\right]+\mu_1\left[\delta+\frac{Q_2\delta+(1-Q_2)(1-\beta_1-\beta_2)b}{1+r}\right]=0.0403>0$$

A two-sided test the null hypothesis that this difference equals zero yields a z-stat of 2.4031, corresponding to a p-value of approximately 0.016. The estimated difference corresponds to a welfare loss when the large blockholder sways and imposes an outcome that is negative and statistically significant. Although the private benefits retained by the large blockholder partially offset the loss of common payoffs, this offset is insufficient to compensate for the aggregate welfare reduction associated with opportunistic governance. Relative to aggregate shareholder welfare along the no-sway path, the estimated loss amounts to approximately 15%. These findings are consistent with the interpretation that the large blockholder extracts private benefits through swaying at the expense of aggregate shareholder welfare.

It is important to note that the estimated change in aggregate shareholder welfare need not coincide with the decline in share prices following the first successful sway, as the two measures capture distinct economic objects. A successful sway reduces the market value held by shareholders by eliminating the common payoffs anticipated before the revelation of preference misalignment. However, the large blockholder retains a private benefit from swaying that is not capitalized into share prices but enters the calculation of aggregate shareholder welfare. This private benefit can therefore partially offset the loss in common payoffs, making the aggregate welfare decline smaller in magnitude than the observed price reaction. This is in line with the finding that the estimated decline in aggregate shareholder welfare is approximately -0.0403, compared with an average price decline of -0.112 following the first successful sway[39]. When normalized by aggregate shareholder welfare along the no-sway path, this decline corresponds to a welfare loss of approximately 15%[40].

[39]This is the estimate reported in Column (4) of Table C.7

[40]The difference between this percentage and the observed price reaction reflects their economic interpretation.

Figure F.3 examines the sensitivity of this result to alternative calibrated values of β_2. The estimated welfare difference remains positive and statistically significant across the calibrations considered, suggesting that the welfare implications of swaying are not driven by the benchmark choice of β_2.

In Appendix F.2, I consider an overidentified specification that additionally targets the two returns following early and delayed first successful sways, increasing the number of targeted moments from six to eight. I recompute the joint covariance matrix to incorporate these additional moments. The Hansen J-test continues to provide no evidence against the model's overidentifying restrictions, including across the alternative calibrations of β_2. Figure F.6 further shows that the estimated welfare differences retain their sign and statistical significance. In Appendix F.3, I instead estimate an exactly identified specification using five targeted moments. I assess its fit using the mean first-sway return as an untargeted moment in this specification, and find no statistically significant difference between the model-implied and empirical values (Figure F.7). The estimated difference in welfare also remains positive and statistically significant (Figure F.8). Overall, these exercises indicate that the aggregate shareholder welfare loss associated with swaying is robust to the choice of targeted moments and to the calibration of β_2.

6.3.3 Counterfactual scenarios: Swaying maximizes shareholder welfare

I conduct counterfactual exercises to show that the model does not mechanically imply that swaying reduces aggregate shareholder welfare. Figures F.4 and F.5 illustrate several equilibria in which the large blockholder instead maximizes aggregate shareholder welfare by swaying.

Two main adjustments are needed for the estimated equilibrium to generate this outcome. The first combines a lower common payoff, δ, and a correspondingly lower equilibrium μ_1 for a given private payoff b. This lower common payoff needs to be coupled with a higher probability that small shareholders can successfully counter an initial swaying attempt Q_1. This probability would need to approximately double or triple relative to the estimated equilibrium, which could arise from less dispersed shareholdings among small shareholders according to the extension of the model in Section 5.2. Alternatively, when δ is lower, equilibria in which swaying maximizes aggregate shareholder welfare can also arise if the large blockholder retains a larger ownership stake early β_1.

7 Conclusion

This paper studies a novel setting in which organizations have experimented with shareholder democracy in its most expansive form. My findings highlight fundamental limitations to expanding shareholder involvement in corporate decision-making. Although allowing shareholders to vote directly on a broader range of decisions can create value when they have meaningful influence over outcomes, frequent proposals and the high attention costs of participating in collective decision-making lead shareholders to disengage. This disengagement concentrates effective voting power in the hands of a few large, active shareholders, enabling them to unilaterally determine governance outcomes.

Using an event-study design, I show that this concentration of control is self-reinforcing. When large shareholders first impose outcomes against small shareholders, small shareholders learn that their preferences are unlikely to be reflected in future decisions. This reduces the value of the DAO for small shareholders, leading to a drop in share prices and further disengagement from governance. The resulting decline in participation further concentrates voting power in proposals following the first swaying-majority event, thereby increasing the likelihood of successful swaying attempts by large shareholders.

I develop a model that rationalizes these findings through small shareholders' uncertainty about the alignment of their preferences with those of a large blockholder from whom they purchase the DAO's shares. When no early swaying occurs, small shareholders update their beliefs toward a greater likelihood of preference alignment, increasing the share price and making it more valuable for the blockholder to delay swaying. When swaying eventually occurs, the share price drops as small shareholders learn that the blockholder's preferences are not aligned with their own. Extending the model to endogenize participation further shows that a successful sway reveals weaker-than-expected small shareholder participation, rationalizing the subsequent decline in turnout observed in the data. Structural estimation sharpens the welfare interpretation of these governance failures. The estimates indicate that the large blockholder's expected private payoff from swaying is insufficient to compensate for the shareholders' forgone continuation value along the no-sway governance path, supporting an interpretation of swaying as private-benefit extraction reducing aggregate shareholder welfare.

The broader implications of my findings are that expanding shareholder involvement in decisions traditionally delegated to management can create value, provided shareholders retain

meaningful influence over outcomes. However, the scope of this involvement must be carefully calibrated. The negative effects of shareholder disengagement can be self-reinforcing, ultimately producing decisions that backfire against the small shareholders whom shareholder democracy is intended to empower. Moreover, large shareholders may have private incentives to sustain inefficient shareholder democracies with low shareholder turnout, as rising disengagement increases their ability to extract private benefits over time. The optimal implementation of shareholder democracy may therefore involve gradually expanding the scope of shareholder voting rather than minimizing managerial delegation at the outset, only to gradually restore it later (as has recently occurred in DAOs).

Finally, my findings imply that a key avenue for future research is identifying the structure of shareholders' attention costs in collective decision-making in order to better design the optimal shareholder democracy. In particular, it would be useful to understand whether these costs are fixed, recurring (even for proposals on the same subject), proposal-specific, or a mix of the three. Because the nature of these costs determines the extent of endogenous free-riding in shareholder voting, characterizing them is central to calibrating the optimal allocation of decision rights between shareholders and management.

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A Theory Appendix

A.1 Proofs: Baseline model

A.1.1 Equilibrium

Period 2 price Conditional on reaching $t = 2$, the small investors prices the share based on their indifference condition between buying and not buying the share. The period-2 competitive price satisfies

$$p_2 = \frac{\pi}{\pi+(1-\pi)\mu_1}\ \delta$$

Period-1 price Using the indifference condition for p_2, the indifference condition of the small shareholders at time 1 and therefore the period-1 price is:

$$p_1 = (\pi+(1-\pi)\mu_1)\delta+\frac{\pi\delta}{1+r} = \frac{\pi\delta^2}{p_2}+\frac{\pi\delta}{1+r}$$

Indifference condition of the large blockholder when $b > 0$

If the large blockholder sways at $t = 1$, it sells β_1 at price p_1 and obtains a private payoff proportional to retained stake:

$$U^{\text{sway at 1}} = \beta_1 p_1+(1-\beta_1)b$$

If the large blockholder refrains at $t = 1$, it sells β_1 at price p_1, receives the common payoff on retained stake $(1-\beta_1)\delta$ in period 1, then sells β_2 at price p_2 in period 2 and sways with private payoff $(1-\beta_1-\beta_2)b$ discounted by $(1+r)^{-1}$:

$$U^{\text{sway at 2}} = \beta_1 p_1+(1-\beta_1)\delta+\frac{\beta_2 p_2+(1-\beta_1-\beta_2)b}{1+r}$$

In a mixed-strategy equilibrium, the large blockholder is indifferent between swaying at $t = 1$ and delaying to $t = 2$:

$$U^{\text{sway at 1}} = U^{\text{sway at 2}}.$$

$$\Leftrightarrow \beta_1 p_1+(1-\beta_1)b = \beta_1 p_1+(1-\beta_1)\delta+\frac{\beta_2 p_2+(1-\beta_1-\beta_2)b}{1+r}$$

$$\Leftrightarrow (1-\beta_1)b(1+r) = (1-\beta_1)\delta(1+r)+\beta_2 p_2+(1-\beta_1-\beta_2)b$$

$$\Leftrightarrow \beta_2(p_2-b) = (1-\beta_1)[rb-\delta(1+r)]$$

$$\Leftrightarrow p_2 = \left(1+\frac{1-\beta_1}{\beta_2}r\right)b-\frac{1-\beta_1}{\beta_2}\delta(1+r)$$

Combining with the indifference condition of the small shareholders at time 2 we get μ_1, the large blockholder mixing probability as a closed form function of (β_1, β_2):

$$\mu_1(\beta_1,\beta_2) = \frac{\pi}{1-\pi}\left(\frac{\delta}{b+\frac{1-\beta_1}{\beta_2}(rb-\delta(1+r))}-1\right)$$

A.1.2 Pure strategies not being equilibria

This section shows that neither pure strategies (always swaying at time 1 or always delaying swaying at time 2) can be sustained in equilibrium. If the $b > 0$ and the large blockholder is expected to sway immediately, then a small probability of restraint makes "no swaying" at time a very good news and raises p_2. This makes delay profitable. By contrast, if the $b > 0$ and the large blockholder is expected never to sway at time 1, then not swaying at time 1 does not give any information of the value of the private benefit. Therefore p_2 remains too low and early swaying is profitable.

At time 1, the large blockholder with misaligned preferences chooses between

$S =$ sway at date 1, $\qquad LS =$ do not sway at date 1 delay and later sway at date 2.

The large blockholder with misaligned preferences payoff from swaying at date 1 is

$$U_S = \beta_1 p_1+(1-\beta_1)b \tag{9}$$

If instead the large blockholder with misaligned preferences does not sway at time 1, it receives the time-1 common payoff δ on its retained stake, sells β_2 shares at date 2 at price p_2, and

then sways at date 2. Its payoff from delaying is

$$U_{LS}(p_2) = \beta_1 p_1 + (1-\beta_1)\delta + \frac{\beta_2 p_2 + (1-\beta_1-\beta_2)b}{1+r} \tag{10}$$

Define the payoff gain from delaying rather than swaying immediately as

$$\Delta(p_2) = U_{LS}(p_2) - U_S \tag{11}$$

Substituting (9) and (10) into (11) gives

$$\Delta(p_2) = (1-\beta_1)\delta + \frac{\beta_2 p_2 + (1-\beta_1-\beta_2)b}{1+r} - (1-\beta_1)b \tag{12}$$

The gain from delay is strictly increasing in p_2:

$$\frac{\partial \Delta(p_2)}{\partial p_2} = \frac{\beta_2}{1+r} > 0 \tag{13}$$

Let p_2^I denote the unique time-2 price that makes the large blockholder indifferent between swaying at date 1 and delaying to date 2 when $b > 0$:

$$\Delta(p_2^I) = 0 \tag{14}$$

By (13), the sign of the incentive to delay is fully characterized by p_2 relative to p_2^I:

$$p_2 > p_2^I \iff U_{LS}(p_2) > U_S \tag{15}$$

and

$$p_2 < p_2^I \iff U_{LS}(p_2) < U_S \tag{16}$$

The analysis focuses on the interior region of the model, in which the large blockholder with misaligned preferences mixes at time 1. Equivalently, there exists a mixing probability

$$\mu_1^* \in (0, 1)$$

such that

$$p_2(\mu_1^*) = p_2^I. \tag{17}$$

Since $p_2(\mu)$ is strictly decreasing in μ_1, we have

$$p_2(0) > p_2^I > p_2(1) \tag{18}$$

with

$$p_2(0) = \delta \qquad p_2(1) = \pi\delta \tag{19}$$

Always swaying not an equilibria

Suppose, that the large blockholder with misaligned preferences always sways at time 1. Then $\mu_1 = 0$. If no swaying is observed at time 1, Bayes' rule implies

$$\Pr(b = 0 \mid \text{no sway at time 1}) = \frac{\pi}{\pi + (1-\pi)0} = 1$$

Therefore, the p_2 following no swaying is

$$p_2(0) = \delta > p_2^I$$

Using (15), this implies

$$U_{LS}(p_2(0)) > U_S$$

Thus, when the large blockholder with misaligned preferences is conjectured to always sway at time 1, it has a strictly profitable deviation: not swaying at time 1, let the absence of swaying induce the posterior belief that $b = 0$, sell β_2 shares at the high price $p_2(0) = \delta$, and then sway at time 2.

Always delaying swaying not an equilibria

Suppose, that the large blockholder with misaligned preferences never sways at time 1 and always delays swaying at time 2. Then $\mu_1 = 1$. In this candidate equilibrium, the large blockholder always refrain from swaying at time 1, therefore the event "no sway at time \$1" does not give any information to update beliefs to the small shareholders, as a result, their

posterior remains equal to their prior. Bayes' rule gives

$$\Pr(b = 0 \mid \text{no sway at time 1}) = \frac{\pi}{\pi + (1-\pi)1} = \pi$$

Consequently,

$$p_2(1) = \pi\delta < p_2^I$$

Using (16), this implies

$$U_{LS}(p_2(1)) < U_S$$

Thus, when the large blockholder with misaligned preferences is conjectured never to sway at time 1, it has a strictly profitable deviation: sway immediately at time 1 and implement the private payoff on the larger retained stake rather than waiting for a time-2 price that remains too low to compensate for delay.

A.1.3 Proposition 1: Comparative statics

Proposition

Proposition 2. *(Comparative statics)*

1. The probability of no early swaying μ_1 is decreasing in β_1, the fraction of ownership sold at time 1.
$$\frac{\partial \mu_1}{\partial \beta_1} < 0$$

2. The magnitude of the price drop when there is delayed swaying at time 2, $CAR_2 = p_2 - 0 = p_2$ is increasing with the fraction of ownership sold by the large blockholder both at time 1 and 2 and increasing in the large blockholder's private payoff.
$$\frac{\partial CAR_2}{\partial \beta_1} > 0, \qquad \frac{\partial CAR_2}{\partial \beta_2} > 0, \qquad \frac{\partial CAR_2}{\partial b} > 0$$

3. The magnitude of the price drop when there is early swaying at time 1, $CAR_1 = p_1 - 0 = p_1$ is decreasing in the fraction of ownership sold by the large blockholder both at time 1 and 2 and decreasing in the large blockholder's private payoff.

$$\frac{\partial CAR_1}{\partial \beta_1} < 0, \qquad \frac{\partial CAR_1}{\partial \beta_2} < 0, \qquad \frac{\partial CAR_1}{\partial b} < 0$$

Intuition

For delayed swaying, higher β_1 means that the large blockholder sells more shares, reducing its "skin in the game" and weakening the incentive of delayed restraint. To counteract this effect, it must have a lower mixing probability μ_1. A lower μ_1 raises the posterior probability that $b = 0$, increases p_2 and leads to a larger price drop when swaying eventually occurs. Through μ_1, $\frac{\partial CAR_2}{\partial \beta_1} > 0$. A higher β_2 has two opposing effects on the payoff from delaying. It allows the blockholder to sell more shares at the continuation price p_2, but it also reduces the stake on which the blockholder receives the private payoff b when it sways at $t = 2$. Holding p_2 fixed, an increase in β_2 reduces the payoff from delaying. Each additional share sold at price p_2 replaces a share on which the blockholder would otherwise obtain the private payoff b. To restore indifference, the equilibrium continuation price p_2 must therefore increase. Since p_2 is decreasing in the probability μ_1 that an opportunistic blockholder refrains from swaying at $t = 1$, this higher p_2 is implemented through a lower μ_1 which increases the magnitude of the drop in price level is larger when the private payoff. Thus, $\frac{\partial CAR_2}{\partial \beta_2} > 0$. A higher per-share private payoff b means that swaying at time 1 is more appealing to the majority blockholder. In equilibrium, its mixing probability at time 1, μ_1, must therefore be lower in order to raise p_2 (the gains from delaying swaying), keeping the large blockholder indifferent. Again, through μ_1, the magnitude of the price drop is larger when the implementable private payoff is large, $\frac{\partial CAR_2}{\partial b} > 0$.

For early swaying, higher β_1 reduces the blockholder's retained stake and weakens its incentive to delay. Equilibrium therefore requires a lower μ_1. While this lower mixing probability makes survival more informative conditional on reaching time 2, before the time 1 action is observed it simply means that an opportunistic blockholder is more likely to sway immediately. This lowers the expected value of the share at time 1, lowers p_1 and therefore the magnitude of the price drop when there is swaying. Consequently, $\frac{\partial CAR_1}{\partial \beta_1} < 0$. A higher β_2 requires a higher continuation price p_2 to maintain the blockholder's indifference, which is implemented in equilibrium through a lower mixing probability μ_1. Ex ante, this lower μ_1 means that an opportunistic blockholder is more likely to sway at time 1. The initial share

price p_1 therefore falls, reducing the magnitude of the price drop associated with an early sway, $\frac{\partial CAR_1}{\partial \beta_2} < 0$. Finally, a higher private payoff b makes immediate swaying more attractive. To keep the opportunistic blockholder indifferent, its equilibrium probability of delaying must fall. The resulting lower μ_1 increases the probability of an immediate sway from the perspective of investors at time 1, reducing the initial price p_1. Therefore, a higher b decreases the magnitude of the price drop conditional on an immediate sway, $\frac{\partial CAR_1}{\partial b} < 0$.

One condition for delayed swaying to be ever attractive is that $\delta(1+r) > rb$ in order for the one-period continuation payoff from not swaying to exceed the opportunity cost of postponing swaying to the second period.

Proof

Sign of the derivative of the probability of not implementing the private payoff μ_1 w.r.t β_1 ownership sold at time 1.

$$\frac{\partial \mu_1}{\partial \beta_1} = -\frac{\pi\delta}{1-\pi}\frac{-\frac{1}{\beta_2}(rb-\delta(1+r))}{(b+\frac{1-\beta_1}{\beta_2}(rb-\delta(1+r))^2} = -\frac{\pi\delta}{(1-\pi)\beta_2}\frac{\delta(1+r)-rb}{(b-\frac{1-\beta_1}{\beta_2}(rb-\delta(1+r))^2} \Leftrightarrow \frac{\partial \mu_1}{\partial \beta_1} < 0$$

Sign of the derivatives for the magnitude of the drop in prices after delayed swaying CAR_2

$$\frac{\partial CAR_2}{\partial \beta_1} = \frac{\partial p_2}{\partial \beta_1} = (-\frac{1}{\beta_2})(rb-\delta(1+r)) > 0$$

$$\frac{\partial CAR_2}{\partial \beta_2} = \frac{\partial p_2}{\partial \beta_2} = \frac{(1-\beta_1)(\delta(1+r)-rb)}{\beta_2^2} > 0$$

$$\frac{\partial CAR_2}{\partial b} = \frac{\partial p_2}{\partial b} = 1+r\frac{1-\beta_1}{\beta_2} > 0$$

Sign of the derivatives for the magnitude of the drop in prices after early swaying CAR_1

$$\frac{\partial CAR_1}{\partial \beta_1} = \frac{\partial p_1}{\partial \beta_1} = -\frac{\pi\delta^2}{p_2^2}\left[-\frac{1}{\beta_2}\left(rb-\delta(1+r)\right)\right] = \frac{\pi\delta^2\left(rb-\delta(1+r)\right)}{\beta_2 p_2^2} < 0$$

$$\frac{\partial CAR_1}{\partial \beta_2} = \frac{\partial p_1}{\partial \beta_2} = -\frac{\pi\delta^2}{p_2^2}\frac{(1-\beta_1)\,(\delta(1+r)-rb)}{\beta_2^2} < 0$$

$$\frac{\partial CAR_1}{\partial b} = \frac{\partial p_1}{\partial b} = -\frac{\pi\delta^2}{p_2^2}\left(1+r\frac{1-\beta_1}{\beta_2}\right) < 0$$

A.2 Proofs: Extension endogenous small shareholder turnout

A.2.1 Strategic small shareholders' turnout game

Attention to governance and its cost

When an a large blockholder attempts to sway a proposal, small shareholder i can acquire governance attention. Let $a_{it} \in [0,1]$ denote the probability that address i is attentive and casts its vote before the proposal closes. Actual participation is $A_{it} \in \{0,1\}$ which follows a Bernoulli with $\mathbf{P}(A_{it} = 1 \mid a_{it}) = a_{it}$. I take the Bernoulli attention realizations A_i to be independent across addresses.

Conditional on attention, casting the vote itself is costless. Acquiring attention is costly. Address i has a privately observed governance participation cost parameter c_i and pays $\Psi_i(a_{it}, c_i)$. Governance participations costs are therefore idiosyncratic across addresses. The cross-sectional distribution of $\boldsymbol{c} = (c_1, \ldots, c_{N_t})$ is a product measure $F = \bigotimes_i F_i$.

Uncertainty about turnout is generated by privately heterogeneous participation costs and individual attention choices. I impose the following regularity conditions for Ψ_i:

1. $\Psi_i(0, c) = 0$ and, for every c, $\Psi_i(\cdot, c)$ is continuously differentiable and strictly convex on $[0,1]$.

2. $\partial_a \Psi_i(a, c)$ is weakly increasing in c.

3. $\Psi_i(a, c)$ is strongly convex in a. There exists $\underline{\kappa} > 0$, common across the relevant ownership sequence, such that:

$$\partial_a \Psi_i(a; c) \geq \underline{\kappa} a \qquad \text{for all } a \in [0,1]$$

The role of the first condition is to ensure that the amount of attention optimally acquired

by an atomistic holder vanishes with its stake. The role of the third condition is to ensure that the marginal cost of attention does not become arbitrarily flat near zero.

Pivotality of small shareholders

Let's fix a proposal and suppress the time subscript. The voting power of all other small shareholders is

$$Y_{-i} = \sum_{j \neq i} x_j A_j$$

Address i is pivotal exactly when the other small shareholders votes fall short of the large blockholder's stake but adding i's stake would block the sway. Define the equilibrium pivotality probability

$$\phi_i(D, \boldsymbol{a}_{-i}) = \Pr_{\boldsymbol{a}_{-i}} (1-s-x_i \leq Y_{-i} < 1-s)$$

The expected payoff from attention for small shareholder i is

$$a_i \, x_i \delta \, \phi_i(D, \boldsymbol{a}_{-i}) - \Psi_i(a_i; c_i)$$

The optimal attention choice is therefore

$$\alpha_i(v_i, c_i) = \arg \max_{a \in [0,1]} \{a v_i - \Psi_i(a; c_i)\} \qquad v_i(D, \boldsymbol{a}_{-i}) = x_i \delta \, \phi_i(D, \boldsymbol{a}_{-i})$$

Strict convexity makes α_i single-valued.

Equilibrium attention

Fix first an arbitrary conjectured vector $\boldsymbol{q} = (q_1, \ldots, q_N) \in [0,1]^N$, where q_j is voter i's conjecture about the probability that address j participates. Given $\boldsymbol{q}_{-i}$ and a realization $c_i = c$, address i's optimal participation probability is

$$a_i(c; D, \boldsymbol{q}_{-i}) = \alpha_i(x_i \delta \, \phi_i(D, \boldsymbol{q}_{-i}), c)$$

This object is specific to address i. The other small shareholders know the distribution of governance costs for i, F_i, and the strategy above. The probability that they rationally assign to seeing address i vote is therefore the probability obtained by integrating out only voter i's

private governance attention cost:

$$\begin{aligned} T_i(\boldsymbol{q}; D) &= \mathbf{P}(A_i = 1 \mid D, \boldsymbol{q}, \text{equilibrium response of } i) \\ &= \int \mathbf{P}(A_i = 1 \mid c_i = c, D, \boldsymbol{q}) dF_i(c) \\ &= \int a_i(c; D, \boldsymbol{q}_{-i}) dF_i(c) \end{aligned} \tag{20}$$

T_i is a mapping from conjectured participation probabilities into the participation probability that voter i's optimal strategy actually generates.

A conjecture $\boldsymbol{q}$ is correct only if each conjectured probability q_i equals the predictive participation probability generated by voter i's own optimal response. Define $\boldsymbol{T}(\boldsymbol{q}; D) = (T_1(\boldsymbol{q}; D), \ldots, T_N(\boldsymbol{q}; D))$. A participation equilibrium is a fixed point that solves:

$$\begin{aligned} & \bar{\boldsymbol{a}}^*(D) = \boldsymbol{T}(\bar{\boldsymbol{a}}^*(D); D) \\ \Leftrightarrow \qquad & \bar{a}_i^*(D) = \int \alpha_i\left(x_i \delta\, \phi_i\left(D, \bar{\boldsymbol{a}}_{-i}^*(D)\right), c\right) dF_i(c) \qquad \forall i \in \{1, ..., N\} \end{aligned} \tag{21}$$

Here $\bar{a}_i^*(D)$ is the equilibrium ex-ante participation probability of voter i. Each voter optimizes against the same participation probabilities that the others actually generate in equilibrium.

Equilibrium expected turnout

Once $\bar{\boldsymbol{a}}^*(D)$ has been found, a voter with realized friction c_i uses the equilibrium type-contingent strategy

$$a_i^*(c_i; D) = \alpha_i\left(x_i \delta\, \phi_i\left(D, \bar{\boldsymbol{a}}_{-i}^*(D)\right), c_i\right)$$

Its realized participation indicator is

$$A_i^* = \mathbf{1}\{U_i \leq a_i^*(c_i; D)\}$$

and realized small shareholders' voting power is therefore

$$X^*(D) = \sum_{i=1}^{N} x_i A_i^*$$

Under the independence of private frictions and the independent randomization devices, the A_i^* are independent Bernoulli variables after integrating out the private frictions. Hence the fixed point in (21) pins down not only expected small shareholders' turnout but the full weighted-turnout distribution used below to compute the probability of blocking the large blockholder.

Equilibrium counter-swaying probability of stopping the large blockholder

Given an equilibrium $\bar{\boldsymbol{a}}^*(D)$ of the participation game, realized small shareholders voting power is the random variable $X^*(D)$ defined above. The large blockholder is stopped if and only if $X^*(D) \geq 1-s$. The equilibrium counter-swaying probability of effective discipline is therefore

$$\begin{aligned} Q(D) &= \mathbf{P}(X^*(D) \geq 1-s \mid D, \bar{\boldsymbol{a}}^*(D)) \\ &= \sum_{S \subseteq \{1,\ldots,N\}} \mathbf{1}\left\{\sum_{i \in S} x_i \geq 1-s\right\} \prod_{i \in S} \bar{a}_i^*(D) \prod_{j \notin S} \left(1-\bar{a}_j^*(D)\right) \end{aligned} \tag{22}$$

Existence of $\bar{\boldsymbol{a}}^*(D)$

Lemma 1 (Participation equilibrium and atomistic free-riding)**.** Under conditions listed in Appendix A.2.1 for Ψ_i, the fixed-point system in (21) has at least one solution $\bar{\boldsymbol{a}}^*(D) \in [0,1]^N$. Every solution satisfies, for every address i

$$\bar{a}_i^*(D) \leq \frac{\delta}{\underline{\kappa}} x_i$$

If $H(D) = \sum_i x_i^2$ denotes the small shareholders' ownership Herfindahl-Hirschman index, expected small shareholders' voting power satisfies

$$M(D) = \sum_i x_i \bar{a}_i^*(D) \leq \frac{\delta}{\underline{\kappa}} H(D)$$

Proof. Fix i and define the finite collection of subsets of other addresses for which i is pivotal,

$$\mathcal{P}_i(D) = \left\{ S \subseteq \{1,\ldots,N\} \backslash \{i\} : \; 1-s-x_i \leq \sum_{j \in S} x_j < 1-s \right\}$$

Because the participation decisions of the other addresses are independent Bernoulli variables with parameters $\bar{\boldsymbol{a}}_{-i}$, the probability that the set of active addresses other than i is exactly S equals

$$\mathbf{P}(\{j \neq i : A_j = 1\} = S) = \prod_{j \in S} \bar{a}_j \prod_{k \in \{1,\ldots,N\} \setminus (S \cup \{i\})} (1 - \bar{a}_k)$$

The pivotality event is the disjoint union of these exact-participation events over $S \in \mathcal{P}_i(D)$. Therefore

$$\phi_i(D, \bar{\boldsymbol{a}}_{-i}) = \sum_{S \in \mathcal{P}_i(D)} \prod_{j \in S} \bar{a}_j \prod_{k \in \{1,\ldots,N\} \setminus (S \cup \{i\})} (1 - \bar{a}_k) \tag{23}$$

There are at most 2^{N-1} subsets of $\{1, ..., N\} \setminus \{i\}$, so the sum is finite. Every factor is either $\bar{a}_j$ or $1 - \bar{a}_j$. In particular, for any fixed $j \neq i$, holding all other probabilities fixed one can partition the terms according to whether $j \in S$ and write

$$\phi_i(D, \bar{\boldsymbol{a}}_{-i}) = \bar{a}_j R_j(\bar{\boldsymbol{a}}_{-\{i,j\}}) + (1 - \bar{a}_j) O_j(\bar{\boldsymbol{a}}_{-\{i,j\}})$$

where R_j and O_j do not depend on $\bar{a}_j$. Thus ϕ_i is affine in each participation probability separately and is therefore a finite multi-affine polynomial in $\bar{\boldsymbol{a}}_{-i}$ which establishes that ϕ_i is continuous.

It remains to establish that the system of conjectured participation probabilities admits a fixed point. Fix the ownership structure D and consider the map

$$\boldsymbol{T}(\boldsymbol{q}, D) = (T_1(\boldsymbol{q}; D), \ldots, T_N(\boldsymbol{q}; D))$$

where

$$T_i(\boldsymbol{q}, D) = \int a_i(c, D, \boldsymbol{q}_{-i})\, dF_i(c) = \int \alpha_i(x_i \delta\, \phi_i(D, \boldsymbol{q}_{-i}), c)\, dF_i(c)$$

First, $T_i(\boldsymbol{,}\,; D)$ is continuous in $\boldsymbol{q}$. For fixed D, the pivotality probability $\phi_i(D, \boldsymbol{q}_{-i})$ is a finite polynomial in $\boldsymbol{q}_{-i}$ and is therefore continuous. Hence

$$v_i(D, \boldsymbol{q}_{-i}) = x_i \delta\, \phi_i(D, \boldsymbol{q}_{-i})$$

is also continuous in $\boldsymbol{q}_{-i}$.

For every fixed realization c of voter i's governance-attention cost, the objective

$$a\,v - \Psi_i(a, c)$$

is continuous in (a, v) on the compact choice set $a \in [0, 1]$. Strict convexity of $\Psi_i(\cdot, c)$ implies strict concavity of the objective in a and therefore a unique maximizer

$$\alpha_i(v, c) = \arg\max_{a \in [0,1]} \{av - \Psi_i(a; c)\}$$

By the maximum theorem, the unique optimal choice $\alpha_i(v, c)$ is continuous in v. It follows that, for every fixed c,

$$\alpha_i(x_i \delta\, \phi_i(D, \boldsymbol{q}_{-i}), c)$$

is continuous in $\boldsymbol{q}_{-i}$.

Moreover, because $\alpha_i(v, c) \in [0, 1]$ for every (v, c), the integrand is uniformly bounded by the integrable constant 1. Therefore, for any sequence $\boldsymbol{q}^n \to \boldsymbol{q}$,

$$\alpha_i\big(x_i \delta\, \phi_i(D, \boldsymbol{q}^n_{-i}), c\big) \longrightarrow \alpha_i(x_i \delta\, \phi_i(D, \boldsymbol{q}_{-i}), c)$$

for every c, and the dominated convergence theorem implies

$$T_i(\boldsymbol{q}^n; D) \longrightarrow T_i(\boldsymbol{q}; D)$$

Thus each component T_i is continuous, and consequently the vector map $\boldsymbol{T}(\cdot; D)$ is continuous on $[0, 1]^N$.

Second, $\boldsymbol{T}$ maps $[0, 1]^N$ into itself. Indeed, since $a_i(c; D, \boldsymbol{q}_{-i})$ is a participation probability,

$$0 \le a_i(c; D, \boldsymbol{q}_{-i}) \le 1$$

for every c and every $\boldsymbol{q}$. Since F_i is a probability distribution,

$$0 \le T_i(\boldsymbol{q}; D) = \int a_i(c, D, \boldsymbol{q}_{-i})\, dF_i(c) \le \int 1\, dF_i(c) = 1.$$

Hence

$$\boldsymbol{T}(\boldsymbol{q}, D) \in [0,1]^N \qquad \text{for every } \boldsymbol{q} \in [0,1]^N.$$

The set $[0,1]^N$ is nonempty, compact, and convex. Therefore $\boldsymbol{T}(\cdot; D)$ is a continuous self-map of a nonempty compact convex subset of $\mathbb{R}^N$. Brouwer's fixed-point theorem consequently guarantees the existence of at least one

$$\boldsymbol{q}^*(D) \in [0,1]^N$$

such that

$$\boldsymbol{q}^*(D) = \boldsymbol{T}(\boldsymbol{q}^*(D), D)$$

Since the equilibrium conjecture $q_i^*(D)$ is the predictive participation probability of voter i, denote

$$\bar{a}_i^*(D) = q_i^*(D)$$

Thus there exists at least one equilibrium participation vector $\bar{\boldsymbol{a}}^*(D)$ satisfying

$$\bar{a}_i^*(D) = \int \alpha_i(x_i \delta\, \phi_i(D, \bar{\boldsymbol{a}}_{-i}^*(D)), c)\, dF_i(c), \qquad i = 1, \ldots, N$$

Free-riding problem

By the regularity conditions for Ψ_i in Appendix A.2.1, the first-order condition is

$$\partial_a \Psi_i(\alpha_i; c) = v_i = x_i \delta\, \phi_i\left(D, \bar{\boldsymbol{a}}_{-i}^*(D)\right) \leq x_i \delta$$

If the optimum is at the upper boundary, $\alpha_i = 1$, the Kuhn-Tucker condition implies

$$\partial_a \Psi_i(1; c) \leq v_i \leq x_i \delta$$

so the same weak inequality applies. If instead the optimum is at the lower boundary, $\alpha_i = 0$, the bound to be established below holds trivially.

Integrating this pointwise inequality with respect to voter i's private friction distribution

F_i yields

$$\begin{aligned}\bar{a}_i^*(D) &= \int_{\mathcal{C}_i} \alpha_i \left(x_i \delta \, \phi_i \left(D, \bar{\boldsymbol{a}}_{-i}^*(D)\right), c\right) dF_i(c) \\ &\leq \int_{\mathcal{C}_i} \frac{\delta}{\underline{\kappa}} x_i dF_i(c) = \frac{\delta}{\underline{\kappa}} x_i\end{aligned}$$

Multiplying by x_i and summing across small shareholders gives

$$M(D) = \sum_{i=1}^{N} x_i \bar{a}_i^*(D) \leq \frac{\delta}{\underline{\kappa}} \sum_{i=1}^{N} x_i^2 = \frac{\delta}{\underline{\kappa}} H(D)$$

□

This lemma illustrates the free-riding problem in this model. Even if aggregate small shareholders' ownership $s = \sum_i x_i$ is large, an individual shareholders internalizes only the benefit accruing to its own stake x_i. Its gross private marginal return to governance attention is therefore bounded above by $x_i\delta$. Thus splitting a fixed aggregate small shareholders' stake among increasingly small shareholders causes individual participation probabilities to vanish and bounds aggregate expected voting power by a measure of ownership concentration rather than by aggregate small shareholders' ownership alone.

A.2.2 Proof: Equilibrium

Period 2 price Conditional on reaching $t = 2$, the small shareholders prices the share based on their indifference condition between buying and not buying the share. If the blockholder is opportunistic, he attempts predation. Small shareholders receive δ only if they defeat him, which happens with probability Q_2. Otherwise, they receive zero. Thus the period-2 competitive price satisfies,

$$\begin{aligned}p_2 &= \delta \left[\Pr(b = 0 \mid \text{no sway at } t = 1) + Q_2 \Pr(b > 0 \mid \text{no sway at } t = 1)\right] \\ &= \delta \left[\rho_2 + (1-\rho_2) Q_2\right]\end{aligned}$$

Since

$$\rho_2 + (1-\rho_2) Q_2 = Q_2 + (1-Q_2)\rho_2$$

the period-2 price can be written as

$$p_2 = \delta \left[Q_2 + (1-Q_2) \frac{\pi}{\pi + (1-\pi)\mu_1} \right]$$

Period-1 price At $t = 1$, small shareholders receive the current payoff δ if (1) the large blockholder's preferences are aligned, (2) the large blockholder's preferences are misaligned but delays swaying, (3), the large blockholder's preferences are misaligned, attempts swaying immediately, but loses the vote. The third event occurs with probability $(1-\pi)(1-\mu_1)q_1$. Therefore, the expected current payoff at $t = 1$ is

$$\delta \left[\pi + (1-\pi)\mu_1 + (1-\pi)(1-\mu_1)Q_1 \right]$$

The discounted $t = 2$ payoff is received only if no swaying occurs at $t = 1$. If the large blockholder's preferences are aligned with probability π, the $t = 2$ payoff is δ. If the large blockholder's preferences are misaligned and delays with probability $(1-\pi)\mu_1$, the $t = 2$ payoff is δ only with probability Q_2. Hence,

$$p_1 = \delta \left[\pi + (1-\pi)\mu_1 + (1-\pi)(1-\mu_1)Q_1 \right] + \frac{\delta}{1+r} \left[\pi + (1-\pi)\mu_1 Q_2 \right]$$

Indifference condition of the large blockholder when $B > 0$

If the large blockholder's preferences are misaligned and attempts predation at $t = 1$, he has already sold β_1 shares at price p_1. He keeps $1-\beta_1$. His expected payoff from attempting predation immediately is

$$U^{\text{sway at } 1} = \beta_1 p_1 + (1-\beta_1) \left[(1-Q_1)b + Q_1 \delta \right]$$

If he delays, he receives the normal payoff δ at $t = 1$, sells β_2 at price p_2, and then attempts predation at $t = 2$. His payoff from delaying is

$$U^{\text{sway at } 2} = \beta_1 p_1 + (1-\beta_1)\delta + \frac{1}{1+r} \left[\beta_2 p_2 + (1-\beta_1-\beta_2) \left((1-Q_2)b + Q_2 \delta \right) \right]$$

The mixed-strategy equilibrium requires indifference:

$$U^{\text{sway at 1}} = U^{\text{sway at 2}}$$

Subtracting the common term $\beta_1 p_1$, multiplying by (1+r), and rearranging gives

$$(1+r)(1-\beta_1)(1-Q_1)(b-\delta) = \beta_2 p_2 + (1-\beta_1-\beta_2)\left[(1-Q_2)b+Q_2\delta\right]$$

Define

$$A(Q_1, Q_2) \equiv (1+r)(1-\beta_1)(1-Q_1)(b-\delta)(1-\beta_1-\beta_2)\left[(1-Q_2)b+Q_2\delta\right]$$

The indifference condition becomes

$$\beta_2\delta\left[Q_2+(1-Q_2)\frac{\pi}{\pi+(1-\pi)\mu_1}\right] = A(Q_1, Q_2)$$

Solving for μ_1 yields

$$\mu_1 = \frac{\pi}{1-\pi}\left[\frac{\beta_2\delta(1-Q_2)}{A(Q_1, Q_2)-\beta_2\delta Q_2}-1\right]$$

A.2.3 Corollary Convergence to the baseline when small shareholders' ownership tends a continuum.

Corollary

Corollary 1 (*Convergence to the baseline when small shareholders' ownership converges to a continuum*)**.**

As small shareholders' ownership converges to a continuum, the counter-swaying probabilities of stopping the large blockholder's attempted sway collapse, $Q_t \to 0$, and the equilibrium

quantities of the model's extension converge to the baseline:

$$
\begin{aligned}
p_2 &\to \delta \frac{\pi}{\pi+(1-\pi)\mu_1} \\
p_1 &\to \delta\left[\pi+(1-\pi)\mu_1\right]+\frac{\pi\delta}{1+r} \\
\mu_1(\beta_1,\beta_2) &\to \frac{\pi}{1-\pi}\left(\frac{\delta}{b+\frac{1-\beta_1}{\beta_2}(rb-\delta(1+r))}-1\right)
\end{aligned}
$$

Proof Fix a governance date t and the aggregate small shareholders' ownership share $s_t \in (0,1)$. Consider a family of finite small shareholders' ownership distributions $D_t = (x_{1t},\ldots,x_{N_t t})$ satisfying for $\varepsilon > 0$

$$
\max_{1\le i\le N_t} x_{it}^{\varepsilon} \longrightarrow 0 \qquad \text{as } \varepsilon \downarrow 0 \tag{24}
$$

Condition (24) ensures that small shareholders' holdings tend to the holdings of a continuum of atomistic small shareholders. In the limit, every individual small shareholders has negligible voting power.

By Lemma 1,

$$
\mathbb{E}\left[X(D_t)\right] \le \frac{\delta}{\underline{\kappa}} H(D_t) \tag{25}
$$

where

$$
H(D_t) = \sum_{i=1}^{N_t} (x_{it})^2
$$

is the Herfindahl-Hirschman index of small shareholders' ownership. The Herfindahl-Hirschman index itself converges to zero as ownership approaches the continuum.

$$
H(D_t) = \sum_{i=1}^{N_t} (x_{it})^2 \le \left(\max_{1\le i\le N_t} x_{it}\right) \sum_{i=1}^{N_t} x_{it} = s_t \max_{1\le i\le N_t} x_{it} \tag{27}
$$

Since s_t is fixed and $\max_i x_{it} \to 0$,

$$
H(D_t) \longrightarrow 0
$$

Combining this result with (25) gives

$$\mathbb{E}\left[X(D_t)\right] \longrightarrow 0$$

The small shareholders block the large blockholder only if realized small shareholders' turnout reaches the large blockholder's voting stake $1-s_t$. Since $X(D_t) \geq 0$, Markov's inequality gives

$$Q_t = \mathbf{P}\left(X(D_t) \geq 1-s_t\right) \leq \frac{\mathbb{E}[X(D_t)]}{1-s_t}$$

Using Lemma 1 and (27),

$$Q_t \leq \frac{\delta}{\underline{\kappa}} \frac{H(D_t)}{1-s_t} \leq \frac{\delta}{\underline{\kappa}} \frac{s_t}{1-s_t} \max_{1 \leq i \leq N_t} x_{it}$$

For the fixed ownership share $s_t \in (0,1)$, the coefficient $\frac{\delta}{\underline{\kappa}} \frac{s_t}{1-s_t}$ is finite. Therefore

$$0 \leq Q_t^{\varepsilon} \leq \frac{\delta}{\underline{\kappa}} \frac{s_t}{1-s_t} \max_i x_{it}^{\varepsilon} \longrightarrow 0$$

Hence $Q_t \longrightarrow 0$ as D_t converges to a continuum of atomistic holdings.

The equilibrium prices and mixing probability are continuous functions of (Q_1, Q_2). Since

$$Q_1 \longrightarrow 0 \qquad \text{and} \qquad Q_2 \longrightarrow 0,$$

Substituting into the stochastic-turnout equilibrium gives the equilibrium quantities of the baseline model.

$$p_2 \longrightarrow \delta \frac{\pi}{\pi + (1-\pi)\mu_1}$$

$$p_1 \longrightarrow \delta\left[\pi + (1-\pi)\mu_1\right] + \frac{\pi\delta}{1+r}$$

$$\mu_1 \longrightarrow \frac{\pi}{1-\pi}\left[\frac{\beta_2\delta}{(1+r)(1-\beta_1)(b-\delta) - (1-\beta_1-\beta_2)b} - 1\right]$$

A.2.4 Proof: Minority disengagement post-swaying

Since the argument is identical for both periods $t \in \{1, 2\}$, I drop the time subscript t throughout the proof to simplify notation. For each small shareholder i, let c_i denote the privately observed governance-attention cost, with $c_i \sim F_i$. Let us denote $\boldsymbol{c} = (c_1, \ldots, c_N)$ the realizations of a random vector of governance costs $\boldsymbol{C}$. The prior belief that the large blockholder can be blocked before the vote is the joint prior over the governance-attention cost draws $\Pi^- \equiv \bigotimes_{i=1}^{N} F_i$. Thus $\boldsymbol{C} \sim \Pi^-$. A successful sway provides information about which realization $\boldsymbol{c}$ is likely to have been drawn. Π^- is therefore updated over the realized governance attention costs profile.

If the expected small shareholders' voting power conditional on $\boldsymbol{c}$ is $m(\boldsymbol{c}) = \sum_{i=1}^{N} x_i a_i(\boldsymbol{c})$. Before observing the vote, the expected small shareholders' turnout is

$$M^- = \mathbf{E}_{\Pi^-}[m(\boldsymbol{C})] \tag{26}$$

Conditional on the same friction profile $\boldsymbol{c}$, the probability that realized small shareholders' turnout is sufficient to block the large blockholder is

$$q(\boldsymbol{c}) = \Pr(\text{small shareholders block} \mid \boldsymbol{c}) = \sum_{S \subseteq \{1,\ldots,N\}} \mathbf{1}\left\{\sum_{i \in S} x_i \geq 1-s\right\} \prod_{i \in S} a_i(\boldsymbol{c}) \prod_{j \notin S} [1-a_j(\boldsymbol{c})] \tag{27}$$

Therefore, the ex-ante counter-swaying probability of small shareholders stopping the large blockholder is

$$Q^- = \mathbf{E}_{\Pi^-}[q(\boldsymbol{C})] \tag{28}$$

Bayesian updating after a successful sway

Let *Sway* denote the event that the large blockholder successfully sways the vote. Conditional on a particular realization attention costs $\boldsymbol{c}$, the large blockholder succeeds if the small shareholders fail to stop it. Hence

$$\Pr(Sway \mid \boldsymbol{C} = \boldsymbol{c}) = 1-q(\boldsymbol{c}) \tag{29}$$

We can write the ex-ante probability of a successful sway as

$$\begin{aligned}\Pr(Sway) &= \int \Pr(Sway \mid \boldsymbol{C} = \boldsymbol{c})\, \Pi^{-}(d\boldsymbol{c}) \\ &= \int [1-q(\boldsymbol{c})]\, \Pi^{-}(d\boldsymbol{c}) \\ &= \mathbf{E}_{\Pi^{-}}[1-q(\boldsymbol{C})] \\ &= 1-Q^{-} \end{aligned} \tag{30}$$

Let $\mathcal{C}$ be a set of the governance attention costs, Bayes' rule gives the updated posterior belief over the realization of the governance attention costs profile after a successful sway:

$$\begin{aligned}\Pi^{Sway}(\mathcal{C}) &= \Pr(\boldsymbol{C} \in \mathcal{C} \mid Sway) \\ &= \frac{\Pr(Sway, \boldsymbol{C} \in \mathcal{C})}{\Pr(Sway)} \\ &= \frac{\int_{\mathcal{C}} [1-q(\boldsymbol{c})]\, d\Pi^{-}(\boldsymbol{c})}{1-Q^{-}} \end{aligned} \tag{31}$$

$\Pi^{Post\ Sway}$is absolutely continuous with respect to the prior Π^{-}, thus using the Radon-Nikodym derivative

$$\frac{d\Pi^{Post\ Sway}}{d\Pi^{-}}(\boldsymbol{c}) = \frac{1-q(\boldsymbol{c})}{1-Q^{-}} \quad \Leftrightarrow \quad d\Pi^{Post\ Sway}(\boldsymbol{c}) = \frac{1-q(\boldsymbol{c})}{1-Q^{-}}\, d\Pi^{-}(\boldsymbol{c}) \tag{32}$$

A successful sway is more likely under governance attention costs for which $q(\boldsymbol{c})$ is low. Bayes' rule therefore assigns relatively greater posterior weight to those profiles. The underlying costs have not changed but beliefs about their latent realization have changed.

Updated blocking probability

Using (32), the posterior counter-swaying probability that small shareholders are able to stop the large blockholder is

$$Q^{Post\ Sway} = \mathbf{E}_{\Pi^{Post\ Sway}}[q(\boldsymbol{C})] = \frac{\mathbf{E}_{\Pi^{-}}\left[q(\boldsymbol{C})(1-q(\boldsymbol{C}))\right]}{1-Q^{-}}$$

Expanding the numerator,

$$\mathbf{E}_{\Pi^-}[q(\boldsymbol{C})(1-q(\boldsymbol{C}))] = \mathbf{E}_{\Pi^-}[q(\boldsymbol{C})] - \mathbf{E}_{\Pi^-}[q(\boldsymbol{C})^2] = Q^- - \mathbf{E}_{\Pi^-}[q(\boldsymbol{C})^2]$$

By definition,

$$\mathbf{Var}_{\Pi^-}(q(\boldsymbol{C})) = \mathbf{E}_{\Pi^-}[q(\boldsymbol{C})^2] - (\mathbf{E}_{\Pi^-}[q(\boldsymbol{C})])^2$$

and therefore

$$\mathbf{E}_{\Pi^-}[q(\boldsymbol{C})^2] = \mathbf{Var}_{\Pi^-}(q(\boldsymbol{C})) + (Q^-)^2$$

It follows that

$$Q^{Post\ Sway} = \frac{Q^- - \mathbf{Var}_{\Pi^-}(q(\boldsymbol{C})) - (Q^-)^2}{1-Q^-} = Q^- - \frac{\mathbf{Var}_{\Pi^-}(q(\boldsymbol{C}))}{1-Q^-}$$

Hence $Q^{Post\ Sway} \leq Q^-$ with strict inequality whenever $\mathbf{Var}_{\Pi^-}(q(\boldsymbol{C})) > 0$

Thus a successful sway lowers the small shareholders' rational assessment of their future counter-swaying probability.

Updated expected small shareholders' turnout

I consider now expected small shareholders' turnout. Using the same posterior,

$$M^{Post\ Sway} = \mathbf{E}_{\Pi^{Sway}}[m(\boldsymbol{C})] = \frac{\mathbf{E}_{\Pi^-}[m(\boldsymbol{C})(1-q(\boldsymbol{C}))]}{1-Q^-}$$

Expanding the numerator gives

$$\mathbf{E}_{\Pi^-}[m(\boldsymbol{C})(1-q(\boldsymbol{C}))] = \mathbf{E}_{\Pi^-}[m(\boldsymbol{C})] - \mathbf{E}_{\Pi^-}[m(\boldsymbol{C})q(\boldsymbol{C})] = M^- - \mathbf{E}_{\Pi^-}[m(\boldsymbol{C})q(\boldsymbol{C})]$$

By the definition of covariance,

$$\mathbf{Cov}_{\Pi^-}(m(\boldsymbol{C}), q(\boldsymbol{C})) = \mathbf{E}_{\Pi^-}[m(\boldsymbol{C})q(\boldsymbol{C})] - \mathbf{E}_{\Pi^-}[m(\boldsymbol{C})]\mathbf{E}_{\Pi^-}[q(\boldsymbol{C})] = \mathbf{E}_{\Pi^-}[m(\boldsymbol{C})q(\boldsymbol{C})] - M^-Q^-$$

Therefore,

$$\mathbf{E}_{\Pi^-}[m(\boldsymbol{C})q(\boldsymbol{C})] = \mathbf{Cov}_{\Pi^-}(m(\boldsymbol{C}), q(\boldsymbol{C})) + M^-Q^-$$

Substitution yields

$$M^{Post\ Sway} = \frac{M^- - \mathbf{Cov}_{\Pi^-}(m(\boldsymbol{C}), q(\boldsymbol{C})) - M^- Q^-}{1 - Q^-} = M^- - \frac{\mathbf{Cov}_{\Pi^-}(m(\boldsymbol{C}), q(\boldsymbol{C}))}{1 - Q^-}$$

Conditional on the equilibrium vector $\bar{\boldsymbol{a}}^*$, $a_i(\boldsymbol{c})$ is weakly decreasing in c_i. Therefore,

$$c_i' > c_i \quad \Longrightarrow \quad a_i(c_i') \leq a_i(c_i)$$

Because

$$m(\boldsymbol{c}) = \sum_{i=1}^{N} x_i a_i(c_i)$$

holding ownership fixed, an increase in any c_i weakly lowers $m(\boldsymbol{c})$. Hence $m(\boldsymbol{c})$ is weakly decreasing in $\boldsymbol{c}$.

To show that the conditional counter-swaying probability $q(\boldsymbol{c})$ is also weakly decreasing in every c_i, I will show that the conditional probability is weakly increasing in every probability of participating in governance a_i^* which themselves are weakly decreasing in their respective individual participation cost c_i.

First, $q(\boldsymbol{c})$ can be written as $q(\boldsymbol{a}^*(\boldsymbol{c}; D))$ where $\boldsymbol{a}^*$ is the equilibrium individual probabilities of voters to participate in governance. Let

$$Y_{-i} = \sum_{j \neq i} x_j A_j$$

denote realized small shareholders' voting power excluding voter i. Holding $\boldsymbol{a}_{-i}$ fixed,

$$q(\boldsymbol{a}^*(\boldsymbol{c}; D)) = a_i^* \Pr\left(Y_{-i} \geq 1 - s - x_i\right) + (1 - a_i^*) \Pr\left(Y_{-i} \geq 1 - s\right)$$

Consequently,

$$\begin{aligned}
\frac{\partial q(\boldsymbol{a}^*(\boldsymbol{c}; D))}{\partial a_i^*} &= \Pr\left(Y_{-i} \geq 1 - s - x_i\right) - \Pr\left(Y_{-i} \geq 1 - s\right) \\
&= \Pr\left(1 - s - x_i \leq Y_{-i} < 1 - s\right) \\
&= \phi_i(D, \boldsymbol{a}_{-i}^*) \geq 0
\end{aligned}$$

Thus $q(\boldsymbol{a}^*(\boldsymbol{c}; D)) = q(\boldsymbol{c})$ is weakly increasing in every participation probability a_i^*. Conditional on the equilibrium vector $\bar{\boldsymbol{a}}^*(D)$, the type-contingent participation probability $a_i^*(c_i; D)$ is weakly decreasing in c_i. Moreover, c_i affects $q(\boldsymbol{c})$ only through $a_i^*(c_i; D)$. It follows that $q(\boldsymbol{c})$ is coordinatewise weakly decreasing in $\boldsymbol{c}$.

Hence the two functions $m(\boldsymbol{c})$ and $q(\boldsymbol{c})$ are monotone in the same direction. Under the prior law $\Pi^- = \bigotimes_{i=1}^N F_i$ the random variables C_i are independent. Product probability measures are associated: for any two integrable functions that are coordinatewise monotone in the same direction, their covariance is nonnegative. Therefore,

$$\mathbf{Cov}_{\Pi^-}\left(m(\boldsymbol{C}), q(\boldsymbol{C})\right) \geq 0 \tag{33}$$

Therefore

$$M^{Post\ Sway} < M^- \tag{34}$$

A successful sway therefore selects, through Bayesian updating, toward persistent small shareholders' governance attention costs under which small shareholders are harder to mobilize. Observing a successful sway predicts both lower subsequent small shareholders' turnout and a lower probability that the small shareholders can discipline the large blockholder.

A.2.5 Additional Proposition and Proof: Non-monotone effective small shareholders' discipline

Proposition 3 (Small shareholders' ownership and effective small shareholders' discipline)**.**

Let $D(s)$ be an small shareholders' ownership distributions indexed by aggregate small shareholders' ownership $s \in (0, 1)$, and let $Q(s) = Q(D(s))$ be generated by the participation equilibrium (20) and counter-swaying probability of (22). If:

1. there exists an intermediate ownership level $s_0 \in (1/2, 1)$ for which the active participation equilibrium is contestable, $Q(s_0) > 0$;

2. ownership becomes sufficiently atomistic at the high-s end of the path,

$$\frac{H(D(s))}{1-s} \longrightarrow 0 \qquad \text{as } s \uparrow 1$$

Then $Q(s)$ is non-monotone in aggregate small shareholders' ownership. If the selected equilibrium path $Q(s)$ is continuous, it attains a strictly positive maximum at at least one interior ownership level $s^* \in (1/2, 1)$. If Q is continuously differentiable, there exist $s_L < s^* < s_H$ such that

$$Q'(s_L) > 0, \qquad Q'(s_H) < 0$$

Hence increasing small shareholders' ownership first can strengthen discipline by reducing the large blockholder's relative voting power and making blocking feasible, while sufficiently dispersed additional ownership eventually weakens discipline because the individual pivotality return to participation vanishes.

Proof. By assumption, $Q(s_0) > 0$ for some $s_0 > 1/2$. Thus Q cannot be weakly decreasing on $(0, 1)$. At the other end of the ownership path, Lemma 1 and Markov's inequality imply

$$Q(s) \leq \frac{\delta}{\underline{\kappa}} \frac{H(D(s))}{1-s}$$

Condition $\frac{H(D(s))}{1-s} \longrightarrow 0 \qquad$ as $s \uparrow 1$ therefore gives $Q(s) \longrightarrow 0 \quad$ as $s \uparrow 1$.

Since $Q(s_0) > 0$, Q cannot be weakly increasing on $(s_0, 1)$. Combining this with the fact that $Q(s) = 0$ for all $s < \frac{1}{2}$, proves non-monotonicity.

As $\lim_{s\uparrow 1} Q(s) = 0$, if $Q(1)$ is set to be 0, then Q is continuous on the compact interval $[1/2, 1]$. By the extreme value theorem, Q attains a maximum on $[1/2, 1]$. Hence there exists $s^* \in [1/2, 1]$ such that

$$Q(s^*) = \max_{s\in[1/2,1]} Q(s)$$

Since $Q(s^*) \geq Q(s_0) > 0$ and $Q(1/2) = Q(1) = 0$ neither endpoint can be a maximizer. Therefore $s^* \in (1/2, 1)$.

□

B Appendix: Additional details on DAOs

B.1 Additional information on DAOs legal status

The legal status of DAOs is incomplete and jurisdiction-specific. Because DAOs operate on blockchains, they are not automatically recognized as legal persons. As a result, courts and regulators have mapped DAOs onto existing legal categories. The SEC's DAO Report emphasizes that tokens issued by a "virtual" organization may fall within securities law when their economic substance satisfies the investment-contract test[41]. Jurisdictions such as Wyoming have begun to try to create legal wrappers, such as the decentralized unincorporated nonprofit association, that provide separate legal personality and liability protection for members[42].

B.2 Additional information on difference in data granularity between DAOs' governance voting data and traditional corporate governance voting data

Traditional corporate governance data offer limited information on individual shareholders' voting behavior. In the United States, ownership information is available through DEF 14A proxy filings, while Form N-PX reports how certain institutional investors vote. These disclosures do not provide a complete, contemporaneous record of each shareholder's ownership and voting decisions. In particular, ownership disclosures and voting records can be separated by several months, during which investors may trade or lend shares. Consequently, the exact voting power exercised by individual shareholders cannot generally be recovered. Moreover, the timing of individual votes is typically unobservable, and ownership disclosures predominantly identify large shareholders.

DAO governance data overcome several of these limitations. For each proposal, Snapshot records every vote cast, the corresponding choice, its timestamp, and the exact voting power of the participating address, determined by shareholdings at a predetermined record date. This eliminates the discrepancy between observed holdings and voting power. Unlike traditional

[41]Source: U.S. Securities and Exchange Commission (2017)
[42]Source: State of Wyoming (2024)

corporate governance data, these records include votes cast by small shareholders, whose holdings would typically fall below disclosure thresholds. However, voting addresses cannot always be mapped to individual investors, and the data do not directly reveal the holdings of addresses that abstain.

DAO voting data also differ in the frequency and scope of decisions observed. Whereas traditional shareholder votes are concentrated around shareholder meetings and concern a relatively narrow set of decisions, DAOs conduct frequent votes on a broader range of matters, including governance, investment policies, and product pricing. Finally, the transparency of blockchain transactions allows voting records to be linked to token transfers and trading activity at the address level. These features provide unusually granular data on the relationship between ownership, voting behavior, and governance outcomes.

B.3 List of DAOs in the sample and activities

- **Decentralized lending**: Aave, Alchemix, Bankless DAO, Gearbox, unFederal Reserve, PoolTogether, Cream finance, Abachi, TrueFi, Inverse finance
- **Decentralized exchanges (DEXs)**: Uniswap, PancakeSwap, Sushiswap, Julswap, Airswap, Bao Finance, Beethoven X, Biswap, Balancer, Rhino.fi, DODO, dYdX, Paraswap, Linear Finance, Hydranet DAO, Saddle Finance, BoringDAO, DFX Finance, Tokenlon, YFDAI Finance, SpritSwap, QuickSwap, Spookyswap, MacaronSwap, Perpetual protocol, Tacoswap, Opium Protocol, Bancor
- **BoostedFi and staking**: Lido, Alchemist, Alpaca Finance, BadgerDAO, BTCST, Pancake Bunny, BarnBridge, Stake DAO, Yearn Finance, ShareStake, Vesper Finance, Merit Circle, Gro DAO, Idle, Ribbon, Paladin, APWine, PieDAO, AladdinDAO, StakeWise, Threshold Network, RomeDAO, Pickle finance, Yam finance, Rari capital, Stargate DAO, Beefy finance, Crystl finance
- **Currency/Unit of account/Stablecoin**: OlympusDAO, Magic Internet Money, TribeDAO, Fortress DAO, Ampleforth, Phonon DAO, Angle protocol, Ripae, Frax, Digital Reserve currency
- **DeFi ecosystems (all of the above)**: Hector Network, OpenDAO, ApeSwap, Mantra

DAO, Curve Finance, Revault

B.4 List of DAOs used for the construction of the Crypto market portfolio

Aave; Abachi; AirSwap; Aladdin DAO; Alchemist; Alchemix; Alpaca Finance; Ampleforth Governance Token; Angle Protocol; ApeSwap Finance; APWine; Arbitrum; Avalanche; Badger DAO; Balancer; Bancor; Bankless DAO; Bao Finance; BarnBridge; Beefy Finance; Beethoven X; Biswap; Bitcoin; BoringDAO; BTC Standard Hashrate Token; Cream Finance; Crystl Finance; Curve DAO Token; DFX Finance; dHEDGE DAO; Digital Reserve Currency; DODO; dYdX; Ethereum; FEI USD; Frax; Gearbox; Gnosis; Gro DAO; Hector DAO; Hydranet; Idle Finance; Inverse Finance; JulSwap; Lido DAO; Linear Finance; MacaronSwap; Magic Internet Money; Maker; MANTRA DAO; Polygon (MATIC); Merit Circle; Olympus DAO; OpenDAO; Opium; Optimism; Paladin; Pancake Bunny; PancakeSwap; ParaSwap; Perpetual Protocol; Phonon DAO; Pickle Finance; PieDAO; PoolTogether; QuickSwap; Rari Governance Token; Revault Network; Rhino.fi; Ribbon Finance; Ripae; Rome DAO; Saddle Finance; SharedStake; SpiritSwap; SpookySwap; Lido Staked Ether; StakeWise; Stargate Finance; Sushi; Tacos; Threshold Network; Tokenlon; Tribe DAO; TrueFi; unFederalReserve; Uniswap; Vesper Finance; YAM; YAM v2; Yearn Finance; YFDAI Finance.

B.5 Additional information about the institutional differences between DAOs governance and shareholder voting

B.5.1 Disclosure of ownership

In traditional U.S. equity markets, large ownership positions are subject to mandatory disclosure. Investors owning more than 5% of the equity securities must disclose their holdings through Schedule 13D or 13G. Securities issuers report large owners in proxy statements filed under Schedule 14A[43]. Because DAOs lack a comparable legal framework, there is no equivalent mandatory disclosure of large token holdings. Ownership can nevertheless be reconstructed at the wallet address level (not necessarily investor-level) by querying the public blockchain.

[43]Source: U.S. Securities and Exchange Commission (1934, 2025a,b)

B.5.2 Announcement of proposals

In traditional shareholder voting, the announcement process is formalized. Public companies provide shareholders with proxy materials describing the matters submitted to a vote, while state corporate law governs notice requirements for shareholder meetings [44]. DAO governance does not rely on an equivalent notice mechanism. Proposals are disseminated through a combination of governance platforms, protocol-specific forums, and community communication channels. On Snapshot, for example, a proposal becomes observable when it is published. Individual DAOs may supplement these announcements with governance forum posts or social-media announcements.

B.5.3 Eligibility to introduce proposals

In traditional shareholder voting, the ability of an investor to require inclusion of a shareholder proposal in the company's proxy materials is governed by the U.S. Rule 14a-8 framework, which states that must satisfy an ownership requirement of at least $2,000 of the relevant securities for three years, $15,000 for two years, or $25,000 for one year[45] . DAO proposal rights are instead typically determined by protocol-specific rules. Snapshot spaces may impose a minimum voting-power requirement for proposal creation or restrict proposal creation to specified authors[46].

B.5.4 Enforceability of proposals

Traditional shareholder governance operates within a well-defined legal framework, but the legal effect of the vote depends on the type of resolution. Certain corporate actions have direct legal consequences when the required shareholder approval is obtained (e.g. mergers), whereas many shareholder proposals submitted under Rule 14a-8 are precatory and request action from the board rather than legally compelling the corporation to implement the requested policy[47]. As DAOs do not operate within a clearly defined legal framework, DAO proposals

[44]Under Delaware law, notice specifies the date and time of the meeting, the means of participation, and the applicable record date, and must ordinarily be provided between 10 and 60 days before the meeting. Source: State of Delaware (2026).

[45]Source: U.S. Securities and Exchange Commission (2020, 2025c)

[46]Source: Snapshot (2026)

[47]Source: U.S. Securities and Exchange Commission (2001, 2015)

therefore generally lack legal enforceability. Depending on the proposal there may, however, be "technical enforceability" of the proposal. While some proposals will require further actions by developers, the DAO foundation or other insiders, other proposals may contain the target smart-contract addresses corresponding to the operations that will be performed if the proposal passes.

B.5.5 Real-time observability of votes

In traditional shareholder meetings, votes are generally not publicly observable as they are cast, and aggregate voting results are typically disclosed only after the meeting.[48] By contrast, on Snapshot, votes are publicly observable throughout the voting period. For each proposal, the voting address, its choice, and its voting power are observable as soon as a vote was cast. Shareholders could therefore observe the evolving vote tally and the voting behavior of other addresses at any point during a proposal.[49]

B.6 Additional information about the data differences between DAOs governance and shareholder voting

B.6.1 Anonymity of blockchain addresses

Governance data are linked to blockchain wallet addresses rather than identifiable individuals. Only a very small subset of participants voluntarily disclose their identities. Therefore, it is difficult to map votes to investors precisely. This is a common caveat with blockchain data. Although some early blockchains, like Bitcoin, allow networks of addresses to be traced, it is impossible to trace transactions with more recent blockchains, especially for users transacting using technologies such as ZK-SNARKs or privacy pools (Buterin et al. (2024)). Anonymity also allows large tokenholders to split their holdings across multiple addresses.

[48] In the United States, public companies generally disclose shareholder voting results within four business days following the meeting under Item 5.07 of Form 8-K (SEC).

[49] Snapshot introduced optional shielded voting in October 2022, allowing voting choices to remain hidden until the proposal closes (Snapshot Labs, 2022). This feature was introduced after the end of my sample period.

B.6.2 Delegates and staking tokens

Some DAOs allow shareholders to delegate their voting rights to other addresses, which vote on their behalf using the combined voting power of their delegates without acquiring ownership of the underlying shares. Although delegation existed in early DAOs, its use has become more prominent in recent years, particularly through professional delegates and formal delegation programs that developed after the early years of Snapshot covered by my sample (2020–2022). Other DAOs assign voting power through staking mechanisms, whereby shareholders lock their tokens in smart contracts and receive voting rights based on their staked holdings, sometimes with additional weight depending on the duration of the lockup.

B.6.3 Transaction availability and anticipation bias

Although shareholdings and transfers are publicly observable on the blockchain, reconstructing their implications for governance requires substantial information acquisition costs. In particular, identifying shareholders' ownership positions and tracking changes in these positions requires retrieving and processing historical transactions and smart-contract interactions, reconstructing token balances across wallet addresses, and accounting for staking and delegation mechanisms. This entails substantial fixed costs in technical data processing, particularly when historical blockchain states must be accessed through archival nodes. Small shareholders are therefore unlikely to form precise expectations about the voting power of potential participants. In contrast, once votes are cast, Snapshot directly displays each participating address's voting power and choice, making the distribution of votes cast observable at negligible information acquisition cost.

C Additional Figures and Tables

Figure C.1 – Timing of votes across voter types.
This figure reports histograms of the timing of votes for different categories of voters. The timing measure is defined as $Timing = \frac{Vote\ casted - Beginning\ proposal}{End\ proposal - Beginning\ proposal}$, and is expressed in percentage terms (i.e., multiplied by 100 on the x-axis). The top- panel shows the distribution for all voters, the bottom-left panel for majority voters, and the bottom-right panel for swaying majority voters. The sample includes all DeFi DAOs. These results are in line with Goldberg and Schär (2023) who find concurring evidence for the Metaverse DAO, Decentraland.

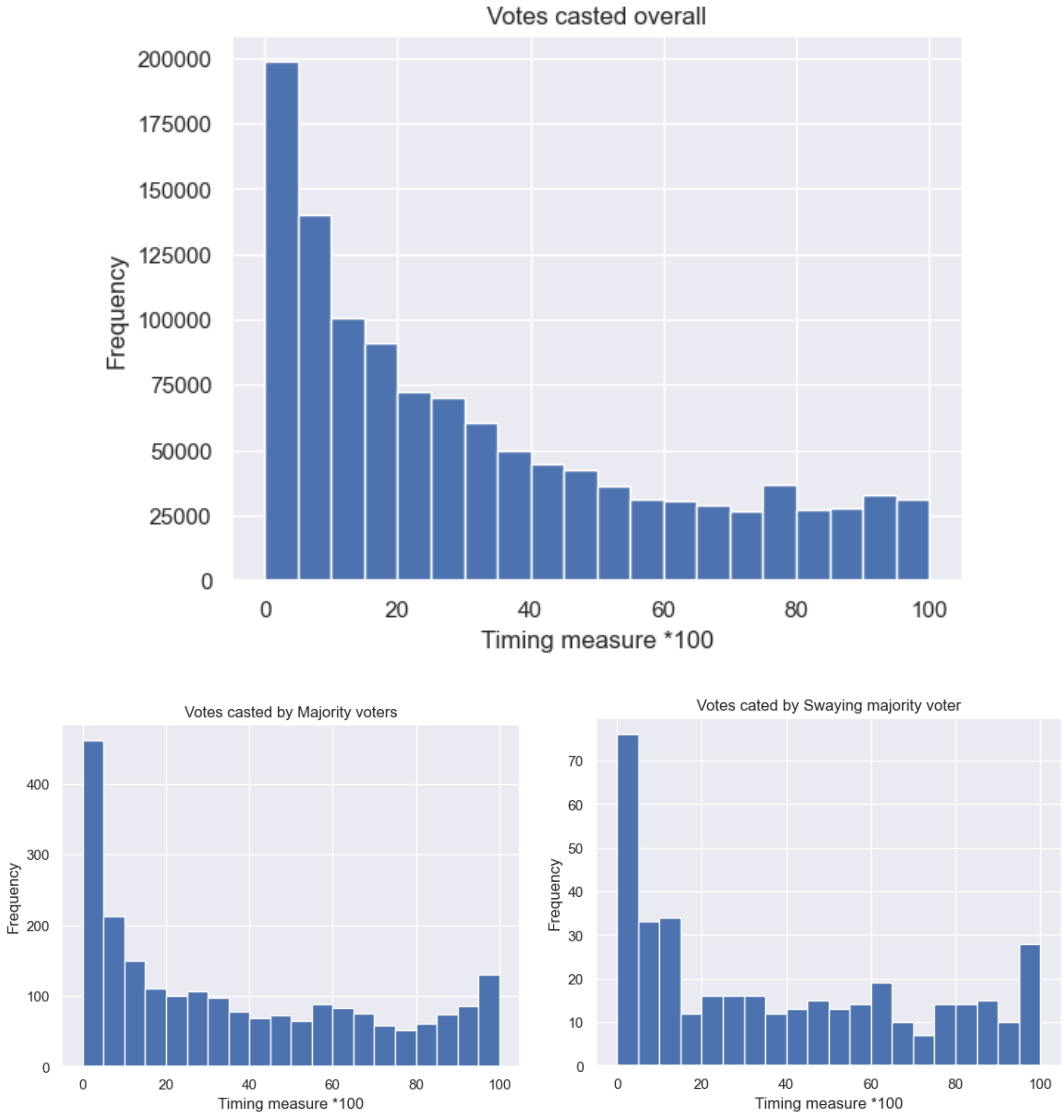
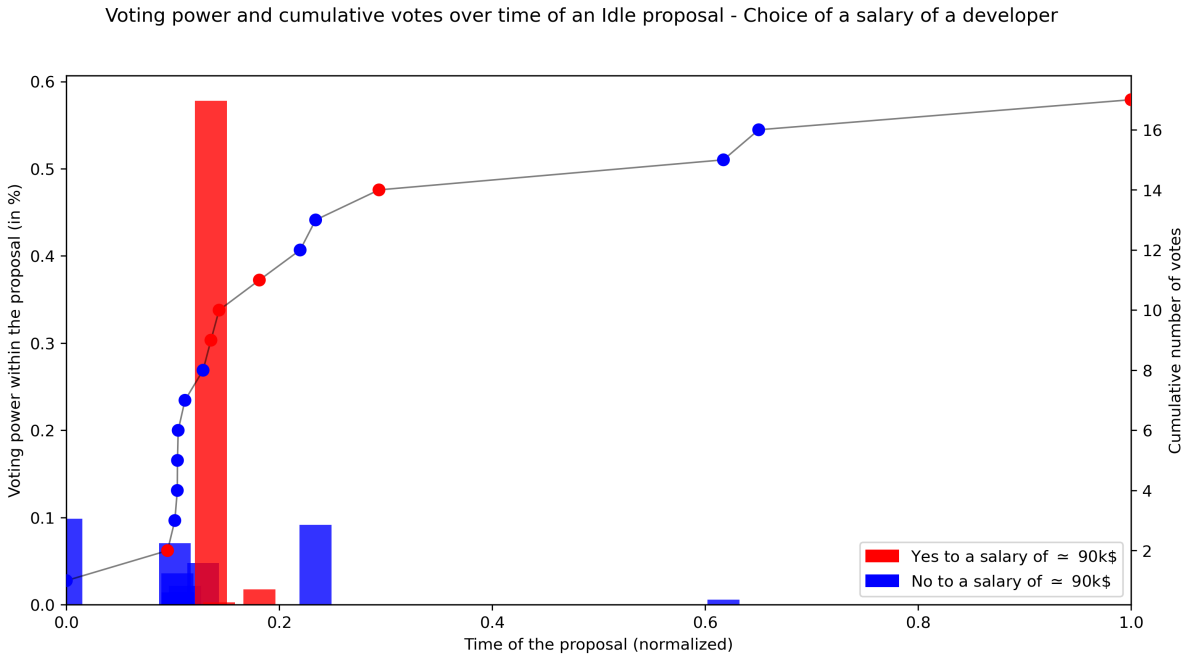


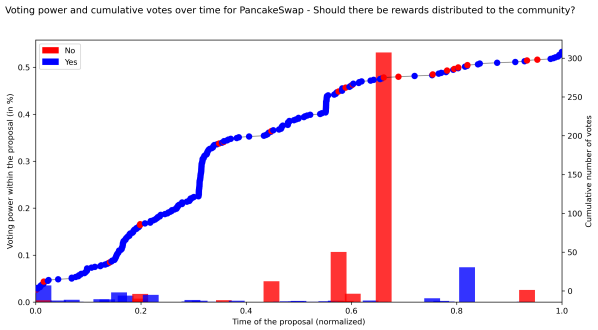
Figure C.2 – Additional detailed example of swaying majority voter: Idle Governance Proposal



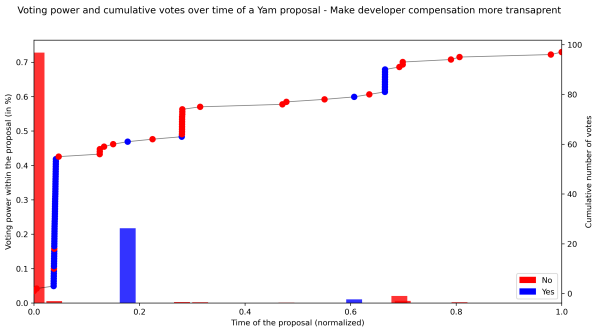
Notes: This figure plots the timing, voting power, and cumulative number of votes for an Idle governance proposal on whether to approve a developer salary of approximately $90,000. The horizontal axis reports proposal time normalized between the start and the end of the proposal. Bars represent the voting power of each vote. Red bars represent votes for the winning outcome, approval of the salary, and blue bars correspond to votes against approval of the salary. The colored dots show the cumulative number of votes and the outcome chosen by each vote.

Figure C.2 provides a second illustrative example of a swaying majority voter in a proposal directly concerning compensation. In this proposal, the staking platform Idle DAO asked shareholders to vote on whether to approve a $90,000 salary for a developer. Small shareholders voted against approving this compensation. However, a single address voted in favor of the salary with approximately 58% of the ex-post voting power engaged in the proposal.

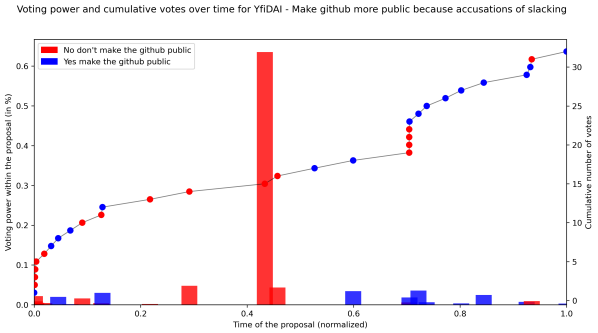
Figure C.3 – Additional Examples of Majority Swaying in DAO Governance Proposals



(a) PancakeSwap: Community rewards



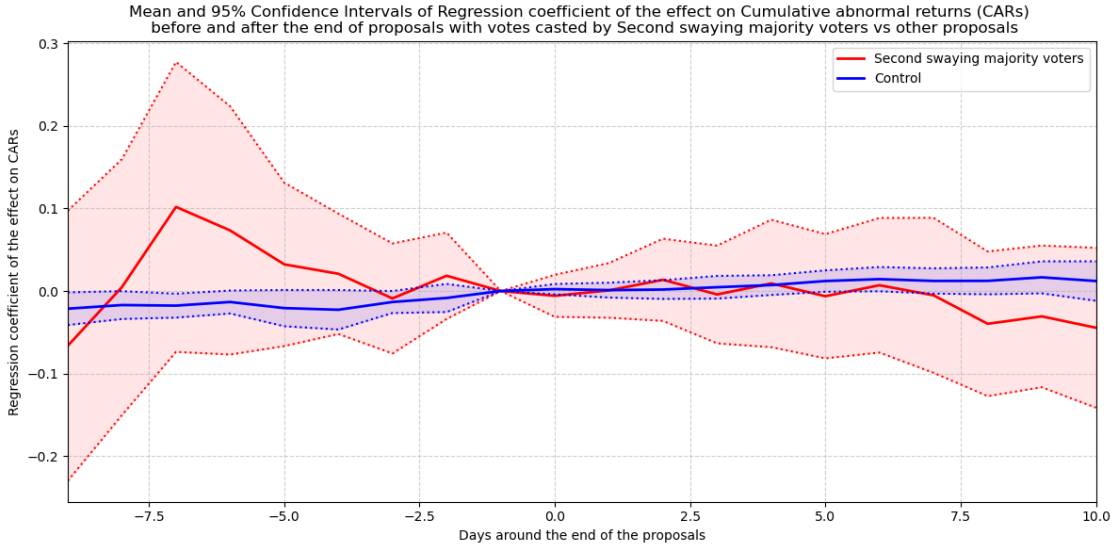
(b) Yam: Developer compensation transparency



(c) YfiDAI: Public GitHub access

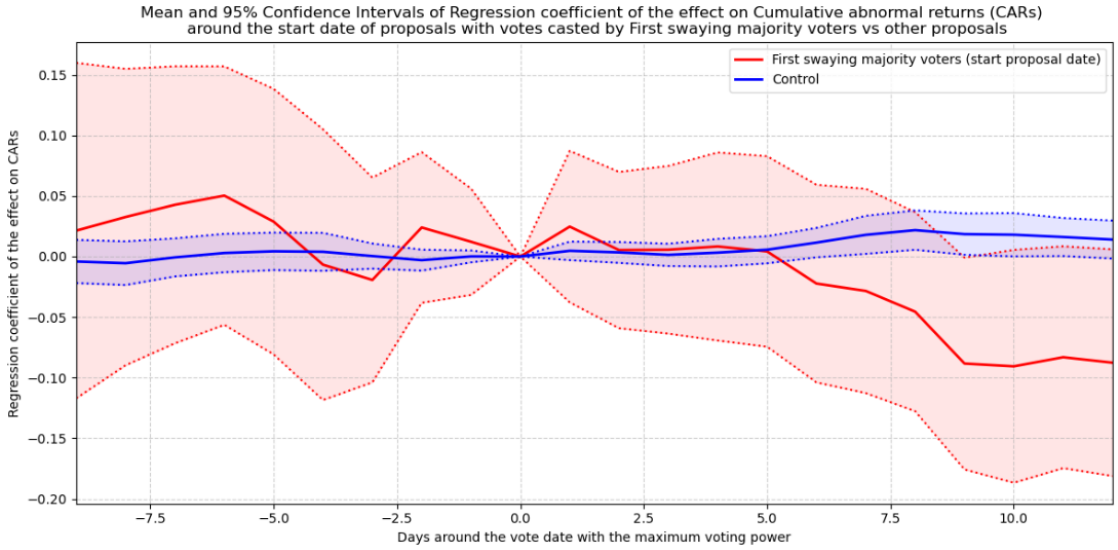
Notes: This figure reports three additional examples of swaying majority votes in DAO governance proposals. In each panel, the horizontal axis reports proposal time normalized between the start and the end of the proposal. Bars measure each vote's share of total voting power. The grey line and colored dots report the cumulative number of votes and the outcome chosen by each vote.

Figure C.4 – Second Swaying voter - Cumulative abnormal returns around end of proposals dates



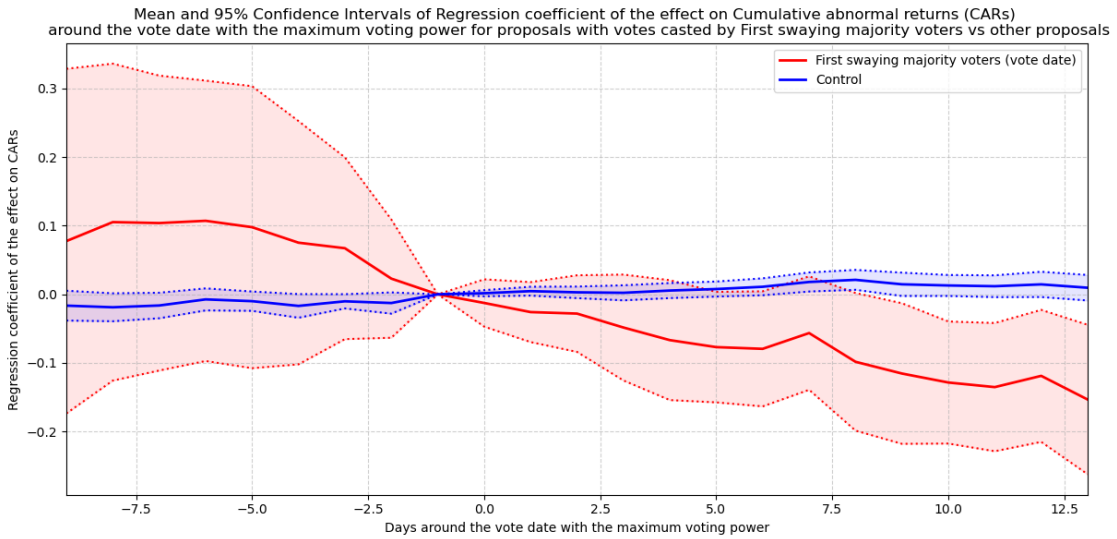
Notes: Figure C.4 reports the estimated coefficients and 95% confidence intervals of the impact of Second swaying majority voters on cumulative abnormal returns (CARs) around proposal event dates which are the votes of the maximum voting power within a proposal rather than the end of the proposal. The control group for the regression of Equation (1) consists of proposals with neither a majority voter nor a swaying voter that are not the DAO's first proposal. The figure shows no effect on CARs.

Figure C.5 – Cumulative abnormal returns around event dates being the start of the proposal rather than the end of the proposal



Notes: Figure C.5 reports the estimated coefficients and 95% confidence intervals of the impact of First swaying majority voters on cumulative abnormal returns (CARs) around proposal event dates which are the starts of proposals rather than the end of the proposal. The control group for the regression of Equation (1) consists of proposals with neither a majority voter nor a swaying voter that are not the DAO's first proposal. The figure shows that CARs decline following the event date not straight away but after $\simeq 8$ days. This event date +8 days is consistent with after the date of the end of the proposal.

Figure C.6 – Cumulative abnormal returns around event dates being the vote with the maximum voting power rather than the end of the proposal



Notes: Figure C.6 reports the estimated coefficients and 95% confidence intervals of the impact of First swaying majority voters on cumulative abnormal returns (CARs) around proposal event dates which are the votes of the maximum voting power within a proposal rather than the end of the proposal. The control group for the regression of Equation (1) consists of proposals with neither a majority voter nor a swaying voter that are not the DAO's first proposal. The figure shows that CARs decline following the event date not straight away but after $\simeq 6$ days. This event date +6 days is consistent with after the date of the end of the proposal.

Table C.1 – Shareholder engagement across proposals

	Obs	Mean	SD	Min	25%	50%	75%	Max
Proposals								
Maximum voting power	5737	0.455	0.259	0.0	0.254	0.407	0.637	1
Fraction of addresses different from one proposal to the next	5737	0.617	0.308	0.0	0.380	0.666	0.905	1
Tokens voted / Circulating supply (%)	5737	3.36	8.79	0.0	0.003	0.4	3.47	99
Tokens voted / Circulating supply (%) Governance proposals only	2711	2.53	7.87	0.0	0.0	0.01	1.19	99
Tokens voted / Circulating supply (%) Partnership proposals only	149	6.13	10.1	0.0	0.3	2.7	6.75	55
Tokens voted / Circulating supply (%) Features proposals only	1831	4.35	9.44	0.0	0.04	1.38	4.04	99
Tokens voted / Circulating supply (%) Business strategy proposals only	268	4.6	9.53	0.0	0.01	0.8	5.56	99
Tokens voted / Circulating supply (%) Cybersecurity proposals only	778	5.03	9.1	0.0	1.06	2.74	5.12	93
Tokens voted / Circulating supply (%) DAO above median marketcap	4743	2.04	6.8	0.0	0.0	0.09	2.4	99
Tokens voted / Circulating supply (%) DAO below median marketcap	994	9.5	13.4	0.0	1.6	5.3	11.5	99
Number of voters DAO above median marketcap	4743	219	528	4	19	59	179	8888
Number of voters DAO below median marketcap	994	117	255	4	20	49.5	122	2906

Table C.2 – Weekly cumulative abnormal returns Summary Statistics

	All DAOs	Large DAOs	Small DAOs	High trade volume	Low trade volume	Early obs	Late obs
All CARs	0.8%	0.4%	1.3%	0.5%	1.2%	0.9%	0.7%
CARs when there is no proposal	1.2%	0.7%	1.6%	0.8%	1.5%	0.9%	1.4%
CARs when there is a proposal	0.4%	0.8%	-0.08%	-0.02%	1%	1%	-0.4%

Table C.3 – Summary Statistics: Majority voters and swaying majority voters

	Obs	Mean	SD	Min	25%	50%	75%	Max
DAO level								
Proposals with majority voters	75	29.7	140	0	1	4	19	1220
Proposals with swaying majority voters	75	5.15	31.8	0	0	1	2	276
Number of proposals before the first majority voter	75	9.1	11.15	0	1	7	10	59
Number of proposals before the first swaying majority voter	75	22.2	25.3	0	8.5	13	26.5	144
Voter level								
Voting speed for majority voters	2219	0.37	0.32	0	0.07	0.28	0.64	1
Voting speed for swaying majority voters	386	0.39	0.33	0	0.08	0.32	0.66	1
First swaying majority voting instances	37							
Token voted / Circulating supply (%)	37	4.54	7.28	0.0	0.07	1.71	4.14	34

Notes: The p-value of the Kolmogorov-Smirnov test between the distributions of numbers of proposals before the first majority voter and number of proposals before the first swaying majority voter across DeFi DAOs is $-1.66e^{-}6$ with a t-statistic of -4.132 for the means of the sample. This indicates that proposals first swaying majority voter arrive later than proposals with the first majority voter.

Table C.4 – Ownership turnout in votes and previous governance activity

	(1) Ownership Voted (%)	(2) Ownership Voted (%)
log(1 + Nb proposals voted in previous 30 days)	-0.573**	-0.619**
	(-2.140)	(-2.387)
Market controls	Y	Y
DAO + Quarter FE	Y	N
DAO × Quarter FE	N	Y
Observations	5683	5683
Adj. R^2	0.50	0.74

Notes: The dependent variable is the percentage of the circulating token supply voted in a proposal. log(1+# proposals in previous 30 days) is the logarithm of one plus the number of governance proposals from the same DAO ending during the previous 30 days. Market controls include the DAO token's market capitalization and trading volume measured at the proposal date. DAO age is measured as the time elapsed since the DAO's first observed proposal in the sample. ***,**,* indicate significance at the 1%, 5% and 10% levels. Standard errors are clustered at the DAO/DAO quarter level. Singletons are excluded from the sample of observation for DAO quarter FE specifications.

Table C.5 – Impact of first swaying majority voters on Weekly CARs - Proposal subjects controls

Dependent variable: Cumulative Abnormal Returns for given token one week following a proposal.
***,**,* indicate significance at the 1%, 5% and 10% levels.
Standard errors are clustered at the DAO/DAO year/DAO quarter level.
Singletons are excluded from the sample of observation for DAO year/DAO quarter FE specifications.

	Weekly CARs		
	(1)	(2)	(3)
First swaying majority voter	-0.1224**	-0.1206***	-0.1273***
	(-2.477)	(-2.615)	(-2.855)
First swaying voter	0.0622	0.0853	0.0985*
	(1.028)	(1.492)	(1.892)
First majority voter	0.0005	-0.0117	0.0135
	(0.0121)	(-0.2557)	(0.2679)
Swaying majority voter	-0.0335**	-0.0225	-0.0200
	(-2.229)	(-1.389)	(-1.158)
Swaying voter	0.0200	0.0104	0.0089
	(1.238)	(0.5248)	(0.5623)
Majority voter	-0.0057	-0.0104	-0.0114
(>50%)	(-0.8215)	(-1.578)	(-1.503)
Governance	0.0051	0.0035	-0.0159
	(0.3207)	(0.2154)	(-1.053)
Partnership	-0.0089	-0.0140	-0.0150
	(-0.3041)	(-0.4511)	(-0.5583)
Cybersecurity	0.0086	0.0078	-0.0079
	(0.5894)	(0.4935)	(-0.4643)
Features	0.0112	0.0077	-0.0114
	(0.7824)	(0.4468)	(-0.7043)
Market + Proposal Controls	Yes	Yes	Yes
DAO + Quarter FE	Yes		
DAO x Year FE		Yes	
DAO x Quarter FE			Yes
Observations	5874	5867	5820
Adj. R^2	0.122	0.132	0.256

Notes: Market controls include: Market capitalization of the DAO (log), Trading volume of the DAO (log), Age of the DAO. Proposal-level controls include: (1) *Number of voters*, which accounts for the number of voters in a proposal; (2) the rolling average of *Number of voters*, which controls for trends in voter turnout over time; (3) *margin of victory*, which captures disagreement among tokenholders within a proposal; and (4) the rolling average of *margin of victory*, which accounts for trends in disagreement within DAOs.

Table C.6 – Shareholder Engagement controls - Summary Statistics

	Obs	Mean	SD	Min	25%	50%	75%	Max
Ratio voting power Circulating supply	5654	0.036	0.087	1e-10	2e-5	0.003	0.34	0.99
Turnover share	5654	0.617	0.31	0	0.38	0.66	0.9	1
Bottom quartile voting power share	5654	0.008	0.035	0	1.5e-5	5e-4	0.003	0.96
Top ten decile voting power share	5654	0.8	0.19	1.3e-5	0.7	0.84	0.95	1.0
Gini index	5654	0.82	0.16	0	0.77	0.87	0.93	0.999
First swaying majority voters								
Ratio voting power Circulating supply	35	0.042	0.072	3.8e-7	6.22e-04	0.0152	0.04	0.34
Turnover share	35	0.623	0.26	0.12	0.47	0.66	0.77	1
Bottom quartile voting power share	35	0.003	0.008	0	7e-5	3e-4	0.002	0.04
Top ten decile voting power share	35	0.84	0.14	0.51	0.76	0.86	0.95	1.0
Gini index	35	0.85	0.1	0.52	0.78	0.87	0.91	0.999

Table C.7 – Impact of first swaying majority voters on Weekly CARs - Engagement Controls

Dependent variable: Cumulative Abnormal Returns for given token one week following a proposal.
***,**,* indicate significance at the 1%, 5% and 10% levels.
Standard errors are clustered at the DAO quarter level. Singletons are excluded from the sample

	Weekly CARs			
	(1)	(2)	(3)	(4)
First swaying majority voter	-0.1186***	-0.1132***	-0.1124***	-0.1125***
	(-2.636)	(-2.668)	(-2.645)	(-2.645)
First swaying voter	0.0938*	0.0960*	0.0974*	0.0974*
	(1.814)	(1.869)	(1.891)	(1.891)
First majority voter	0.0089	0.0093	0.0077	0.0080
	(0.1807)	(0.2013)	(0.1655)	(0.1708)
Swaying majority voter	-0.0209	-0.0202	-0.0203	-0.0205
	(-1.191)	(-1.205)	(-1.209)	(-1.217)
Swaying voter	0.0088	0.0079	0.0082	0.0083
	(0.5462)	(0.5077)	(0.5237)	(0.5297)
Majority voter	-0.0110	-0.0111	-0.0109	-0.0119
(>50%)	(-1.451)	(-1.446)	(-1.424)	(-1.452)
Proposal Controls	Yes	Yes	Yes	Yes
Market Controls	Yes	Yes	Yes	Yes
Circulating supply Controls	Yes	Yes	Yes	Yes
Token engagement Controls	No	Yes	Yes	Yes
Token engagement relative to supply Controls	No	No	Yes	Yes
Voting Concentration Controls	No	No	No	Yes
DAO x Quarter FE	Yes	Yes	Yes	Yes
Observations	5683	5683	5683	5683
Adj. R^2	0.20593	0.20770	0.20849	0.20824

Notes: Column (1) includes baseline controls for total voting power (in logs) and its rolling average (log total tokens). Column (2) further adds controls for token supply, including log circulating supply and its rolling average. Column (3) additionally incorporates saliency controls capturing the intensity of governance participation, namely the ratio of voting power to circulating supply and its rolling average. Column (4) presents the most saturated specification and further includes voting concentration controls, namely the Gini coefficient and the Nakamoto number.

Table C.8 – Impact of first swaying majority voters on Weekly CARs
Truncated sample to proposals with bottom x percentile of total token voted exclude
Dependent variable: Cumulative Abnormal Returns for given token one week following a proposal.
***,**,* indicate significance at the 1%, 5% and 10% levels.
Standard errors are clustered at the DAO quarter level. Singletons are excluded from the sample.

	Weekly CARs			
	(1)	(2)	(3)	(4)
First swaying majority voter	-0.1028**	-0.1117**	-0.1310**	-0.1922**
	(-2.207)	(-2.331)	(-2.269)	(-2.421)
First swaying voter	0.0974	0.1090*	0.1061	0.1826*
	(1.644)	(1.697)	(1.373)	(1.710)
First majority voter	-0.0036	-0.0113	-0.0073	0.0059
	(-0.0722)	(-0.2225)	(-0.1073)	(0.0651)
Swaying majority voter	-0.0248	-0.0260	-0.0259	-0.0166
	(-1.403)	(-1.402)	(-1.157)	(-0.6606)
Swaying voter	0.0134	0.0138	0.0103	0.0049
	(0.7983)	(0.7817)	(0.4902)	(0.2113)
Majority voter	-0.0136*	-0.0145*	-0.0177**	-0.0189*
(>50%)	(-1.778)	(-1.789)	(-2.105)	(-1.664)
All gov engagement controls	Yes	Yes	Yes	Yes
Proposal Controls	Yes	Yes	Yes	Yes
Market controls	Yes	Yes	Yes	Yes
DAO x Quarter FE	Yes	Yes	Yes	Yes
Observations	5365	5083	4231	2820
Adj. R^2	0.20873	0.20090	0.19905	0.21519

Notes: Each column reports estimates using samples filtered on proposal saliency within each DAO. Specifically, I exclude proposals with low engagement based on the distribution of total voting power at the DAO level. Column (1) excludes the bottom 5% of proposals, Column (2) the bottom 10%, Column (3) the bottom 25%, and Column (4) the bottom 50% of proposals with the lowest voting power within each DAO. This procedure ensures that the first swaying results are not driven by low-saliency proposals with limited participation.

Table C.9 – Impact of first swaying majority voters on the average Gini index over the 5 following proposals

Dependent variable: Cumulative Abnormal Returns for given token one week following a proposal.
***,**,* indicate significance at the 1%, 5% and 10% levels.
Standard errors are clustered at the DAO quarter level. Singletons are excluded from the sample.

	Avg Gini Index over the next 5 proposals		
	(1)	(2)	(3)
First swaying majority voter	0.0386**	0.0384**	0.0390**
	(2.068)	(2.069)	(2.066)
First swaying voter	-0.0004	0.0026	0.0028
	(-0.0298)	(0.1899)	(0.2025)
First majority voter	0.0049	0.0044	0.0050
	(0.4552)	(0.4051)	(0.4626)
Swaying majority voter	-0.0140*	-0.0130	-0.0133
	(-1.776)	(-1.627)	(-1.612)
Swaying voter	0.0147*	0.0133*	0.0136*
	(1.747)	(1.659)	(1.662)
Swaying voter	0.0048	0.0050	0.0047
	(1.265)	(1.531)	(1.524)
Controls	Yes	Yes	Yes
DAO x Quarter FE	Yes	Yes	Yes
Observations	5683	5683	5683
Adj. R^2	0.45954	0.46456	0.46476

Notes: All specifications control market capitalization, trading volume, DAO age, the rolling average of turnout and margin of victory. The second specification further adds percentage of ownership voted and its rolling average, the log total voting power in terms of tokens, the circulating supply of tokens and its rolling average. The third column adds control for turnover of addresses and number of voters.

Table C.10 – Impact of first swaying majority voters on the ratio percentage of ownership voted over the 5 following proposals

***,**,* indicate significance at the 1%, 5% and 10% levels.
Standard errors are clustered at the DAO quarter level. Singletons are excluded from the sample.

	Ratio of ownership voted over the next 5 proposals	
	(1)	(2)
First swaying majority voter	0.0002	0.0002
	(0.0698)	(0.0414)
First swaying voter	0.0017	0.0014
	(0.3819)	(0.2830)
First majority voter	-0.0053	-0.0074*
	(-1.305)	(-1.682)
Swaying majority voter	3.36×10^{-5}	-0.0012
	(0.0252)	(-0.7717)
Swaying voter	0.0003	0.0021
	(0.3016)	(1.157)
Majority voter	-0.0004	-0.0001
	(-0.5076)	(-0.1513)
Controls	Yes	Yes
DAO x Quarter FE	Yes	Yes
Observations	5665	5665
Adj. R^2	0.86307	0.86694

Notes: All specifications control market capitalization, trading volume, DAO age, the rolling average of turnout and margin of victory. The second specification further adds percentage of ownership voted and its rolling average, the log total voting power in terms of tokens, the circulating supply of tokens and its rolling average, turnover of addresses, margin of victory and Nakamoto number.

Table C.11 – Impact of first swaying majority voters on the average maximum voting power over the 5 following proposals

***,**,* indicate significance at the 1%, 5% and 10% levels.
Standard errors are clustered at the DAO quarter level. Singletons are excluded from the sample.

	Avg maximum share of the voting power over the next 5 proposals		
	(1)	(2)	(3)
First swaying majority voter	0.0358	0.0371*	0.0380*
	(1.639)	(1.710)	(1.760)
First swaying voter	0.0095	0.0106	0.0108
	(0.5853)	(0.6483)	(0.6662)
First majority voter	-0.0032	-0.0033	-0.0033
	(-0.2340)	(-0.2369)	(-0.2378)
Swaying majority voter	-0.0077	-0.0074	-0.0073
	(-0.8002)	(-0.7732)	(-0.7648)
Swaying voter	0.0117	0.0116	0.0111
	(1.569)	(1.529)	(1.474)
Majority voter	0.0163***	0.0162***	0.0159***
	(2.915)	(2.932)	(2.888)
Controls	Yes	Yes	Yes
DAO x Quarter FE	Yes	Yes	Yes
Observations	5683	5683	5683
Adj. R^2	0.65182	0.65218	0.65231

Notes: All specifications control market capitalization, trading volume, DAO age, the rolling average of turnout and margin of victory. The second specification further adds percentage of ownership voted and its rolling average, the log total voting power in terms of tokens, the circulating supply of tokens and its rolling average. The third column adds control for turnover of addresses and number of voters.

Table C.12 – Impact of first swaying majority voters on the minority tokenholders' voting power share over the 5 following proposals

***,**,* indicate significance at the 1%, 5% and 10% levels.

Standard errors are clustered at the DAO quarter level. Singletons are excluded from the sample.

	Avg voting share of minority tokenholders over the next 5 proposals		
	(1)	(2)	(3)
First swaying majority voter	-0.0412**	-0.0413**	-0.0418**
	(-2.098)	(-2.115)	(-2.121)
First swaying voter	0.0040	0.0005	0.0003
	(0.2704)	(0.0329)	(0.0231)
First majority voter	0.0040	0.0043	0.0040
	(0.3111)	(0.3338)	(0.3045)
Swaying majority voter	0.0144*	0.0132*	0.0134*
	(1.859)	(1.703)	(1.721)
Swaying voter	-0.0126**	-0.0111**	-0.0112**
	(-2.263)	(-2.077)	(-2.096)
Majority voter	-0.0081**	-0.0082**	-0.0080**
	(-2.438)	(-2.537)	(-2.434)
Controls	Yes	Yes	Yes
DAO x Quarter FE	Yes	Yes	Yes
Observations	5683	5683	5683
Adj. R^2	0.56	0.56	0.56

Notes: The voting share of the minority tokenholders is measured as 1 minus the voting share of the voting share top decile of addresses with the most voting power in a proposal. As voting power is extremely concentrated, focusing on the voting power held by the bottom decile, bottom quartile, or even addresses below the median would yield voting shares that are consistently close to zero. All specifications control market capitalization, trading volume, DAO age, the rolling average of turnout and margin of victory. The second specification further adds percentage of ownership voted and its rolling average, the log total voting power in terms of tokens, the circulating supply of tokens and its rolling average. The third column adds control for turnover of addresses and number of voters.

Table C.13 – Impact of first swaying majority voters on the average margin of victory over the 5 following proposals

Dependent variable: Cumulative Abnormal Returns for given token one week following a proposal.
***,**,* indicate significance at the 1%, 5% and 10% levels.
Standard errors are clustered at the DAO quarter level. Singletons are excluded from the sample.

	Avg Margin of victory over the next 5 proposals		
	(1)	(2)	(3)
First swaying majority voter	0.0516**	0.0534**	0.0526**
	(1.984)	(2.025)	(2.013)
First swaying voter	-0.0141	-0.0158	-0.0147
	(-0.5363)	(-0.6054)	(-0.5658)
First majority voter	-0.0163	-0.0160	-0.0141
	(-0.6950)	(-0.6925)	(-0.6084)
Swaying majority voter	-0.0042	-0.0048	-0.0055
	(-0.3006)	(-0.3498)	(-0.3864)
Swaying voter	-0.0100	-0.0095	-0.0093
	(-0.7881)	(-0.7633)	(-0.7197)
Majority voter	0.0090*	0.0090	0.0027
	(1.694)	(1.648)	(0.3589)
Controls	Yes	Yes	Yes
DAO x Quarter FE	Yes	Yes	Yes
Observations	5683	5683	5683
Adj. R^2	0.86425	0.86438	0.86472

Notes: All specifications control market capitalization, trading volume, DAO age, the rolling average of turnout and margin of victory. The second specification further adds percentage of ownership voted and its rolling average, the log total voting power in terms of tokens, the circulating supply of tokens and its rolling average. The third column adds control for Gini coefficients of proposals and number of voters.

Table C.14 – Absence of positive association with returns for proposals without a majority voter after there has been the first swaying majority voter

Dependent variable: Cumulative Abnormal Returns for given token one week following a proposal.
***,**,* indicate significance at the 1%, 5% and 10% levels.
Standard errors are clustered at the DAO quarter level. Singletons are excluded from the sample.

	Weekly CARs	
	(1)	(2)
No majority voter	-0.0404	
	(-1.108)	
No majority voter x Governance		-0.0583
		(-1.358)
No majority voter x Partnership		-0.0229
		(-0.2957)
No majority voter x Business strategy		0.1422
		(1.504)
No majority voter x Features		-0.0741
		(-1.279)
No majority voter x Cybersecurity		-0.0101
		(-0.2457)
Governance	-0.0593	0.0586*
	(-1.044)	(1.763)
Partnership	-0.0546	0.0409
	(-0.6190)	(0.6596)
Cybersecurity	-0.0263	0.0576
	(-0.5108)	(1.345)
Features	-0.0215	0.1096*
	(-0.4028)	(1.888)
Tokenholder engagement controls	Yes	Yes
Market Controls	Yes	Yes
DAO x Quarter FE	Yes	Yes
Observations	843	843
Adjusted R^2	0.34549	0.34858

Notes: Business strategy indicator not in the regression to avoid co-linearity. Tokenholder engagement controls are: Number of voters, the rolling average of Number of voters, margin of victory, the rolling average of margin of victory, log of the total voting power in tokens, rolling average of the log of the total voting power in tokens, log of the circulating supply of tokens, rolling average of the log of the circulating supply of tokens, ratio of token voted to the circulating supply, rolling average of the ratio of token voted to the circulating supply, the gini index of the proposal and the Nakamoto number of the proposal. Market controls are: Market capitalization of the DAO, Trading volume of the token and the age of the DAO.

Table C.15 – Pre-Proposal Governance-Token Sales by First Swaying Majority voters compared to Majority voters

***,**,* indicate significance at the 1%, 5% and 10% levels.
Standard errors are clustered at the DAO quarter level or DAO year level. Singletons are excluded from the sample.

	Share of outflow gov token prior proposal		Share of outflow gov token after proposal	
	(1)	(2)	(3)	(4)
First swaying majority voter	-0.0302	-0.0274	-0.1042*	-0.0995
	(-0.5124)	(-0.4818)	(-1.679)	(-1.656)
Share of inflow gov token prior	0.4008***	0.4048***		
	(3.488)	(3.850)		
Share of inflow gov token after			0.5115***	0.6152***
			(3.067)	(4.135)
Market Controls	Yes	Yes	Yes	Yes
Proposal controls	Yes	Yes	Yes	Yes
DAO x Quarter FE	Yes		Yes	
DAO x Year FE		Yes		Yes
Observations	268	268	261	261
Adj. R^2	0.72	0.67	0.56	0.49

Notes: The dependent variables are the share of governance-token outflows the month prior to or the month after the proposal. The sample compares trading volumes of majority voters to trading volumes of first swaying majority voters prior the first swaying majority instances. For DAOs which have had a first swaying majority vote event the sample of proposals stop after this event. For DAOs which have never had a swaying majority event, the sample keeps all of the times a majority voter casts a vote. Market-level controls are market capitalization, trading volume and age of the DAO. Proposal-level controls are the number of voters, the rolling average turnout and the margin of victory. As tokens recorded on the Ethereum blockchain do not always have the same name as the DAO recorded on Snapshot, the sample is restricted to the trading of token transactions whose names have at least 75% overlap with the corresponding Snapshot DAO name.

Table C.16 – Pre-Proposal Governance-Token Purchases by First Swaying Majority voters compared to Majority voters

***,**,* indicate significance at the 1%, 5% and 10% levels.
Standard errors are clustered at the DAO quarter level or DAO year level. Singletons are excluded from the sample.

	Share of inflow gov token prior proposal		Share of inflow gov token after proposal	
	(1)	(2)	(3)	(4)
First swaying majority voter	-0.0812	-0.0656	0.0589	0.0507
	(-1.353)	(-1.198)	(0.9086)	(0.8232)
Majority voter	0.0597	0.0491	0.0425	0.0435
	(1.608)	(1.061)	(1.364)	(1.150)
Market Controls	Yes	Yes	Yes	Yes
Proposal controls	Yes	Yes	Yes	Yes
DAO x Quarter FE	Yes		Yes	
DAO x Year FE		Yes		Yes
Observations	15232	15232	14806	14806
Adjusted R^2	0.155	0.145	0.187	0.178

Notes: The dependent variables are the share of governance-token inflows the month prior to or the month after the proposal. The sample compares trading volumes of medium voters as defined as voters with a voting power within proposals between 10% and 30% to the trading volumes of majority voters and first swaying majority voters. Market-level controls are market capitalization, trading volume and age of the DAO. Proposal-level controls are the number of voters, the rolling average turnout and the margin of victory. As tokens recorded on the Ethereum blockchain do not always have the same name as the DAO recorded on Snapshot, the sample is restricted to the trading of token transactions whose names have at least 75% overlap with the corresponding Snapshot DAO name.

D Additional robustness tests

Table D.1 – Impact of majority voters on Weekly CARs
Dependent variable: Weekly Cumulative Abnormal Returns following the proposal.
***,**,* indicate significance at the 1%, 5% and 10% levels.
Standard errors are clustered at the DAO/DAO year/DAO quarter level. Singletons are excluded from the sample.

	Weekly CARs					
	(1)	(2)	(3)	(4)	(5)	(6)
Majority voter (>50%)	-0.0099 (-1.388)	-0.0111 (-1.653)	-0.0150*** (-2.724)	-0.0152** (-2.428)	-0.0161** (-2.125)	-0.0147* (-1.906)
Market Controls	Yes	Yes	Yes	Yes	Yes	Yes
Proposal Controls		Yes		Yes		Yes
DAO + Quarter FE	Yes	Yes				
DAO x Year FE			Yes	Yes		
DAO x Quarter FE					Yes	Yes
Observations	5874	5874	5867	5867	5820	5820
Adj. R^2	0.12137	0.12089	0.13201	0.13145	0.25513	0.25481

Notes: Market controls include: (1) the log of the average market capitalization around the event, (2) the log of the average trading volume for the token around the event and (3) the age of the DAO at the time of the event. Proposal-level controls include: (1) Number of voters, which accounts for the number of voters in a proposal; (2) the rolling average of Number of voters, which controls for trends in voter turnout over time; (3) margin of victory, which captures disagreement among tokenholders within a proposal; and (4) the rolling average of margin of victory, which accounts for trends in disagreement within DAOs.

Table D.2 – Impact of swaying majority voters on Weekly CARs

Dependent variable: Weekly Cumulative Abnormal Returns following the proposal.
***,**,* indicate significance at the 1%, 5% and 10% levels.
Standard errors are clustered at the DAO/DAO year/DAO quarter level. Singletons are excluded from the sample.

	Weekly CARs					
	(1)	(2)	(3)	(4)	(5)	(6)
Swaying majority voter	-0.0455**	-0.0486**	-0.0383*	-0.0390*	-0.0359*	-0.0367*
	(-2.177)	(-2.146)	(-1.902)	(-1.823)	(-1.732)	(-1.774)
Swaying voter	0.0221	0.0275	0.0192	0.0208	0.0184	0.0199
	(1.264)	(1.339)	(1.057)	(0.9251)	(1.127)	(1.136)
Majority voter	-0.0042	-0.0058	-0.0102*	-0.0107	-0.0115	-0.0104
(>50%)	(-0.5385)	(-0.7908)	(-1.669)	(-1.517)	(-1.508)	(-1.311)
Market Controls	Yes	Yes	Yes	Yes	Yes	Yes
Proposal Controls		Yes		Yes		Yes
DAO + Quarter FE	Yes	Yes				
DAO x Year FE			Yes	Yes		
DAO x Quarter FE					Yes	Yes
Observations	5874	5874	5867	5867	5820	5820
Adj. R^2	0.12194	0.12152	0.13232	0.13176	0.25540	0.25508

Notes: Market controls include: (1) the log of the average market capitalization around the event, (2) the log of the average trading volume for the token around the event and (3) the age of the DAO at the time of the event. Proposal-level controls include: (1) Number of voters, which accounts for the number of voters in a proposal; (2) the rolling average of Number of voters, which controls for trends in voter turnout over time; (3) margin of victory, which captures disagreement among tokenholders within a proposal; and (4) the rolling average of margin of victory, which accounts for trends in disagreement within DAOs.

Table D.3 – Impact of first swaying majority voters on Weekly CARs - DAO with the most proposals excluded

Dependent variable: Weekly Cumulative Abnormal Returns following the proposal.
***,**,* indicate significance at the 1%, 5% and 10% levels.
Standard errors are clustered at the DAO/DAO year/DAO quarter level. Singletons are excluded from the sample.

	Weekly CARs					
	(1)	(2)	(3)	(4)	(5)	(6)
First swaying majority voter	-0.1322***	-0.1286**	-0.1416***	-0.1355***	-0.1406***	-0.1373***
	(-2.793)	(-2.619)	(-3.115)	(-2.855)	(-3.189)	(-3.014)
First swaying voter	0.0604	0.0534	0.0914	0.0877	0.0997*	0.0982*
	(0.9982)	(0.8596)	(1.640)	(1.523)	(1.964)	(1.908)
First majority voter	0.0097	0.0068	0.0013	0.0019	0.0213	0.0221
	(0.2151)	(0.1457)	(0.0282)	(0.0407)	(0.4258)	(0.4388)
Swaying majority voter	-0.0216	-0.0349	-0.0041	-0.0137	-0.0069	-0.0127
	(-0.7166)	(-1.202)	(-0.1247)	(-0.4211)	(-0.2352)	(-0.4310)
Swaying voter	0.0204	0.0390*	0.0084	0.0222	0.0091	0.0208
	(0.9612)	(1.705)	(0.3831)	(0.8918)	(0.3909)	(0.8150)
Majority voter (>50%)	0.0021	-0.0007	-0.0069	-0.0109	-0.0068	-0.0088
	(0.1653)	(-0.0554)	(-0.5303)	(-0.8157)	(-0.4808)	(-0.6218)
Market controls	Yes	Yes	Yes	Yes	Yes	Yes
Proposal controls	Yes		Yes		Yes	Yes
DAO + Quarter FE	Yes	Yes				
DAO x Year FE			Yes	Yes		
DAO x Quarter FE					Yes	Yes
Observations	3554	3554	3547	3547	3500	3500
Adj. R^2	0.11	0.11	0.11	0.115	0.268	0.268

Notes: Market controls include: (1) the *Market capitalization* of the DAO (log of the average market capitalization from one week before to one week after the proposal), (2) the *Trading volume* of the token of the DAO (log of the average trading volume from one week before to one week after the proposal), (3) the *Age* of the DAO at the moment of the proposal. Proposal-level controls include: (1) *Number of voters*, which accounts for the number of voters in a proposal; (2) the rolling average of *Number of voters*, which controls for trends in voter turnout over time; (3) *margin of victory*, which captures disagreement among tokenholders within a proposal; and (4) the rolling average of *margin of victory*, which accounts for trends in disagreement within DAOs. The regression is done on a sample of proposals which exclude the DAO with the most proposal (PancakeSwap)

Table D.4 – Impact of first swaying majority voters on Weekly CARs - Sushi Swap with potential price API problems highlighted in Schwenkler et al. (2026) excluded

Dependent variable: Weekly Cumulative Abnormal Returns following the proposal.
***,**,* indicate significance at the 1%, 5% and 10% levels. Standard errors are clustered at the DAO year/DAO quarter level. Singletons are excluded from the sample.

	Weekly CARs	
	(1)	(2)
First swaying majority voter	-0.1214***	-0.1150***
	(-2.723)	(-2.696)
First swaying voter	0.0990*	0.0995*
	(1.719)	(1.934)
First majority voter	0.0002	0.0066
	(0.0041)	(0.1376)
Swaying majority voter	-0.0156	-0.0164
	(-1.097)	(-1.001)
Swaying voter	0.0018	0.0036
	(0.0986)	(0.2401)
Majority voter	-0.0121*	-0.0115
	(-1.819)	(-1.363)
Market Controls	Yes	Yes
Proposal Controls	Yes	Yes
All Saliency controls	Yes	Yes
DAO x Year FE	Yes	No
DAO x Quarter FE	No	Yes
Observations	5578	5532
Adj. R^2	0.12871	0.19442

Notes: Market controls include: (1) the *Market capitalization* of the DAO (log of the average market capitalization from one week before to one week after the proposal), (2) the *Trading volume* of the token of the DAO (log of the average trading volume from one week before to one week after the proposal), (3) the *Age* of the DAO at the moment of the proposal. Proposal-level controls include: (1) *Number of voters*, which accounts for the number of voters in a proposal; (2) the rolling average of *Number of voters*, which controls for trends in voter turnout over time; (3) *margin of victory*, which captures disagreement among tokenholders within a proposal; and (4) the rolling average of *margin of victory*, which accounts for trends in disagreement within DAOs. Saliency controls are the ones defined in Table C.7. The regression is done on a sample of proposals which exclude the only DAO most exposed to potential problems of the Coingecko Price API as listed in Schwenkler et al. (2026) (Sushi Swap).

Table D.5 – Impact of first swaying majority voters on Weekly CARs - Additional control of whether author of the proposal is also the largest voter

Dependent variable: Weekly Cumulative Abnormal Returns following the proposal. ***,**,* indicate significance at the 1%, 5% and 10% levels. Standard errors are clustered at the DAO year/DAO quarter level. Singletons are excluded from the sample.

	Weekly CARs	
	(1)	(2)
First swaying majority voter	-0.1182***	-0.1126***
	(-2.642)	(-2.649)
First swaying voter	0.0955*	0.0972*
	(1.661)	(1.888)
First majority voter	0.0006	0.0079
	(0.0144)	(0.1687)
Swaying majority voter	-0.0216	-0.0202
	(-1.387)	(-1.220)
Swaying voter	0.0088	0.0089
	(0.4534)	(0.5690)
Majority voter	-0.0125*	-0.0126
	(-1.904)	(-1.509)
Proposal author largest voter	0.0210**	0.0222
	(2.363)	(1.047)
Market Controls	Yes	Yes
Proposal Controls	Yes	Yes
All Saliency controls	Yes	Yes
DAO x Year FE	Yes	No
DAO x Quarter FE	No	Yes
Observations	5729	5683
Adj. R^2	0.14	0.209

Notes: Market controls include: (1) the *Market capitalization* of the DAO (log of the average market capitalization from one week before to one week after the proposal), (2) the *Trading volume* of the token of the DAO (log of the average trading volume from one week before to one week after the proposal), (3) the *Age* of the DAO at the moment of the proposal. Proposal-level controls include: (1) *Number of voters*, which accounts for the number of voters in a proposal; (2) the rolling average of *Number of voters*, which controls for trends in voter turnout over time; (3) *margin of victory*, which captures disagreement among tokenholders within a proposal; and (4) the rolling average of *margin of victory*, which accounts for trends in disagreement within DAOs. Saliency controls are the ones defined in Table C.7.

Table D.6 – Impact of first swaying majority voters on Weekly CARs
Truncated sample to proposals with bottom x percentile of total token voted exclude
Dependent variable: Weekly Cumulative Abnormal Returns following the proposal.
***,**,* indicate significance at the 1%, 5% and 10% levels.
Standard errors are clustered at the DAO year level. Singletons are excluded from the sample.

	Weekly CARs			
	(1)	(2)	(3)	(4)
First swaying majority voter	-0.1098**	-0.0907*	-0.1152**	-0.1487**
	(-2.252)	(-1.845)	(-2.225)	(-2.056)
First swaying voter	0.0984	0.0957	0.0894	0.1448
	(1.470)	(1.366)	(1.134)	(1.297)
Swaying majority voter	-4.63×10^{-5}	-0.0062	-0.0058	0.0374
	(-0.0010)	(-0.1277)	(-0.0944)	(0.4614)
Swaying voter	-0.0235	-0.0237	-0.0286	-0.0244
	(-1.416)	(-1.366)	(-1.422)	(-1.119)
Swaying voter	0.0098	0.0095	0.0101	0.0085
	(0.4564)	(0.4243)	(0.3683)	(0.3903)
Majority voter (>50%)	-0.0109*	-0.0126**	-0.0127*	-0.0115
	(-1.804)	(-1.984)	(-1.882)	(-1.048)
Market controls	Yes	Yes	Yes	Yes
Proposal Controls	Yes	Yes	Yes	Yes
All saliency Controls	Yes	Yes	Yes	Yes
DAO x Year FE	Yes	Yes	Yes	Yes
Observations	5409	5125	4267	2845
Adj. R^2	0.14418	0.14491	0.15039	0.17739

Notes: Each column reports estimates using samples filtered on proposal saliency within each DAO. Specifically, I exclude proposals with low engagement based on the distribution of total voting power at the DAO level. Column (1) excludes the bottom 5% of proposals, Column (2) the bottom 10%, Column (3) the bottom 25%, and Column (4) the bottom 50% of proposals with the lowest voting power within each DAO. This procedure ensures that the first swaying results are not driven by low-saliency proposals with limited participation. Market controls include: (1) the *Market capitalization* of the DAO (log of the average market capitalization from one week before to one week after the proposal), (2) the *Trading volume* of the token of the DAO (log of the average trading volume from one week before to one week after the proposal), (3) the *Age* of the DAO at the moment of the proposal. Proposal-level controls include: (1) *Number of voters*, which accounts for the number of voters in a proposal; (2) the rolling average of *Number of voters*, which controls for trends in voter turnout over time; (3) *margin of victory*, which captures disagreement among tokenholders within a proposal; and (4) the rolling average of *margin of victory*, which accounts for trends in disagreement within DAOs. Saliency controls are the ones defined in Table C.7.

Table D.7 – Impact of first swaying majority voters on Weekly CARs, Minority turnout and Number of Voters - Information release and the number of proposals before first swaying majority votes

***,**,* indicate significance at the 1%, 5% and 10% levels. Standard errors are clustered at the DAO year/DAO quarter level. Singletons are excluded from the sample.

	Weekly CARs (1)	Voting Power Minority (2)	Nb Voters (3)
First swaying majority voter	-0.1183**	0.2611	113.4*
	(-2.164)	(1.632)	(1.783)
First swaying majority voter	0.0004	-0.0100	-0.4633
x Nb prop 3 past months	(0.3972)	(-1.617)	(-0.2374)
Nb prop 3 past months	1.66×10^{-5}	0.0002	-0.1384
	(0.1760)	(0.4933)	(-1.479)
Nb subjects 3 past months	-0.0124	-0.0330	-2.161
	(-0.6191)	(-1.628)	(-0.2019)
Controls	Yes	Yes	Yes
DAO x Quarter FE	Yes	Yes	Yes
Observations	5683	5674	5683
Adjusted R^2	0.209	0.874	0.482

Notes: In column (1) the dependent variable are the weekly cumulative abnormal returns following proposals. In column (2), the voting power of the minority is calculated as the log of the minority share of the total number tokens which were voted in the proposal. In column (3), the number of voters is the number of addresses which voted in the proposal. The number of proposals interacted with first swaying majority voter is the number of proposals which the DAO have voted on in the 3 months previous to the launch of the current proposal. All three specifications additionally control for lower level interaction of the triple difference-in-difference defined in Equation 1, market capitalization, trading volume, DAO age, the rolling average of turnout and margin of victory , percentage of ownership voted and its rolling average, the log total voting power in terms of tokens, the circulating supply of tokens and its rolling average, turnover of addresses, margin of victory, Nakamoto number and Gini coefficients. Nb prop past month is the number of proposals which were voted on in the three previous months by the DAO. Nb subject past month is the number of proposals' subjects which were voted on in the previous three previous months by the DAO among Governance, Partnership, Features, Business Strategy and Cybersecurity.

Intuition: Following Hirshleifer et al. (2009), as the price response around the first swaying majority voter instances reflects the release of a new negative information, the extent to which this new information is incorporated into token prices should depend on the DAO's recent attention costs imposed on voters. When a DAO has voted on a larger number of proposals, market participants have had to process more information, therefore an incremental

information with the first swaying majority voter should be less fully incorporated into token prices and small tokenholders should turnout less in votes as they have had to vote in several proposals recently. This logic implies a positive coefficient for the interaction between first swaying majority voter and the number of proposals recently voted on in column (1) for the effect on returns and negative coefficients on the interactions for the interaction between first swaying majority voter and the number of proposals recently voted on in columns (2) and (3) for turnout. Although not statistically significant, consistent with this logic, the interaction between the first swaying majority voter and the number of proposals is positive in column (1) and negative in (2) and (3).

D.1 Implementation of the pre-trend test

I assess whether CARs exhibit a pre-trend prior to the end of proposals involving a first swaying majority voter by a joint test event-study coefficients prior to the date of the event. A single regression is run in which the treatment indicator, all control variables, and the DAO-quarter fixed effects are interacted with event time.

I use a cluster-robust covariance matrix, with clustering at the DAO-quarter level. This is particularly important in an event study of CARs because coefficient estimates at adjacent event dates are not necessarily independent. The cluster-robust covariance matrix allows for arbitrary correlation among regression residuals within a DAO-quarter, including correlation across event dates. Its diagonal elements contain the estimated variances of the individual event-time coefficients, while its off-diagonal elements capture the covariance between coefficients at different horizons. By contrast, using a diagonal covariance matrix would impose zero covariance across event-time coefficients and would therefore ignore this dependence.

Joint test of the pre-event CAR path:
Let $\widehat{\boldsymbol{\beta}}_{\text{pre}}$ denote the vector of treatment coefficients for event days -8 through -2, and let $\widehat{V}_{\text{pre}}$ denote the corresponding submatrix of the cluster-robust covariance matrix. I test the joint null hypothesis

$$H_0 : \beta_{-8} = \beta_{-7} = \cdots = \beta_{-2} = 0$$

against the alternative that at least one pre-event CAR coefficient differs from zero. The Wald statistic is

$$W = \widehat{\boldsymbol{\beta}}'_{\text{pre}} \widehat{V}^{-1}_{\text{pre}} \widehat{\boldsymbol{\beta}}_{\text{pre}},$$

which is compared with an asymptotic χ^2 distribution with seven degrees of freedom.

This test evaluates whether the pre-event CAR path is jointly distinguishable from zero once the dependence across event-time estimates is taken into account. Failure to reject the null therefore indicates that the data provide no statistical evidence of a differential pre-trend in CARs over the pre-event window.

D.2 Multiple addresses and vote fragmentation

D.2.1 Intuition

As blockchain addresses are pseudonymous, a single entity could distribute its voting power across multiple addresses. To try to get a sense of ow prevalent is this concern and whether this could influence the overall voting outcomes as well as the measurement of the impact of first swaying majority voters on DAOs, I isolate clusters of small addresses within proposals that cast votes for the same outcome at exactly the same time. Such clusters could be consistent with a single entity controlling multiple addresses. Although this test controls partially for vote fragmentation, it only controls for a particular form of address fragmentation. Therefore a voter employing a more sophisticated strategy, such as staggering votes across timestamps, would not be detected.

D.2.2 Method

I group small addresses into blocks when at least two distinct addresses vote for the same alternative within the same second[50]. Each address contributes its final recorded vote to the analysis. I aggregate the voting power of these several addresses and compute its size relative to the largest voter voting power. I then assess whether the block could overturn the alternative supported by the largest voter. I also assess whether the presence of such blocks and their relative size affect the regression results. I add two additional controls in Equation (1): an indicator for the presence of at least one synchronized block in a proposal and the voting power of the largest such block relative to that of the largest individual voter.

D.2.3 Results

Table D.8 reports that among 5874 proposals, 864 (14.7%) contain at least one such small voters block. These patterns are less frequent in proposals with a swaying majority voters, occurring in only 29 of 386 proposals (7.5%). Those occurrences fall to 2 of 38 proposals (5.3%) in proposals with first swaying majority voters.

[50]Here the condition for a block to exist is at least two distinct addresses, each controlling no more than 10% of the largest individual voter's voting power voting in the same second. Varying this voting power threshold does not change the results.

Table D.8 – Synchronized Small-Voter Blocks

	N	N with blocks	Frequency	Overturns largest
All proposals	5874	864	14.7%	0/864
Swaying large voter	386	29	7.5%	0/29
First voter is swaying large	38	2	5.3%	0/2

Notes: This table reports the prevalence and potential influence of synchronized small-voter blocks. A block consists of at least two distinct addresses, each controlling no more than 10% of the largest individual voter's voting power, casting votes for the same alternative within the same second. Frequency is the fraction of proposals containing at least one block. Overturns largest reports the number of proposals in which removing a block restores the largest voter's preferred alternative as the winner, relative to proposals for which the counterfactual is assessable.

Table D.9 – Distribution of Synchronized Small-Voter Block Sizes

Measure	N	Mean	Median	P90	P99	Max
Number of small voters	39233	2.28	2.00	2.00	10.00	50.00
Block voting power	39233	0.00	0.00	0.00	0.00	0.29
Block voting power / largest voter	39233	0.00	0.00	0.00	0.03	0.67

Notes: This table reports descriptive statistics for synchronized small-voter blocks. A block consists of at least two distinct addresses voting for the same alternative within the same second, each holding no more than 10% of the largest individual voter's voting power in the proposal. Block voting power is the sum of the voting power of all addresses in the block. The last row reports this aggregate voting power relative to that of the largest individual voter in the proposal.

Table D.9 shows that the influence of these blocks in proposals is inexistent. The median block contains two addresses, and the 99th percentile of aggregate block voting power relative to the largest voter is only 3%. No identified block exceeds the largest voter in any proposal. Moreover, removing these blocks never changes the winning alternative, and no block overturns the largest voter's preferred outcome in any proposal for which this counterfactual can be assessed.

Table D.10 shows that neither of the two additional controls is statistically significant in the regression, suggesting that observable synchronized voting patterns do not impact the effect of the first swaying majority voters on returns.

Table D.10 – Impact of first swaying majority voters on Weekly CARs - Additional control of whether there is a block of small voters and the voting power of this block of small voters relative to the voting power of the swaying majority voter

Dependent variable: Weekly Cumulative Abnormal Returns following the proposal.
***,**,* indicate significance at the 1%, 5% and 10% levels. Standard errors are clustered at the DAO quarter level. Singletons are excluded from the sample.

	Weekly CARs	
	(1)	(2)
First swaying majority voter	-0.1269***	-0.1272***
	(-2.884)	(-2.891)
First swaying voter	0.0980*	0.0985*
	(1.900)	(1.910)
First majority voter	0.0129	0.0129
	(0.2586)	(0.2569)
Swaying majority voter	-0.0200	-0.0196
	(-1.147)	(-1.123)
Swaying voter	0.0086	0.0082
	(0.5435)	(0.5146)
Majority voter	-0.0110	-0.0109
	(-1.453)	(-1.440)
Presence of a block of small voters	0.0043	0.0026
	(0.3904)	(0.2347)
Ratio voting power block of small voters over largest voting power		0.1443
		(0.8763)
Market Controls	Yes	Yes
Proposal Controls	Yes	Yes
DAO x Quarter FE	Yes	Yes
Observations	5874	5874
Adj. R^2	0.25335	0.25328

Notes: Market controls include: (1) the *Market capitalization* of the DAO (log of the average market capitalization from one week before to one week after the proposal), (2) the *Trading volume* of the token of the DAO (log of the average trading volume from one week before to one week after the proposal), (3) the *Age* of the DAO at the moment of the proposal. Proposal-level controls include: (1) *Number of voters*, which accounts for the number of voters in a proposal; (2) the rolling average of *Number of voters*, which controls for trends in voter turnout over time; (3) *margin of victory*, which captures disagreement among tokenholders within a proposal; and (4) the rolling average of *margin of victory*, which accounts for trends in disagreement within DAOs.

E Step-by-step implementation of the GMM

The purpose of the implementation is to recover the structural parameter vector $\theta = (\pi, \delta, b, Q_1, Q_2)$. The equilibrium mixing probability μ_1 and the competitive prices p_1 and p_2 are not separately optimized. They are recovered from the model's equilibrium restrictions for each candidate value of θ.

E.1 Optimization Variables and Parameter Transformations

The structural parameters of the model are $\theta = (\pi, \delta, b, Q_1, Q_2)$. These parameters are economically constrained. The probabilities π, Q_1, and Q_2 must lie between zero and one, the convenience yield δ must be positive, and the private payoff b must be larger than δ. Thus, admissible parameters must satisfy

$$0 < \pi < 1, \qquad \delta > 0, \qquad b > \delta, \qquad 0 < Q_1 < 1, \qquad 0 < Q_2 < 1.$$

Instead of asking the optimizer to search directly over these constrained parameters, the code asks it to search over an unconstrained numerical vector

$$x = (x_\pi, x_\delta, x_b, x_{Q1}, x_{Q2}) \in \mathbb{R}^5$$

Each component of x is then transformed into an economically admissible structural parameter.

For the probability parameters, the code uses the logistic transformation

$$\pi = \frac{1}{1+\exp(-x_\pi)}, \quad Q_1 = \frac{1}{1+\exp(-x_{Q1})}, \quad Q_2 = \frac{1}{1+\exp(-x_{Q2})}$$

This transformation maps any real number into the interval $(0, 1)$. No matter what values the optimizer chooses for x_π, x_{Q1}, and x_{Q2}, the implied values of π, Q_1, and Q_2 are valid probabilities.

For the convenience yield, the code uses an exponential transformation $\delta = \exp(x_\delta)$ Since the exponential function is always strictly positive, this guarantees $\delta > 0$. For the private payoff, the code uses $b = \delta\,[1+\exp(x_b)]$. This transformation is chosen to impose the model restriction $b > \delta$. Indeed, $\frac{b}{\delta} = 1+\exp(x_b)$. Because $\exp(x_B) > 0$ for any finite value of x_b, it

follows that $\frac{b}{\delta} > 1$. Thus, the optimizer never has to handle the constraint $b > \delta$ directly. It is automatically satisfied by construction. The transformed parameters used in the model are therefore

$$\pi = \frac{1}{1+\exp(-x_\pi)}$$

$$\delta = \exp(x_\delta)$$

$$b = \exp(x_\delta)\,[1+\exp(x_b)]$$

$$Q_1 = \frac{1}{1+\exp(-x_{Q1})} \qquad Q_2 = \frac{1}{1+\exp(-x_{Q2})}$$

These transformations are purely numerical and only used to make sure that every parameter vector evaluated by the optimizer satisfies the economic restrictions of the model. The code also imposes bounds on the raw optimizer variables:

$$x_\pi \in [-12, 12], \quad x_\delta \in [-20, 5] \quad x_b \in [-20, 8] \quad x_{Q1} \in [-12, 12] \quad x_{Q2} \in [-12, 12]$$

These bounds are numerical safeguards. Without such bounds, the optimizer could try extremely large positive or negative values. The bounds are intentionally very wide. For example,

$$\frac{1}{1+\exp(-12)} \simeq 0.000006, \qquad \frac{1}{1+\exp(12)} \simeq 0.999994.$$

Thus the bounds on x_π, x_{Q1}, and x_{Q2} allow the corresponding probabilities to be essentially anywhere between zero and one. Similarly $x_\delta \in [-20, 5]$ allows $\delta \in [\exp(-20), \exp(5)]$ which is a very wide positive range. The purpose of the bounds is to keep the numerical optimization stable.

In summary, the optimizer searches over the raw vector x, while the model is always evaluated at the transformed structural vector

$$\theta(x) = \left(\frac{1}{1+\exp(-x_\pi)}, \exp(x_\delta), \exp(x_\delta)\,[1+\exp(x_b)]\,, \frac{1}{1+\exp(-x_{Q1})}, \frac{1}{1+\exp(-x_{Q2})} \right)$$

This procedure lets the code solve an unconstrained numerical problem while ensuring that every candidate parameter vector satisfies the model restrictions.

E.2 Equilibrium Recovery for Candidate Parameter Vector

For each candidate value chosen by the optimizer, the code first constructs a candidate structural parameter vector $\theta = (\pi, \delta, b, Q_1, Q_2)$ obtained from the raw optimizer vector $x = (x_\pi, x_\delta, x_b, x_{Q1}, x_{Q2})$. The code then checks whether this candidate vector supports a valid interior equilibrium of the model. For a candidate vector $(\pi, \delta, b, Q_1, Q_2)$ the code uses the indifference condition of the large blockholder who has misaligned preferences

$$(1+r)(1-\beta_1)(1-Q_1)(b-\delta) = \beta_2 p_2 + (1-\beta_1-\beta_2)\left[(1-Q_2)b + Q_2\delta\right]$$

This condition says that, in a mixed equilibrium, the large blockholder who has misaligned preferences must be indifferent between attacking at date 1 and waiting until date 2. Define $c_1 = (1+r)(1-\beta_1)(1-Q_1)$ and $c_2 = 1-\beta_1-\beta_2$. The indifference condition can be solved for the period-2 price implied by indifference:

$$p_2^I = \frac{c_1(b-\delta) - c_2\left[(1-Q_2)b + Q_2\delta\right]}{\beta_2}$$

The code first requires this implied price to be positive $p_2^I > 0$. If this condition fails, the candidate parameter vector cannot support the equilibrium and is rejected. The model also implies the period-2 pricing equation $p_2 = \delta\left[Q_2 + (1-Q_2)q_2\right]$ where q_2 is the posterior probability that the large blockholder is has preferences aligned with small shareholders after no successful attack at date 1. Combining this pricing equation with the price p_2^I implied by indifference gives

$$q_2 = \frac{p_2^I/\delta - Q_2}{1-Q_2}$$

The code then checks that the implied posterior is an interior probability $0 < q_2 < 1$. If this condition fails, the candidate vector is rejected. Given the posterior q_2, Bayes' rule links the posterior to the date-1 mixing probability μ_1, $q_2 = \frac{\pi}{\pi + (1-\pi)\mu_1}$. Solving this equation for μ_1 gives

$$\mu_1 = \frac{\pi}{1-\pi}\left(\frac{1}{q_2} - 1\right)$$

The code then checks that the implied mixing probability is also interior $0 < \mu_1 < 1$. If the implied value of μ_1 is not between zero and one, the candidate parameter vector does not

correspond to a valid mixed equilibrium and is therefore rejected.

Thus, for each candidate vector, the code checks whether the candidate parameters imply valid equilibrium prices, a valid posterior belief and a valid mixing probability. If any of these checks fail, the candidate parameter vector is treated as invalid.

E.3 Analytical moments and empirical counterparts

The GMM objective compares analytical moments implied by the model to corresponding empirical moments. The analytical moment vector is

$$m(\theta;\gamma) = \Big(m_A(\theta;\gamma), m_E(\theta;\gamma), m_N(\theta;\gamma), m_{Q1}(\theta;\gamma), m_{Q2}(\theta;\gamma)\Big)$$

where $m_A(\theta;\gamma)$ is the successful swaying frequency, $m_E(\theta;\gamma)$ is the successful swaying frequency when there is the first vote of the large blockholder, $m_N(\theta;\gamma)$ is the mean return no-swaying return when small shareholders get their convenience yield, $m_{Q1}(\theta;\gamma)$ is the early counter-swaying frequency, and $m_{Q2}(\theta;\gamma)$ is the late counter-swaying frequency. $\gamma = (\beta_1, \beta_2, r)$ is the vector of calibrated parameters.

Analytical moments can be written as functions of parameters within θ. The first two moments are successful attack frequencies. An early successful attack occurs when the blockholder is opportunistic, attacks at date 1, and is not blocked by small shareholders' turnout:

$$m_E(\theta;\gamma) = (1-\pi)\,[1-\mu_1(\theta;\gamma)]\,(1-Q_1)$$

A delayed successful attack occurs when the large blockholder has misaligned preferences, waits until date 2, and is not blocked at date 2:

$$m_L(\theta;\gamma) = (1-\pi)\mu_1(\theta;\gamma)(1-Q_2)$$

The total successful sway frequency is therefore

$$m_A(\theta;\gamma) = m_E(\theta;\gamma)+m_L(\theta;\gamma),$$

or equivalently

$$m_A(\theta;\gamma) = (1-\pi)\left[1-\mu_1(\theta;\gamma)\right](1-Q_1)+(1-\pi)\mu_1(\theta;\gamma)(1-Q_2)$$

The third moment is the mean return conditional on no successful sway. Define the date-1 no-success return as

$$R_1^{no}(\theta;\gamma) = \delta+\frac{p_2(\theta;\gamma)}{1+r}-p_1(\theta;\gamma)$$

and the date-2 no-success return as

$$R_2^{no}(\theta;\gamma) = \delta-p_2(\theta;\gamma)$$

The date-1 no-success probability is

$$\Omega_1(\theta;\gamma) = \Pr(\text{no successful attack at } t=1)$$

This includes three cases: the blockholder is has preferences aligned with the small shareholders, the blockholder is has preferences misaligned with the small shareholders and delays, or the blockholder is has preferences misaligned with the small shareholders, sways early but is blocked by small shareholders. Hence

$$\Omega_1(\theta;\gamma) = \pi+(1-\pi)\mu_1(\theta;\gamma)+(1-\pi)\left[1-\mu_1(\theta;\gamma)\right]Q_1$$

Since

$$m_E(\theta;\gamma) = (1-\pi)\left[1-\mu_1(\theta;\gamma)\right](1-Q_1)$$

this can also be written as

$$\Omega_1(\theta;\gamma) = 1-m_E(\theta;\gamma)$$

The date-2 no-success probability is

$$\Omega_2(\theta;\gamma) = \Pr(\text{no successful attack by } t=2)$$

This excludes both early successful attacks and delayed successful attacks. Therefore,

$$\Omega_2(\theta;\gamma) = 1-m_A(\theta;\gamma)$$

Equivalently,

$$\Omega_2(\theta;\gamma) = \pi+(1-\pi)\left[1-\mu_1(\theta;\gamma)\right]Q_1+(1-\pi)\mu_1(\theta;\gamma)Q_2$$

The analytical no-success return moment is therefore

$$m_N(\theta;\gamma) = \frac{\Omega_1(\theta;\gamma)R_1^{no}(\theta;\gamma)+\Omega_2(\theta;\gamma)R_2^{no}(\theta;\gamma)}{\Omega_1(\theta;\gamma)+\Omega_2(\theta;\gamma)}$$

Using the no-success probabilities above, this is

$$m_N(\theta;\gamma) = \frac{\left[1-m_E(\theta;\gamma)\right]\left[\delta+\dfrac{p_2(\theta;\gamma)}{1+r}-p_1(\theta;\gamma)\right]+\left[1-m_A(\theta;\gamma)\right]\left[\delta-p_2(\theta;\gamma)\right]}{\left[1-m_E(\theta;\gamma)\right]+\left[1-m_A(\theta;\gamma)\right]}$$

The fourth and fifth analytical moments are the two counter-swaying probabilities and are recovered directly:

$$m_{Q1}(\theta;\gamma) = Q_1 \qquad m_{Q2}(\theta;\gamma) = Q_2$$

I now derive the inverse mapping from analytical moments to parameters. Define the delayed successful sway moment as

$$m_L = m_A-m_E$$

Since

$$m_E = (1-\pi)(1-\mu_1)(1-Q_1)$$

and

$$m_L = (1-\pi)\mu_1(1-Q_2)$$

the two opportunistic-state masses are

$$a_E(m) = \frac{m_E}{1-m_{Q1}} \qquad \text{and} \qquad a_L(m) = \frac{m_A-m_E}{1-m_{Q2}}$$

These satisfy

$$a_E(m) = (1-\pi)(1-\mu_1) \qquad a_L(m) = (1-\pi)\mu_1$$

Therefore,

$$1-\pi = a_E(m)+a_L(m)$$

so the prior probability of the large blockholder's preferences being aligned type is

$$\pi(m) = 1-\frac{m_E}{1-m_{Q1}}-\frac{m_A-m_E}{1-m_{Q2}}$$

The delay probability is

$$\mu_1(m) = \frac{a_L(m)}{a_E(m)+a_L(m)} = \frac{(m_A-m_E)(1-m_{Q1})}{(m_A-m_E)(1-m_{Q1})+m_E(1-m_{Q2})}$$

The posterior belief can also be written as a function of analytical moments. Since

$$q_2 = \frac{\pi}{\pi+(1-\pi)\mu_1} = \frac{\pi(m)}{\pi(m)+a_L(m)} = \frac{1-\frac{m_E}{1-m_{Q1}}-\frac{m_A-m_E}{1-m_{Q2}}}{1-\frac{m_E}{1-m_{Q1}}}$$

Because both prices are proportional to δ, define the period-2 price coefficient

$$A_2(m) = m_{Q2}+(1-m_{Q2})q_2(m)$$

Substituting $q_2(m)$,

$$A_2(m) = m_{Q2}+(1-m_{Q2})\frac{1-\frac{m_E}{1-m_{Q1}}-\frac{m_A-m_E}{1-m_{Q2}}}{1-\frac{m_E}{1-m_{Q1}}}$$

Thus

$$p_2 = \delta A_2(m).$$

Similarly, the period-1 price coefficient is

$$A_1(m;\gamma) = \pi(m)+a_L(m)+a_E(m)m_{Q1}+\frac{\pi(m)+a_L(m)m_{Q2}}{1+r}$$

Substituting the analytical-moment expressions,

$$A_1(m;\gamma) = \left[1-\frac{m_E}{1-m_{Q1}}-\frac{m_A-m_E}{1-m_{Q2}}\right]+\frac{m_A-m_E}{1-m_{Q2}}+\frac{m_E}{1-m_{Q1}}m_{Q1}$$

$$+\frac{\left[1-\frac{m_E}{1-m_{Q1}}-\frac{m_A-m_E}{1-m_{Q2}}\right]+\frac{m_A-m_E}{1-m_{Q2}}m_{Q2}}{1+r}.$$

Thus

$$p_1 = \delta A_1(m;\gamma)$$

The no-success return moment identifies δ. Since

$$R_1^{no} = \delta\left[1+\frac{A_2(m)}{1+r}-A_1(m;\gamma)\right],$$

and

$$R_2^{no} = \delta\left[1-A_2(m)\right]$$

the analytical no-success return moment satisfies

$$m_N = \delta\frac{(1-m_E)\left[1+\frac{A_2(m)}{1+r}-A_1(m;\gamma)\right]+(1-m_A)\left[1-A_2(m)\right]}{(1-m_E)+(1-m_A)}$$

Therefore,

$$\delta(m;\gamma) = \frac{m_N\left[(1-m_E)+(1-m_A)\right]}{(1-m_E)\left[1+\frac{A_2(m)}{1+r}-A_1(m;\gamma)\right]+(1-m_A)\left[1-A_2(m)\right]}.$$

Finally, b is recovered from the opportunistic blockholder's indifference condition. Since

$$p_2 = \delta(m;\gamma)A_2(m)$$

the indifference condition is

$$(1+r)(1-\beta_1)(1-m_{Q1})\left[b-\delta(m;\gamma)\right] = \beta_2\delta(m;\gamma)A_2(m)$$

$$+(1-\beta_1-\beta_2)\left[(1-m_{Q2})b+m_{Q2}\delta(m;\gamma)\right].$$

Solving for b gives

$$b(m;\gamma) = \delta(m;\gamma)\frac{(1+r)(1-\beta_1)(1-m_{Q1})+\beta_2 A_2(m)+(1-\beta_1-\beta_2)m_{Q2}}{(1+r)(1-\beta_1)(1-m_{Q1})-(1-\beta_1-\beta_2)(1-m_{Q2})}$$

Thus, the five structural parameters can be written as explicit functions of the five analytical moments. The inverse mapping is well defined only when the analytical moments imply an admissible equilibrium. The numerical estimator solves the same exactly identified system while imposing these feasibility and equilibrium restrictions directly.

The empirical target vector is

$$\widehat{m} = \left(\widehat{m}_A, \widehat{m}_E, \widehat{m}_N, \widehat{m}_{Q1}, \widehat{m}_{Q2}\right)$$

where $\widehat{m}_A$ is the frequency of DAOs with majority swaying, $\widehat{m}_E$ is the frequency of DAOs with first majority swaying in the same proposal as proposals where there is the first majority voter, $\widehat{m}_N$ is the mean return of small shareholders grasping their convenience yield , $\widehat{m}_{Q1}$ is the frequency of proposals in which the minority turnout would have been sufficient to first majority swaying occurrence for DAOs for which the first swaying majority occurrence is also the first occurrence of a majority voter. $\widehat{m}_{Q2}$ is the frequency of proposals in which the minority turnout would have been sufficient to first majority swaying occurrence for DAOs for which the first swaying majority occurrence is not the first occurrence of a majority voter.

E.4 Construction of the Objective Function

The function that constructs the objective takes three types of inputs. First, it takes the empirical target moments $\widehat{m}$. Second, it takes the empirical standard errors of these moments. Third, it takes the calibrated parameters β_1, β_2, r. For any raw optimizer vector x, the code first maps x into structural parameters $\theta(x) = (\pi(x), \delta(x), b(x), Q_1(x), Q_2(x))$. It then checks whether this candidate supports a valid equilibrium. If it does, the code computes the analytical model moments $m(\theta(x))$. If the candidate vector does not generate a valid equilibrium, the objective does not attempt to compute model moments. For a feasible candidate x, the code first computes the vector of moment errors

$$e(x) = m(\theta(x))-\widehat{m}$$

Using the full bootstrap covariance matrix of the empirical moment vector, $\widehat{\Sigma}_m$, the GMM objective is

$$\mathcal{O}(x) = e(x)'\widehat{\Sigma}_m^{-1}e(x) = [m(\theta(x))-\widehat{m}]'\,\widehat{\Sigma}_m^{-1}\,[m(\theta(x))-\widehat{m}]$$

E.5 Computation of the covariance matrix

I estimate the covariance matrix of the empirical moments using a joint DAO-level bootstrap. The bootstrap is constructed so that all five targeted moments are recomputed within the same resampled dataset in each bootstrap draw. This preserves the sampling dependence between the frequency-based moments and the reduced-form return moment.

Specifically, in bootstrap draw (b), I sample DAOs with replacement from the estimation sample. For each sampled DAO, all underlying observations associated with that DAO are retained, so that the within-DAO dependence structure is preserved. When a DAO is sampled more than once, each occurrence is treated as a separate bootstrap copy. The fixed-effect and clustering identifiers used in the reduced-form regression are correspondingly relabeled across bootstrap copies so that repeated draws of the same original DAO are treated as distinct bootstrap sampling units. Overall I run computations with 2000 bootstrap draws.

For each bootstrap sample, I first recompute the four moments constructed directly from the DAO-level data: the successful-sway frequency, the early successful-sway frequency, and the two blocking-frequency moments. I then re-estimate the reduced-form return regression used to construct the no-sway return moment, average first sway return moment, average early first sway return moment and average late first sway return moment on the same bootstrap sample and record the coefficient corresponding to the no-sway feature interaction. Thus, the all return moments are bootstrapped jointly with the other.

If the empirical moment i obtained in bootstrap draw (b) is denoted $\widehat{m}_i^{(b)}$, then the final estimate of the bootstrapped moment i is $\widehat{m}_i = \frac{1}{B_{\text{boot}}}\sum_{b=1}^{B_{\text{boot}}}\widehat{m}_i^{(b)}$. The empirical moment

covariance matrix is then $\widehat{\Sigma}_m^{\text{boot}} =$

$$\begin{pmatrix} \widehat{\text{Var}}(\widehat{m}_A) & \widehat{\text{Cov}}(\widehat{m}_A, \widehat{m}_E) & \widehat{\text{Cov}}(\widehat{m}_A, \widehat{m}_N) & \widehat{\text{Cov}}(\widehat{m}_A, \widehat{m}_{Q1}) & \widehat{\text{Cov}}(\widehat{m}_A, \widehat{m}_{Q2}) & \widehat{\text{Cov}}(\widehat{m}_A, \widehat{m}_S) \\ \widehat{\text{Cov}}(\widehat{m}_E, \widehat{m}_A) & \widehat{\text{Var}}(\widehat{m}_E) & \widehat{\text{Cov}}(\widehat{m}_E, \widehat{m}_N) & \widehat{\text{Cov}}(\widehat{m}_E, \widehat{m}_{Q1}) & \widehat{\text{Cov}}(\widehat{m}_E, \widehat{m}_{Q2}) & \widehat{\text{Cov}}(\widehat{m}_E, \widehat{m}_S) \\ \widehat{\text{Cov}}(\widehat{m}_N, \widehat{m}_A) & \widehat{\text{Cov}}(\widehat{m}_N, \widehat{m}_E) & \widehat{\text{Var}}(\widehat{m}_N) & \widehat{\text{Cov}}(\widehat{m}_N, \widehat{m}_{Q1}) & \widehat{\text{Cov}}(\widehat{m}_N, \widehat{m}_{Q2}) & \widehat{\text{Cov}}(\widehat{m}_N, \widehat{m}_S) \\ \widehat{\text{Cov}}(\widehat{m}_{Q1}, \widehat{m}_A) & \widehat{\text{Cov}}(\widehat{m}_{Q1}, \widehat{m}_E) & \widehat{\text{Cov}}(\widehat{m}_{Q1}, \widehat{m}_N) & \widehat{\text{Var}}(\widehat{m}_{Q1}) & \widehat{\text{Cov}}(\widehat{m}_{Q1}, \widehat{m}_{Q2}) & \widehat{\text{Cov}}(\widehat{m}_{Q1}, \widehat{m}_S) \\ \widehat{\text{Cov}}(\widehat{m}_{Q2}, \widehat{m}_A) & \widehat{\text{Cov}}(\widehat{m}_{Q2}, \widehat{m}_E) & \widehat{\text{Cov}}(\widehat{m}_{Q2}, \widehat{m}_N) & \widehat{\text{Cov}}(\widehat{m}_{Q2}, \widehat{m}_{Q1}) & \widehat{\text{Var}}(\widehat{m}_{Q2}) & \widehat{\text{Cov}}(\widehat{m}_{Q2}, \widehat{m}_S) \\ \widehat{\text{Cov}}(\widehat{m}_S, \widehat{m}_A) & \widehat{\text{Cov}}(\widehat{m}_S, \widehat{m}_E) & \widehat{\text{Cov}}(\widehat{m}_S, \widehat{m}_N) & \widehat{\text{Cov}}(\widehat{m}_S, \widehat{m}_{Q1}) & \widehat{\text{Cov}}(\widehat{m}_S, \widehat{m}_{Q2}) & \widehat{\text{Var}}(\widehat{m}_S) \end{pmatrix}$$

E.6 Starting Values and Multiple Initializations

As the numerical minimization may depend on the initial value supplied to the optimizer, to reduce this dependence, the code solves the GMM problem from many different starting values and keeps the solution with the lowest objective value.

The code starts from the auxiliary tuple $(\pi_0, \delta_0, \mu_{1,0}, Q_{1,0}, Q_{2,0})$. Given this tuple, it uses the equilibrium indifference condition to recover the corresponding value of b_0. This produces the starting vector $(\pi_0, \delta_0, B_0, Q_{1,0}, Q_{2,0})$. The optimizer itself does not work directly with the tuple, it works with the transformed vector $x_0 = (x_{\pi,0}, x_{\delta,0}, x_{b,0}, x_{Q1,0}, x_{Q2,0})$. Therefore, after constructing a valid structural starting vector $(\pi_0, \delta_0, B_0, Q_{1,0}, Q_{2,0})$, the code converts it into:

$$x_{\pi,0} = \log\left(\frac{\pi_0}{1-\pi_0}\right), \quad x_{\delta,0} = \log(\delta_0), \quad x_{b,0} = \log\left(\frac{b_0}{\delta_0} - 1\right) \quad x_{Q1,0} = \log\left(\frac{Q_{1,0}}{1-Q_{1,0}}\right) \quad x_{Q2,0} = \log\left(\frac{Q_{2,0}}{1-Q_{2,0}}\right)$$

The code uses two separate types of starting values. The first type consists of four deterministic starting tuples. They are four complete five-dimensional candidate tuples: (0.52,0.14,0.55,0.03,0.03), (0.45,0.10,0.40,0.08,0.05), (0.65,0.20,0.70,0.05,0.08), (0.35,0.08,0.30,0.10,0.10). Each tuple corresponds to $(\pi_0, \delta_0, \mu_{1,0}, Q_{1,0}, Q_{2,0})$. For each tuple, the code recovers B_0 from the equilibrium indifference condition. If the resulting vector $(\pi_0, \delta_0, B_0, Q_{1,0}, Q_{2,0})$ supports a valid interior equilibrium, it is converted into the raw optimizer vector x_0 and added to the list of starting values. If it does not support a valid equilibrium, it is discarded.

The second type consists of random starting tuples. These random starts are independent of the deterministic starts. They are simply an additional set of initial guesses. In the baseline

implementation described here, the code uses `random_starts` = 50000. For each random start, the code draws

$$\pi_0 \sim U(0.05, 0.95)$$
$$u_{\delta,0} \sim U(\log(0.002), \log(1.0))$$
$$\mu_{1,0} \sim U(0.05, 0.95)$$
$$Q_{1,0} \sim U(0.005, 0.25)$$
$$Q_{2,0} \sim U(0.005, 0.25)$$

The code treats this random tuple in exactly the same way as a deterministic tuple. It uses the equilibrium indifference condition to recover B_0, thereby constructing $(\pi_0, \delta_0, b_0, Q_{1,0}, Q_{2,0})$ If this structural vector supports a valid interior equilibrium, it is converted into raw optimizer coordinates and added to the list of starting values. If it does not support a valid equilibrium, it is skipped.

The total number of optimizer runs is equal to the number of valid starting values. The code first attempts four deterministic starting tuples and then attempts 50000 random starts.

E.7 Optimization Algorithm

For each valid starting value, the code calls the Newton algorithm for bound-constrained optimization (L-BFGS-B in `scipy.optimize.minimize`). The code minimizes a smooth objective over a small number of parameters while imposing simple bounds on the raw optimizer variables.

$$\widehat{x} = \arg\min_x \mathcal{O}(x)$$

subject to the bounds

$$-12 \leq x_\pi \leq 12 \quad -20 \leq x_\delta \leq 5 \quad -20 \leq x_b \leq 8 \quad -12 \leq x_{Q1} \leq 12 \quad -12 \leq x_{Q2} \leq 12$$

L-BFGS-B is appropriate here for three reasons. First, the objective is smooth whenever the candidate vector supports an interior equilibrium. The model-implied moments are analytical functions of the transformed parameters. Therefore, a gradient-based method can efficiently

search for the minimum. Second, the optimizer must respect numerical bounds. Third, the dimension of the problem is small $x \in \mathbb{R}^5$, a quasi-Newton method is therefore computationally efficient.

The optimizer is calls `maxiter` $= 5000$ which gives the optimizer a large number of iterations to converge from different starting values, `ftol` $= 10^{-14}$ which requires the objective value to stop improving before the algorithm declares convergence and `gtol` $= 10^{-10}$ which requires the projected gradient to be very small.

After all starting values have been used, the code keeps the solution with the lowest objective value:

$$\widehat{x} = \widehat{x}^{\,s^\star}, \qquad s^\star = \arg\min_s \mathcal{O}(\widehat{x}^{\,s})$$

The final raw optimizer vector $\widehat{x}$ is then transformed back into the estimated structural parameters:

$$\widehat{\theta} = \theta(\widehat{x}) = (\widehat{\pi}, \widehat{\delta}, \widehat{B}, \widehat{Q}_1, \widehat{Q}_2)$$

After selecting the best optimizer result, the code performs a final equilibrium check before reporting the estimates.

E.8 Validation

The code computes a model-implied untargeted validation moment, namely the mean first-majority sway return. This moment is not used in the GMM objective. It is computed after estimation and compared to its empirical counterpart as an out-of-sample validation of the model. The model-implied untargeted moment is

$$\widehat{g}(\widehat{\theta}) = \frac{\widehat{f}_E(-\widehat{p}_1)+\widehat{f}_L(-\widehat{p}_2)}{\widehat{f}_E+\widehat{f}_L}$$

where

$$\widehat{f}_E = (1-\widehat{\pi})(1-\widehat{\mu}_1)(1-\widehat{Q}_1)$$

is the probability of a successful early sway, and

$$\widehat{f}_L = (1-\widehat{\pi})\widehat{\mu}_1(1-\widehat{Q}_2)$$

is the probability of a successful delayed sway. Equivalently,

$$\widehat{g}(\widehat{\theta}) = -\frac{(1-\widehat{\mu}_1)(1-\widehat{Q}_1)\widehat{p}_1+\widehat{\mu}_1(1-\widehat{Q}_2)\widehat{p}_2}{(1-\widehat{\mu}_1)(1-\widehat{Q}_1)+\widehat{\mu}_1(1-\widehat{Q}_2)}$$

With equilibrium-implied prices

$$\widehat{p}_2 = \widehat{\delta}\left[\widehat{Q}_2+(1-\widehat{Q}_2)\widehat{q}_2\right], \quad \widehat{p}_1 = \widehat{\delta}\left[\widehat{\pi}+(1-\widehat{\pi})\widehat{\mu}_1+(1-\widehat{\pi})(1-\widehat{\mu}_1)\widehat{Q}_1\right]+\frac{\widehat{\delta}}{1+r}\left[\widehat{\pi}+(1-\widehat{\pi})\widehat{\mu}_1\widehat{Q}_2\right]$$

and $\widehat{\mu}_1 = \frac{\widehat{\pi}}{1-\widehat{\pi}}\left(\frac{1}{\widehat{q}_2}-1\right)$ with $\widehat{q}_2 = \frac{\widehat{p}_2^I/\widehat{\delta}-\widehat{Q}_2}{1-\widehat{Q}_2}$. The raw optimizer solution is retained for post-estimation of $\delta-(1-\beta_1-\beta_2)B$ evaluated as functions of $\widehat{x}$.

E.9 Standard errors computations

I compute standard errors using the delta method. The delta method provides a local linear approximation to the mapping from the empirical moments into the estimated structural parameters. Although this mapping is nonlinear, its behavior in a neighborhood of the estimate can be approximated using the corresponding Jacobian matrices. This approximation allows the sampling uncertainty in the empirical moments to be propagated into sampling uncertainty in the structural parameters and in functions of those parameters.

Let x denote the vector of raw optimizer coordinates and let

$$m(\theta(x);\gamma)$$

denote the vector of model-implied targeted moments, where $\theta(x)$ maps the raw optimizer coordinates into the structural parameters and γ collects the calibrated parameters. The Jacobian of the model moments with respect to the raw optimizer coordinates is

$$G = \left.\frac{\partial m(\theta(x);\gamma)}{\partial x'}\right|_{x=\widehat{x}}$$

In the implementation, this Jacobian is evaluated numerically using finite differences. A first-order Taylor expansion around the estimated optimizer vector gives

$$m(\theta(x);\gamma) \approx m(\theta(\widehat{x});\gamma)+G(x-\widehat{x})$$

Covariance matrix of the estimated parameters

Let $\widehat{\Sigma}_m^{\text{boot}} = \widehat{\Sigma}_m$ denote the full bootstrap covariance matrix of the empirical moment estimates. The minimum-distance weighting matrix is constructed as

$$W = \widehat{\Sigma}_m^{+},$$

where + denotes the Moore-Penrose pseudoinverse. In the Python implementation, the Moore-Penrose pseudoinverse is computed using NumPy's `np.linalg.pinv()` function, with the option `hermitian=True` for the symmetric covariance-type matrices.

Given G, W, and $\widehat{\Sigma}_m$, the covariance matrix of the raw optimizer vector is computed using the GMM sandwich formula

$$\widehat{\mathrm{Var}}(\widehat{x}) = (G'WG)^{+} G'W\widehat{\Sigma}_m WG\,(G'WG)^{+}$$

The uncertainty in the raw optimizer estimates is translated into uncertainty in the structural parameters using the delta method. Let

$$\left.\frac{\partial \theta(x)}{\partial x'}\right|_{x=\widehat{x}}$$

denote the Jacobian that maps small changes in the raw optimizer vector (x) into changes in the structural parameter vector θ. In the implementation, this Jacobian is computed numerically using finite differences. The covariance matrix of the estimated structural parameters is then

$$J_\theta \widehat{\mathrm{Var}}(\widehat{x}) J_\theta'$$

The standard error of each structural parameter is obtained as the square root of the corresponding diagonal element of this covariance matrix $\widehat{SE}(\widehat{\theta}) = \sqrt{\left[\widehat{\mathrm{Var}}(\widehat{\theta})\right]_{kk}}$.

Delta-method inference for structural tests

The same approach is used to conduct inference on nonlinear restrictions involving the

estimated structural parameters. Let

$$g_j(x) = g_j(\theta(x); \gamma)$$

denote a scalar function representing structural test j. Depending on the economic restriction of interest, g_j may measure, for example, the difference between two model-implied payoffs or values. For each test, I first evaluate the restriction at the estimated parameters,

$$\widehat{g}_j = g_j(\widehat{x}),$$

and compute its gradient with respect to the raw optimizer coordinates,

$$J_{g_j} = \left. \frac{\partial g_j(x)}{\partial x'} \right|_{x=\widehat{x}}$$

As with the moment and parameter Jacobians, J_{g_j} is evaluated numerically using finite differences. The delta-method variance of the estimated restriction is

$$\widehat{\mathrm{Var}}(\widehat{g}_j) = J_{g_j} \widehat{\mathrm{Var}}(\widehat{x}) J_{g_j}'$$

so that

$$\widehat{SE}(\widehat{g}_j) = \sqrt{J_{g_j} \widehat{\mathrm{Var}}(\widehat{x}) J_{g_j}'}$$

The corresponding standardized test statistic is

$$z_{g_j} = \frac{\widehat{g}_j}{\widehat{SE}(\widehat{g}_j)}$$

For a one-sided restriction of the form

$$H_0 : g_j \leq 0, \qquad H_1 : g_j > 0,$$

the reported p-value is $p_{g_j} = 1 - \Phi(z_{g_j})$ where $\Phi(\cdot)$ denotes the standard normal cumulative distribution function.

The figures across different values of β_2 in Appendix F report symmetric two-sided confidence intervals around the estimated restriction, in order to display the magnitude and

sampling uncertainty of the restriction across the different calibrations of β_2.

Untargeted validation moment

The same delta-method logic is also used for the untargeted validation moment. Let $g_{\text{val}}(x) = m_{\text{val}}^{\text{model}}(x) - \widehat{m}_{\text{val}}^{\text{data}}$ denote the difference between the model-implied untargeted moment and its empirical counterpart. The code uses $\widehat{SE}(g_{\text{val}}) = \sqrt{\widehat{SE}\left(m_{\text{val}}^{\text{model}}\right)^2 + \widehat{SE}\left(\widehat{m}_{\text{val}}^{\text{data}}\right)^2}$ which assumes independence between the model-implied and empirical components. Because the validation exercise tests equality rather than a directional inequality, the corresponding statistic is

$$z_{\text{val}} = \frac{m_{\text{val}}^{\text{model}}(\widehat{x}) - \widehat{m}_{\text{val}}^{\text{data}}}{\widehat{SE}(g_{\text{val}})}$$

with two-sided p-value $p_{\text{val}} = 2\left[1 - \Phi\left(|z_{\text{val}}|\right)\right]$.

E.10 Regression for the early and late effect of first swaying majority on weekly CARs

To estimate the returns associated with early and delayed first successful sways, I adapt the triple-difference regression design in Equation 1 to distinguish the timing of the first swaying-majority-voter occurrence. Specifically, Equation 35 interacts the first swaying-majority-voter indicator with the first majority-voter indicator, identifying instances in which the first successful sway coincides with the first majority-voter occurrence. Conversely, Equation 36 interacts the first swaying-majority-voter indicator with the complement of the first majority-voter indicator, identifying instances in which the first successful sway occurs after an earlier majority-voter occurrence. Both specifications retain the remaining voting-status indicators, the same set of controls, and the proposal-by-time fixed effects from the baseline specification. The coefficients $\widehat{\alpha}1^E$ and $\widehat{\alpha}1^L$ capture the incremental price responses associated with early and delayed first successful sways, respectively, conditional on these controls. These two coefficients provide the empirical return moments used to assess the model's predictions for the early and delayed first-sway returns, $m_{SE}(\theta;\gamma) = -p_1$ and $m_{SL}(\theta;\gamma) = -p_2$.

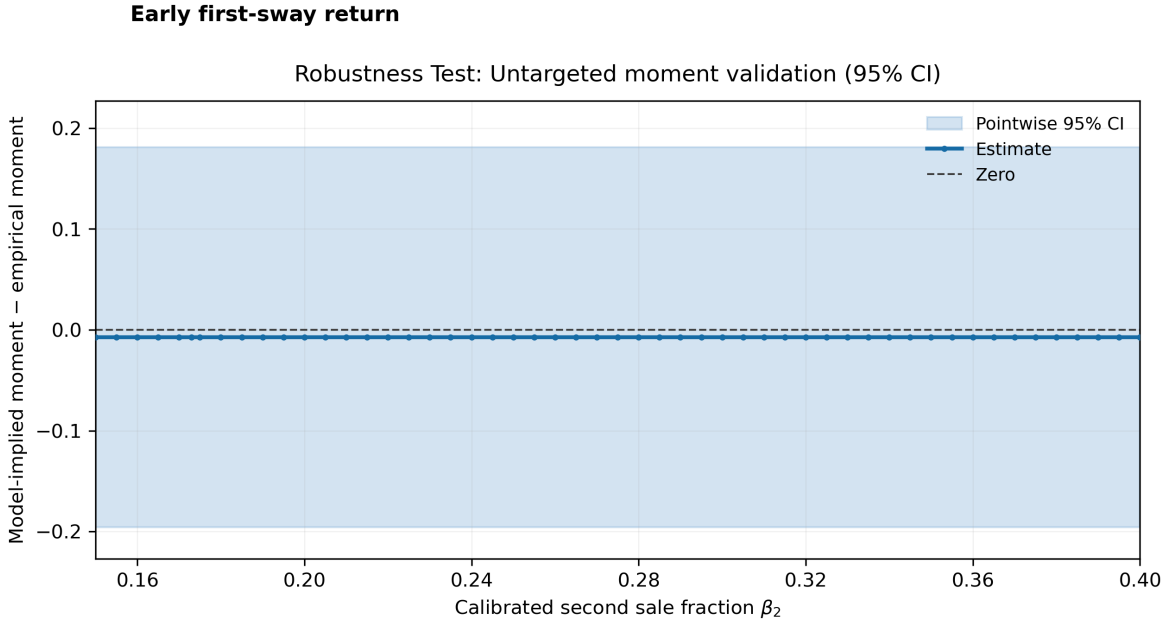
$$
\begin{aligned}
CAR_{i,d,t} = {} & \alpha_1^E \cdot \mathbf{1}(\text{First Swaying Majority voter})_{i,d} \cdot \mathbf{1}(\text{First Majority voter})_{i,d} \\
& + \alpha_2^E \cdot \mathbf{1}(\text{First Swaying voter})_{i,d} \\
& + \alpha_3^E \cdot \mathbf{1}(\text{First Majority voter})_{i,d} \\
& + \alpha_4^E \cdot \mathbf{1}(\text{Swaying Majority voter})_{i,d} \\
& + \alpha_5^E \cdot \mathbf{1}(\text{Swaying voter})_{i,d} \\
& + \alpha_6^E \cdot \mathbf{1}(\text{Majority voter})_{i,d} \\
& + (\boldsymbol{\beta}^E)^\top \mathbf{X}_{i,d,t} + \gamma_{d\times t}^E + \varepsilon_{i,d,t}^E.
\end{aligned} \tag{35}
$$

$$
\begin{aligned}
CAR_{i,d,t} = {} & \alpha_1^L \cdot \mathbf{1}(\text{First Swaying Majority voter})_{i,d} \cdot [1 - \mathbf{1}(\text{First Majority voter})_{i,d}] \\
& + \alpha_2^L \cdot \mathbf{1}(\text{First Swaying voter})_{i,d} \\
& + \alpha_3^L \cdot \mathbf{1}(\text{First Majority voter})_{i,d} \\
& + \alpha_4^L \cdot \mathbf{1}(\text{Swaying Majority voter})_{i,d} \\
& + \alpha_5^L \cdot \mathbf{1}(\text{Swaying voter})_{i,d} \\
& + \alpha_6^L \cdot \mathbf{1}(\text{Majority voter})_{i,d} \\
& + (\boldsymbol{\beta}^L)^\top \mathbf{X}_{i,d,t} + \gamma_{d\times t}^L + \varepsilon_{i,d,t}^L.
\end{aligned} \tag{36}
$$

F Robustness checks: Structural estimation

F.1 Baseline 6 moments estimation

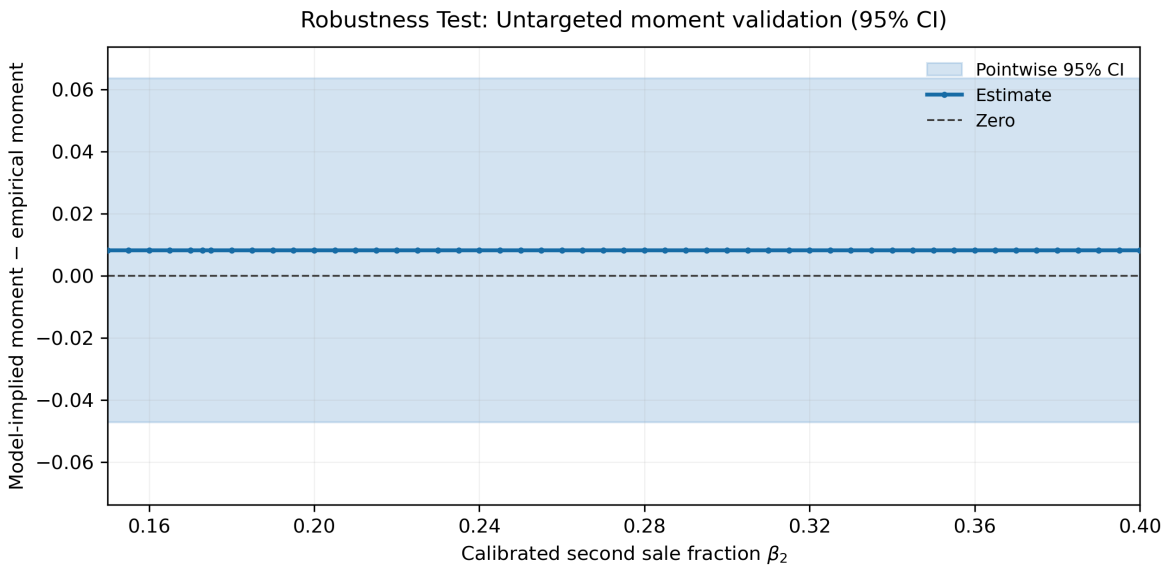
Figure F.1 – Sensitivity of the difference between the estimated mean return after an early sway and the data estimate to the calibration of β_2. The solid line reports the point estimate, the shaded area denotes the 95% confidence interval.



Pointwise 95% confidence interval for the model-minus-data difference; covariance-corrected using the joint DAO bootstrap.

Figure F.2 – Sensitivity of the difference between the estimated mean return after a late sway and the data estimate to the calibration of β_2. The solid line reports the point estimate, the shaded area denotes the 95% confidence interval.

Delayed first-sway return



Pointwise 95% confidence interval for the model-minus-data difference; covariance-corrected using the joint DAO bootstrap.

Figure F.3 – Sensitivity of the expected large-blockholder payoff condition to the calibration of β_2. The figure plots the percentage decline in aggregate shareholder welfare when the large blockholder sways, relative to welfare along the no-sway path. A value of x% indicates that swaying reduces aggregate shareholder welfare by x% relative to the no-sway benchmark. The solid line represents the point estimate, and the shaded area denotes the 95% confidence interval.

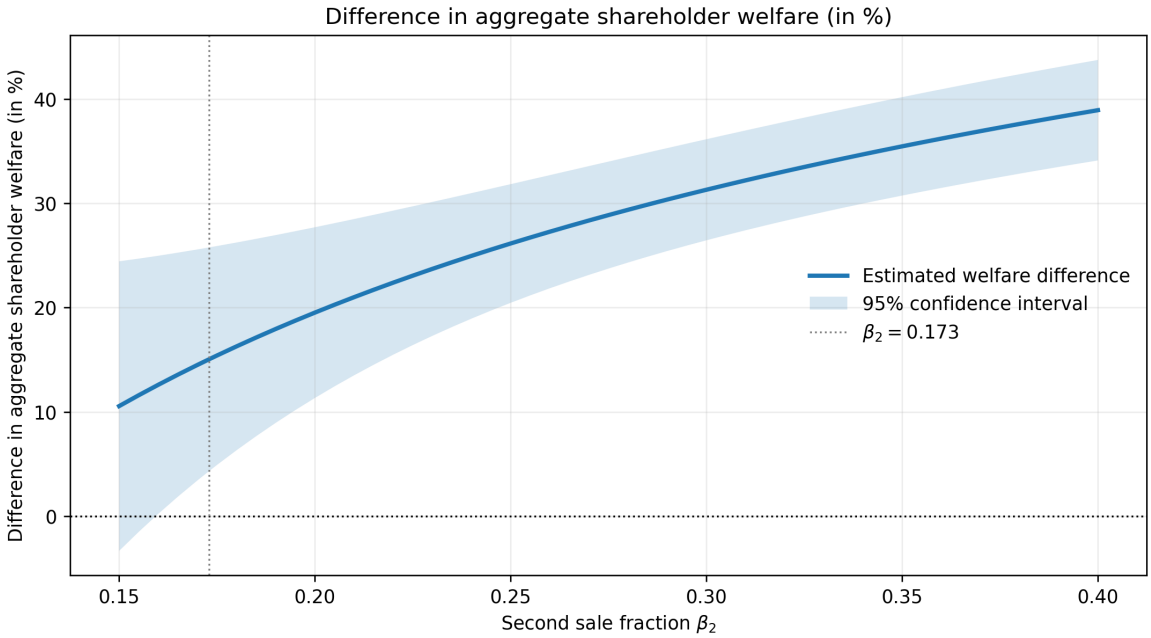
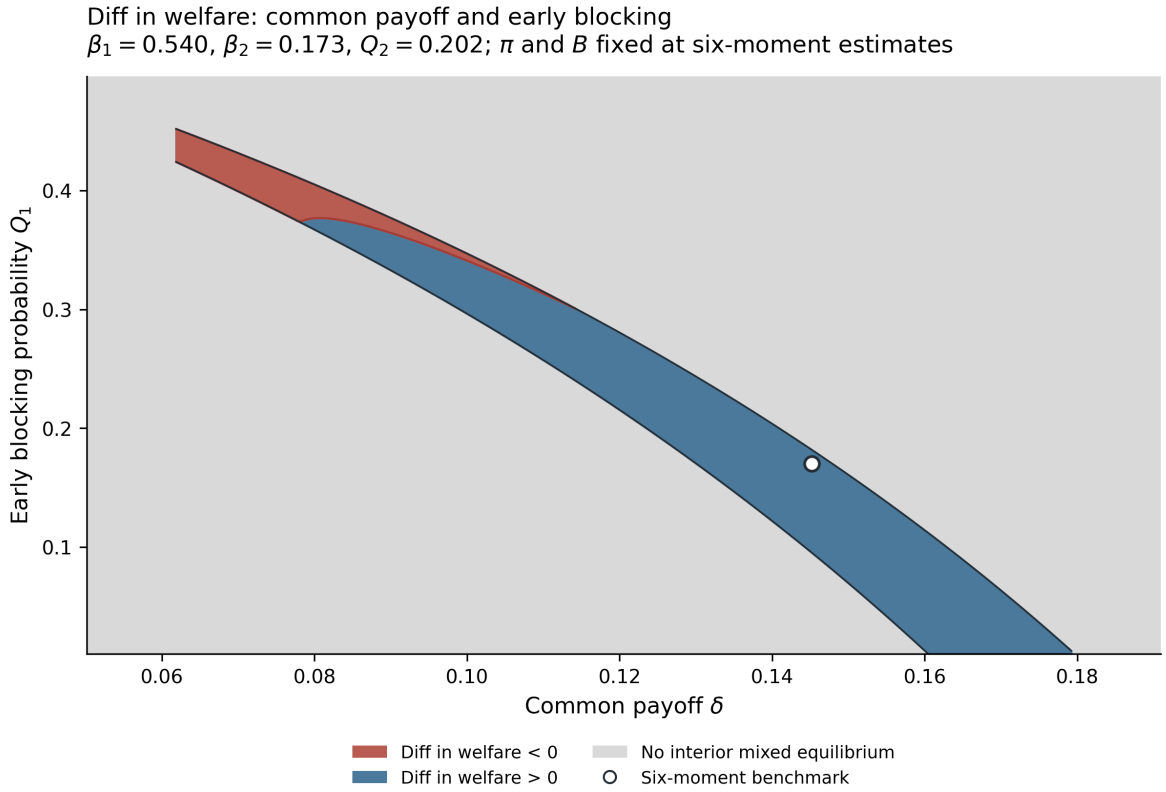
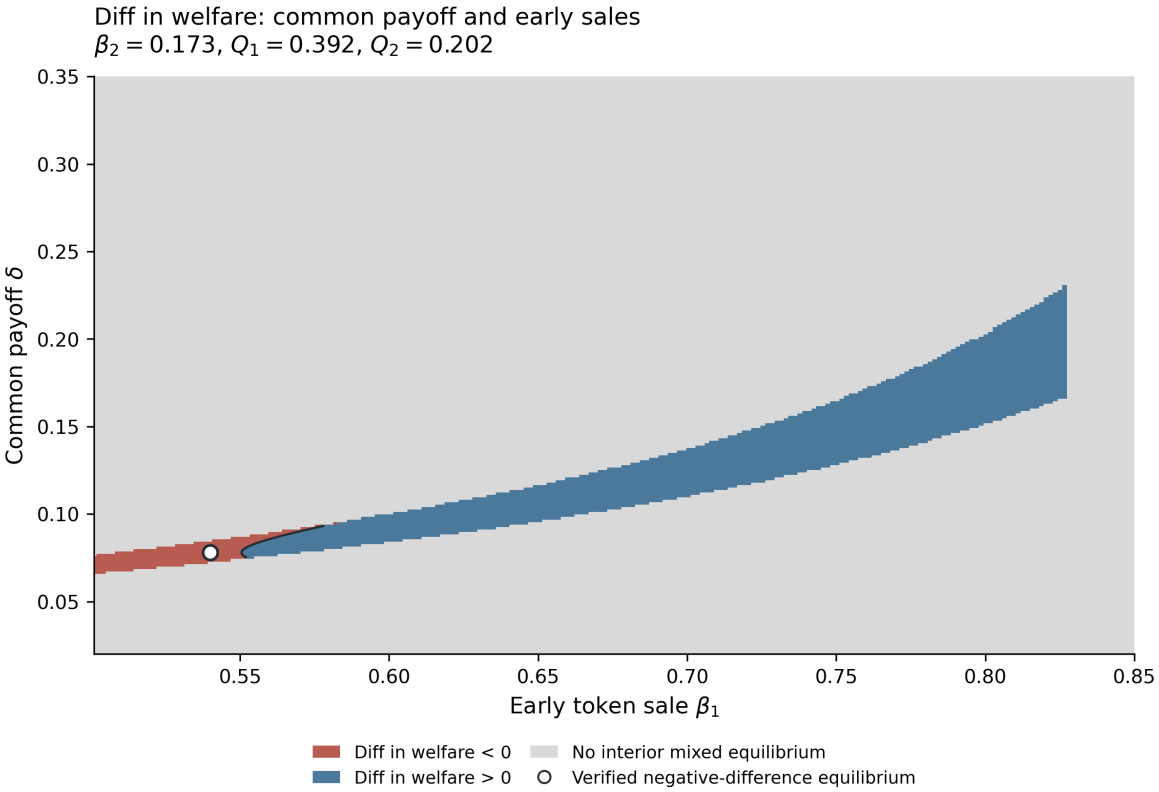


Figure F.4 – Counterfactual Scenarios for welfare effects of swaying: Common Payoff and Early Blocking Probability



Notes. This figure examines how the welfare effects of swaying vary with the common payoff δ and the probability that small shareholders successfully block an early swaying attempt, Q_1. The parameters $\beta_1 = 0.540$, $\beta_2 = 0.173$, and $Q_2 = 0.202$ are held fixed, together with π and B at their six-moment estimates. Red regions indicate negative welfare differences, corresponding to equilibria in which the large blockholder maximizes aggregate shareholder welfare by swaying rather than following the no-sway path. Blue regions indicate positive welfare differences, corresponding to equilibria in which swaying reduces aggregate shareholder welfare.

Figure F.5 – Counterfactual Scenarios for welfare effects of swaying: common payoff and early token sales



Notes. This figure examines how the welfare effects of swaying vary with the common payoff δ and the early token-sale parameter β_1.The parameters $\beta_2 = 0.173$, $Q_1 = 0.392$, and $Q_2 = 0.202$ are held fixed. Red regions indicate negative welfare differences, corresponding to equilibria in which the large blockholder maximizes aggregate shareholder welfare by swaying rather than following the no-sway path. Blue regions indicate positive welfare differences, corresponding to equilibria in which swaying reduces aggregate shareholder welfare.

F.2 8 moments estimation robustness check

In this robustness check, I show that structurally estimating with 2 additional overidentifying moments lead a good fit and the same result for the welfare differences.

F.2.1 Additional price restrictions

I extend the baseline six-moment estimation by incorporating two additional return moments that distinguish the market response to the first successful sway according to its timing. The seventh moment is the mean return following an early first successful sway, defined as an event in which the first swaying-majority-voter occurrence coincides with the first majority-voter occurrence. I estimate its empirical counterpart using the adaptation of the baseline triple-difference specification in Equation 35. The coefficient $\widehat{\alpha}_1^E$ measures the incremental cumulative abnormal return associated with this early event, conditional on the remaining voting indicators, controls, and fixed effect structure. The corresponding model moment is $m_{SE}(\theta;\gamma) = -p_1(\theta;\gamma)$. This additional restriction disciplines the initial valuation implied by the estimated common payoff δ, the prior probability of aligned preferences π, and expectations about subsequent swaying.

The eighth moment is the mean return following a delayed first successful sway, defined as an event in which the first swaying-majority-voter occurrence does not coincide with the first majority-voter occurrence. I obtain its empirical counterpart from Equation 36, using the coefficient $\widehat{\alpha}_1^L$. Its model-implied counterpart is $m_{SL}(\theta;\gamma) = -p_2(\theta;\gamma)$. Unlike p_1, the second-period token price incorporates the information conveyed by the absence of an early successful sway. In the model, the posterior probability of an aligned blockholder is $q_2 = \pi/[\pi+(1-\pi)\mu_1]$, and the second-period price satisfies $p_2 = \delta[Q_2+(1-Q_2)q_2]$. The eighth moment therefore disciplines the valuation generated by Bayesian updating, the equilibrium delay probability, and the possibility that small shareholders prevent a late swaying attempt.

I match these 8 moments with 8 empirical counterparts:

$$\widehat{m} = \begin{pmatrix} \widehat{m}_A \\ \widehat{m}_E \\ \widehat{m}_N \\ \widehat{m}_{Q1} \\ \widehat{m}_{Q2} \\ \widehat{m}_S \\ \widehat{m}_{SE} \\ \widehat{m}_{SL} \end{pmatrix} = \begin{pmatrix} \text{Frequency of sway} \\ \text{Frequency of early sway} \\ \text{Reg coef no majority x features on returns} \\ \text{Freq small turnout able to stop early sway} \\ \text{Freq small turnout able to stop late sway} \\ \text{Reg coef first majority sway on returns} \\ \text{Reg coef early first majority sway on returns} \\ \text{Reg coef late first majority sway on returns} \end{pmatrix}$$

F.2.2 Joint bootstrap covariance and GMM inference

I repeat the DAO-level bootstrap procedure used for the six-moment specification, now recomputing all eight moments jointly in each resample. In particular, I re-estimate the reduced-form return coefficients underlying the mean first-sway return and the early- and delayed-sway returns within the same bootstrap replication, together with the frequency, no-sway-return, and blocking moments. Stacking the resulting estimates yields the full 8×8 bootstrap covariance matrix, $\widehat{\Sigma}_8$. Here, $\widehat{V}_i$ denotes the bootstrapped variance of moment i, and $\widehat{C}_{i,j}$ denotes the bootstrapped covariance between moments i and j. The resulting boostrap covariance matrix is he resulting empirical covariance matrix is

$$\widehat{\Sigma}^{\text{boot}}_{m,8} = \begin{pmatrix} \widehat{V}_A & \widehat{C}_{A,E} & \widehat{C}_{A,N} & \widehat{C}_{A,Q1} & \widehat{C}_{A,Q2} & \widehat{C}_{A,S} & \widehat{C}_{A,SE} & \widehat{C}_{A,SL} \\ \widehat{C}_{E,A} & \widehat{V}_E & \widehat{C}_{E,N} & \widehat{C}_{E,Q1} & \widehat{C}_{E,Q2} & \widehat{C}_{E,S} & \widehat{C}_{E,SE} & \widehat{C}_{E,SL} \\ \widehat{C}_{N,A} & \widehat{C}_{N,E} & \widehat{V}_N & \widehat{C}_{N,Q1} & \widehat{C}_{N,Q2} & \widehat{C}_{N,S} & \widehat{C}_{N,SE} & \widehat{C}_{N,SL} \\ \widehat{C}_{Q1,A} & \widehat{C}_{Q1,E} & \widehat{C}_{Q1,N} & \widehat{V}_{Q1} & \widehat{C}_{Q1,Q2} & \widehat{C}_{Q1,S} & \widehat{C}_{Q1,SE} & \widehat{C}_{Q1,SL} \\ \widehat{C}_{Q2,A} & \widehat{C}_{Q2,E} & \widehat{C}_{Q2,N} & \widehat{C}_{Q2,Q1} & \widehat{V}_{Q2} & \widehat{C}_{Q2,S} & \widehat{C}_{Q2,SE} & \widehat{C}_{Q2,SL} \\ \widehat{C}_{S,A} & \widehat{C}_{S,E} & \widehat{C}_{S,N} & \widehat{C}_{S,Q1} & \widehat{C}_{S,Q2} & \widehat{V}_S & \widehat{C}_{S,SE} & \widehat{C}_{S,SL} \\ \widehat{C}_{SE,A} & \widehat{C}_{SE,E} & \widehat{C}_{SE,N} & \widehat{C}_{SE,Q1} & \widehat{C}_{SE,Q2} & \widehat{C}_{SE,S} & \widehat{V}_{SE} & \widehat{C}_{SE,SL} \\ \widehat{C}_{SL,A} & \widehat{C}_{SL,E} & \widehat{C}_{SL,N} & \widehat{C}_{SL,Q1} & \widehat{C}_{SL,Q2} & \widehat{C}_{SL,S} & \widehat{C}_{SL,SE} & \widehat{V}_{SL} \end{pmatrix}$$

F.2.3 Structural estimates and fit

Table F.1 reports the estimates, their delta-method standard errors for the calibration with $\beta_1 = 0.54$, $\beta_2 = 0.173$, and $r = 0.183$. All eight targeted moments at the benchmark. The J-statistic is small and equal to 0.767 corresponding to a p-value of 0.856, so the overidentifying restrictions cannot be rejected at conventional significance levels.

Table F.1 – Structural estimates and model fit

	Symbol	Model	S.E.	Data/Target
Panel A. Estimated parameters				
Prior probability of benevolent type	π	0.4074	0.073	–
Shareholders' payoff	δ	0.143	0.04	–
Large blockholder's private payoff	b	0.393	0.137	–
Early counter-sway probability (time 1)	Q_1	0.173	0.109	–
Late counter-sway probability (time 2)	Q_2	0.2024	0.052	–
Delay probability	μ_1	0.746	Estimated via eq.	–
Panel B. Targeted moments				
Successful sway frequency	-	0.478	0.056	0.477
Early successful sway frequency	-	0.124	0.034	0.136
Mean no-sway return	-	0.04	0.011	0.043
Mean first sway return	-	-0.11	0.033	-0.112
Early counter-sway frequency (time 1)	-	0.173	0.109	0.168
Late counter-sway frequency (time 2)	-	0.201	0.052	0.201
Mean early first-sway return	-	-0.185	0.056	-0.178
Mean late first-sway return	-	-0.083	0.026	-0.093

Notes. Panel A reports the estimated structural parameters. Panel B reports the model-implied targeted moments and their empirical counterparts, together with standard errors. The Hansen J-statistic is J=0.7688, with a p-value of 0.8568, indicating that the overidentifying restrictions cannot be rejected. Standard errors of model-implied moments are computed using the delta method, as detailed in Appendix E.9.

F.2.4 Shareholder welfare

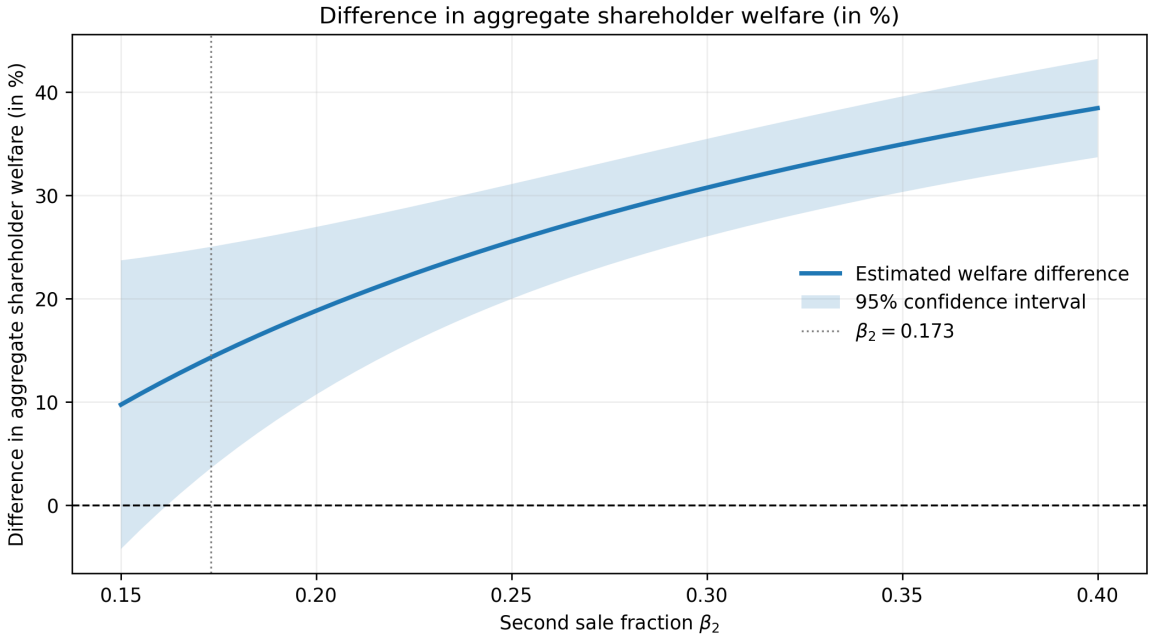
Finally, I repeat the eight-moment estimation for alternative calibrations of the second-period share sale fraction β_2, holding β_1 and r fixed. For each calibration, I recover the blockholder's private benefit from the equilibrium indifference condition and recompute the welfare comparison using the same payoff specification as in the baseline analysis. Specifically, the no-sway benchmark is $(1+1/(1+r))\delta$, while expected aggregate shareholder welfare along

the misaligned-blockholder path is

$$(1-\mu_1)\left[Q_1\delta+(1-Q_1)(1-\beta_1)b\right]+\mu_1\left[\delta+\frac{Q_2\delta+(1-Q_2)(1-\beta_1-\beta_2)b}{1+r}\right]$$

Figure F.6 shows that the estimated change in welfare remains negative and statistically different from zero across the calibrated values of β_2.

Figure F.6 – Sensitivity of the expected large-blockholder payoff condition to the calibration of β_2. The figure plots the percentage decline in aggregate shareholder welfare when the large blockholder sways, relative to welfare along the no-sway path. A value of x% indicates that swaying reduces aggregate shareholder welfare by x% relative to the no-sway benchmark. The solid line represents the point estimate, and the shaded area denotes the 95% confidence interval.



F.3 5 moments exactly identified calibration

As an additional robustness check, I estimate an exactly identified specification using five empirical moments to recover the five structural parameters $(\pi, \delta, B, Q_1, Q_2)$. The five targeted moments are the overall successful-sway frequency,the early successful-sway frequency, the mean no-sway return, and the two counter-swaying frequencies. The sway frequencies continue to discipline the large blockholder's decision to sway immediately or delay, while the equilibrium

timing-indifference condition recovers the private benefit B. Its fit is measured relative to an untargeted moment, here I use the mean return after first sway.

F.3.1 Validation using the untargeted first-sway return

I use the mean return following the first successful sway as an untargeted moment. Its empirical counterpart is the coefficient $\widehat{\alpha}_1$ on the first swaying-majority-voter indicator in the baseline triple-difference regression in Equation 1. The model-implied return is

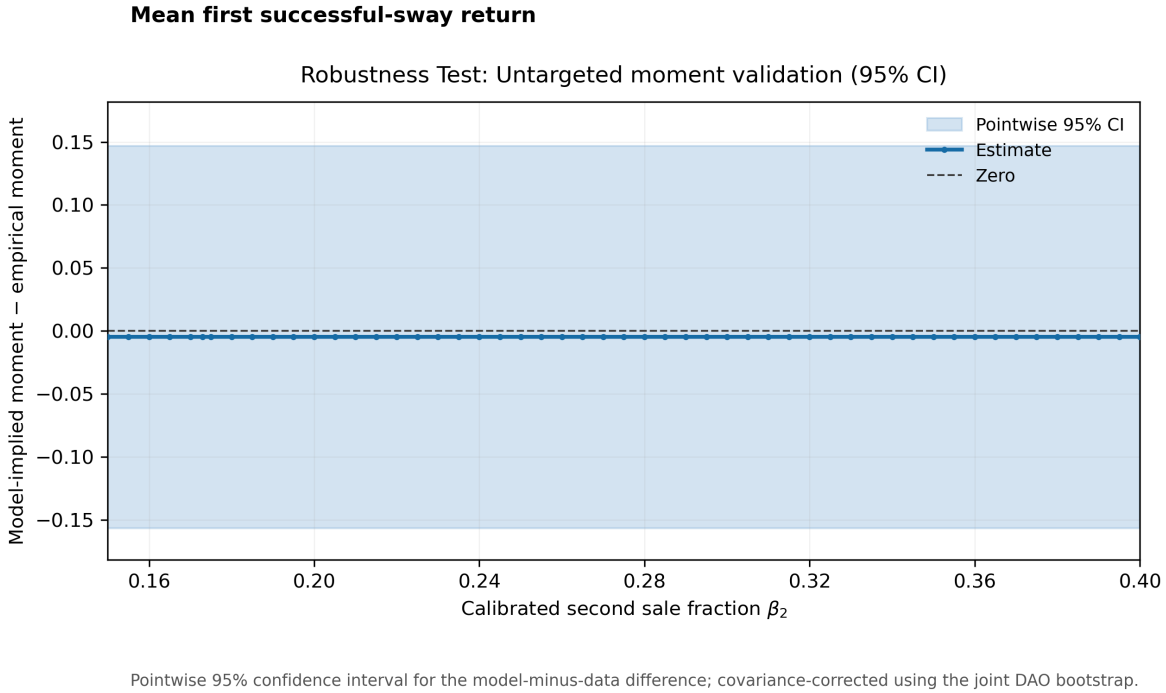
$$m_S(\theta;\gamma) = -\frac{m_E(\theta;\gamma)p_1(\theta;\gamma)+[m_A(\theta;\gamma)-m_E(\theta;\gamma)]p_2(\theta;\gamma)}{m_A(\theta;\gamma)} \tag{37}$$

which weights the early and delayed first-sway price declines by their respective frequencies. The calculation uses the joint bootstrap covariance between the five targeted moments and the untargeted return, thereby accounting for the fact that both estimates are constructed from the same underlying data. The covariance from this joint bootstrap is

$$\widehat{\Sigma}_m^{\text{boot}} = \begin{pmatrix} \widehat{\text{Var}}(\widehat{m}_A) & \widehat{\text{Cov}}(\widehat{m}_A,\widehat{m}_E) & \widehat{\text{Cov}}(\widehat{m}_A,\widehat{m}_N) & \widehat{\text{Cov}}(\widehat{m}_A,\widehat{m}_{Q1}) & \widehat{\text{Cov}}(\widehat{m}_A,\widehat{m}_{Q2}) \\ \widehat{\text{Cov}}(\widehat{m}_E,\widehat{m}_A) & \widehat{\text{Var}}(\widehat{m}_E) & \widehat{\text{Cov}}(\widehat{m}_E,\widehat{m}_N) & \widehat{\text{Cov}}(\widehat{m}_E,\widehat{m}_{Q1}) & \widehat{\text{Cov}}(\widehat{m}_E,\widehat{m}_{Q2}) \\ \widehat{\text{Cov}}(\widehat{m}_N,\widehat{m}_A) & \widehat{\text{Cov}}(\widehat{m}_N,\widehat{m}_E) & \widehat{\text{Var}}(\widehat{m}_N) & \widehat{\text{Cov}}(\widehat{m}_N,\widehat{m}_{Q1}) & \widehat{\text{Cov}}(\widehat{m}_N,\widehat{m}_{Q2}) \\ \widehat{\text{Cov}}(\widehat{m}_{Q1},\widehat{m}_A) & \widehat{\text{Cov}}(\widehat{m}_{Q1},\widehat{m}_E) & \widehat{\text{Cov}}(\widehat{m}_{Q1},\widehat{m}_N) & \widehat{\text{Var}}(\widehat{m}_{Q1}) & \widehat{\text{Cov}}(\widehat{m}_{Q1},\widehat{m}_{Q2}) \\ \widehat{\text{Cov}}(\widehat{m}_{Q2},\widehat{m}_A) & \widehat{\text{Cov}}(\widehat{m}_{Q2},\widehat{m}_E) & \widehat{\text{Cov}}(\widehat{m}_{Q2},\widehat{m}_N) & \widehat{\text{Cov}}(\widehat{m}_{Q2},\widehat{m}_{Q1}) & \widehat{\text{Var}}(\widehat{m}_{Q2}) \end{pmatrix}$$

Table F.2 shows the estimated recovered parameters for this calibration and Figure F.7 plots the difference between the model-implied and empirical first-sway returns as the calibrated second-period share sale fraction β_2 varies. The estimated difference remains close to zero. Thus, the exactly identified model also reproduces the first-sway return despite not targeting it in estimation.

Figure F.7 – Untargeted first-sway return: five-moment exactly identified calibration
The figure plots the difference between the model-implied mean return following the first successful sway and its empirical counterpart across calibrations of β_2. The solid line is the estimated difference and the shaded area is the pointwise 95% confidence interval.



F.3.2 Shareholder welfare

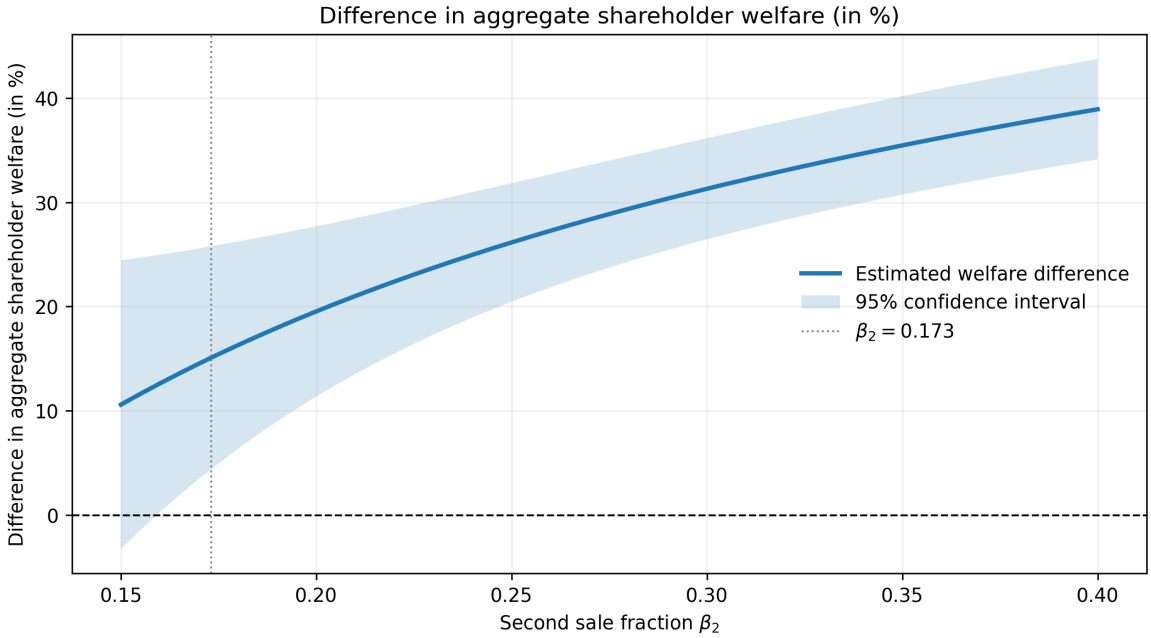
I next recompute the welfare comparison under the same payoff specification as in the baseline analysis. Figure F.8 shows that the estimated welfare loss remains positive throughout the considered range of β_2 and significant.

Table F.2 – Structural estimates and model fit

	Symbol	Model	S.E.	Data/Target
Panel A. Estimated parameters				
Prior probability of benevolent type	π	0.406	0.08	–
Shareholders' payoff	δ	0.149	0.07	–
Large blockholder's private payoff	b	0.41	0.21	–
Early counter-sway probability (time 1)	Q_1	0.168	0.111	–
Late counter-sway probability (time 2)	Q_2	0.202	0.052	–
Delay probability	μ_1	0.721	Estimated via eq.	–
Panel B. Targeted moments				
Successful sway frequency	-	0.479	-	0.479
Early successful sway frequency	-	0.137	-	0.137
Mean no-sway return	-	0.043	-	0.043
Early counter-sway frequency (time 1)	-	0.169	-	0.169
Late counter-sway frequency (time 2)	-	0.201	-	0.201
Panel C. Untargeted moments				
Mean first sway return	-	-0.117	0.062	-0.112

Notes. Panel A reports the estimated structural parameters. Panel B reports the model-implied targeted moments and their empirical counterparts. As it is an exactly identified calibration, the moments are matched up to numerical saturation. Panel C reports the corresponding untargeted moments. Two-sided tests of equality between the model-implied and empirical untargeted moments yield p-values of 0.95 for mean returns following first swaying. This difference is statistically significant at conventional levels, suggesting that the model reproduces these untargeted moments. Standard errors of model-implied moments are computed using the delta method, as detailed in Appendix E.9.

Figure F.8 – Sensitivity of the expected large-blockholder payoff condition to the calibration of β_2. The figure plots the percentage decline in aggregate shareholder welfare when the large blockholder sways, relative to welfare along the no-sway path. A value of x% indicates that swaying reduces aggregate shareholder welfare by x% relative to the no-sway benchmark. The solid line represents the point estimate, and the shaded area denotes the 95% confidence interval.



G Chat-GPT prompts to classify proposal subjects

Prompt 1: Single-category classification (one label)

```
Your task is to categorize proposals from Decentralised Autonomous
    Organisations (DAOs) on Snapshot.org.
These DAOs are all from the DeFi (Decentralized Finance) space.

It is crucial to be precise.

Reading the title, body, and choices of the proposal, you must assign
    one and only one category to it. In case
multiple categories apply, you must choose the most relevant one.

These are the categories you can choose from, followed by keywords that
    can help you identify the category:

- "Cybersecurity". Keywords: audits of smart contracts, or multisig
    decisions.

- "Features". Keywords: launch of new liquidity pools, rewards from
    liquidity pools, fees, utilization ratio, and risk parameters for
    decentralized lending pools.

- "Governance". Keywords: voting incentives, quorums, voting thresholds,
    voting with new tokens, councils, committee, delegates, founder,
    majority, guardian, administrator.

- "Partnership". Keywords: buying tokens from another DAO to put in
    treasury, or establishing a partnership with another DAO, a member of
    another DAO, or with a protocol.
```

```
- "Business strategy". Keywords: budgets, events, advertising, airdrops,
    investment strategies or Tokemak or Fuse reactors.

Please make _only_ one valid JSON object available for download
    containing the following properties:

*   id: The id of the proposal.
*   reasoning: Briefly explain why you assigned the category to the
    proposal.
*   category: The category you assigned to the proposal, must be one of
    the following: "Cybersecurity", "Features", "Governance",
    "Partnership", "Business strategy".
*   confidence: A number between 0 and 1, where 0 means you are not
    confident at all about the category you assigned, and 1 means you are
    very confident about the category you assigned.

Do not add any other text to your answer.

You will find the id, title and the body of the proposal in the attached
    file.
```

H Detailed examples of governance proposals

H.1 OlympusDAO

OlympusDAO is a DAO which aims at creating a reserve currency protocol for digital assets and at becoming the unit of account of the DeFi space. The OHM tokens are backed by assets in the treasury (like DAI or wETH). 1 OHM is backed by 1 DAI (so 1 dollar as DAI is a stablecoin pegged to the dollar developed by MakerDAO) theoretically. If the price of OHM is above 1 dollar, it is profit for the treasury. Since the user bought 1 OHM at more than 1 dollar, the protocol mints extra OHM tokens that they give back to the stakers of the protocol. The value of the OHM token is not dramatically affected by the creation of new OHM because the user is staking the token (not selling), and the DAO holds almost all of its treasury, enabling it to proceed to buybacks when needed.

Improvement proposals which were put up for votes for OlympusDAO at the beginning were mainly to expand the protocol and to enter strategic partnerships. Early on, OlympusDAO entered a strategic partnership with FRAX (algorithmic stablecoin), opened a liquidity pool on Uniswap, and entered in a strategic partnership with AAVE for an amount of token corresponding to 1M$. The DAO continued to enter strategic partnerships throughout the sample with DAOs such as Umami Finance or Yearn finance, and expanded on sidechains such as Phantom. They also chose to add blue chips tokens to their treasury with OIP-15 and OIP-16, by adding ETH and BTC to their treasury; OIP-36 adds wBTC and OIP-24 adds LUSD. OIP-17 and OIP-23 are examples of cybersecurity proposals in which they implement a bug bounty program or pay for an audit of critical smart contracts. Examples of centralization proposals include OIP-56 which puts forward that the technical side of the development of the DAO will no longer require votes, but will be left to the coding team; OIP-73 which implements that only key treasury decisions will be put up for votes not operational decision.

On the subject of compensation of key members OIP-75 is put forward and voted that a member will be paid 500$ monthly while a lead developer of the DAO will have a 30k$ monthly salary.

For Features development proposals, OIP-39 states that funds with OHM tokens from treasury will be invested in yield generating liquidity pool. OIP-43 allows the launch of Curve Finance bonds with Olympus, OIP-37 implements the creation of OHM-ETH bonds. OIP-18

or OIP-63 adjust the reward rates of staking.

H.2 Balancer

Balancer a decentralized exchange (DEX). It enables liquidity pools which are blends of several tokens, contrary to the traditional ways of DEXs, which have liquidity pools for only a given pair of tokens (Uniswap V2 or Sushiswap). In the beginning, Balancer focused on improvement proposals which decided where to attribute rewards and was, therefore, focusing on boosting network externalities and increasing the adoption of the platform. For example, 7500 BAL token were emitted every week to reimburse gas fees to users[51]. Balancer engaged in strategic partnerships and expansion policies, such as creating a fork on the Terra blockchain called Hexagon, and using 6% (60M$ in March 2022 when it was implemented) of the total supply of tokens to do so. They also expanded on the Gnosis sidechain, creating a friendly fork call Symetric with 100k USDC and voted to allocate 31k BAL tokens as incentives (network externalities) on Optimism (another Ethereum sidechain). A strategic partnership which can be cited is the one with AAVE, as they did a 200k BAL token swap to diversify each DAO's treasury and hired ex-AAVE staff (they did the same token swap with Gnosis DAO).

Centralization improvement proposals were also implemented such as the creation of the Balancer Foundation, which is centralized with a CEO, and some decentralization proposals were put forward such as enabling the holders of the vlAURA token to take part in governance of the DAO (raising the quorum for proposals). Finally, improvement proposals implementing nominations of signatories of the treasury wallets were also put forward.

There are also proposals which are specific to DEXs such as deciding on the liquidity providers reward, the pools that the protocol want to create (with risky assets or blue chip tokens), the amount of liquidity invested in the new liquidity pools (Balancer initiated a AAVE/wETH pool with 12.5k tokens allocated as future LP rewards for that pool). Votes on liquidity pools could be for example the launch of the BADGER/wBTC pool or the enablement a veBAL gauge (token earned as a liquidity provider) for the HAUS/wETH pool.

[51]The overall coded possible supply of token for balancer is 96M.

I Advertising decentralization in white papers impact on negative returns

I.1 Intuition and text classification

In this Appendix, I ask whether the negative return responses following First swaying majority voter instances are especially strong in DAOs whose public descriptions in their white papers have encouraged confidence in the decentralization of the voting power in their governance. If investors assign each DAO some ex ante probability of private benefit extraction, then a DAO that strongly advertises decentralization may lead investors to attach a lower probability of private benefit extraction. When the DAO's first swaying majority voter is observed, that belief is revised and the magnitude of the price drop should be stronger compared to the DAOs which did not make those claims in their white papers.

To measure decentralization advertising, I construct a DAO-level textual indicator using hand-collected white papers or descriptions of DAO governance. I then use aspect-based sentiment analysis (ABSA) to measure the sentiment towards decentralization in those white papers and governance texts. Instead of attaching one positive or negative score to an entire document, the ABSA algorithm predicts whether language surrounding selected governance-related words conveys negative, neutral, or positive sentiment. The model combines contextual representations from a BERT-like encoder with a local sentiment-aggregation representation specific to the target term. A positive sentiment attached to a decentralization term is interpreted as advertising an attractive governance arrangement.

For every matched term k in DAO d's text, ABSA assigns a numeric label $s_{dk} \in \{-1, 0, 1\}$ for negative, neutral, or positive sentiment. Terms not actually occurring in the text are removed by retaining only those with strictly positive term-frequency-inverse-document-frequency (TF-IDF) scores. I then aggregate the terms with positive TF-IDF weights as

$$S_d = \sum_{k \in \mathcal{A}_d} w_{dk} s_{dk}, \qquad A_d = \mathbf{1}\{S_d > 0\}, \qquad w_{dk} \in \{1, \text{TFIDF}_{dk}\} \tag{38}$$

where $\mathcal{A}_d$ denotes the relevant observed terms.

In practice, terms do not receive conflicting positive and negative classifications, so weighted

and unweighted aggregation yield the same binary split. The final treatment $A_d = 1$ identifies DAOs advertising decentralization and/or righteous management; $A_d = 0$ identifies neutral governance texts. The text-based sample contains 15 DAOs which advertised decentralization and their governance and 53 neutral DAOs.

I.2 Estimation the additional effect

The specification mirrors Equation (1). For proposal i in DAO d, let Z_{id} contain the six indicators: majority voter, swaying voter, swaying majority voter, first majority voter, first swaying voter, and first swaying majority voter. I now run the following regression to assess the additional impact on CARs for DAOs which have advertised decentralization:

$$CAR_{id} = \sum_{k=1}^{6} \alpha_k Z_{id}^{(k)} + \sum_{k=1}^{6} \theta_k (A_d Z_{id}^{(k)}) + X_{id}'\beta + A_d X_{id}'\phi + \gamma_{d\times t} + \varepsilon_{id} \tag{39}$$

The vector X_{id} includes the first-proposal indicator, market capitalization, trading volume, DAO age, proposal turnout, average prior turnout, the proposal's margin of victory, and the rolling average margin of victory. The two principal specifications use DAO x Quarter FE and DAO x Year FE. Here A_d is the time-invariant textual classification. In this regression α_6 is the first-swaying-majority coefficient for all DAOs, θ_6 is the additional effect for DAOs which advertised decentralized governance, and $\alpha_6+\theta_6$ is the total coefficient for advertised DAOs.

I.3 Results

Table I.1 isolates the additional effect of advertising decentralization. Overall the average coefficient on the first swaying majority voter is negative -0.0813 and not significant whereas the incremental effect for DAOs that advertised decentralization in governance is -0.2102 (significant at 5%) and more negative than what is found in Section 4.2.2.

I.4 Limitations

In this exercise, inference is constrained by a small and highly unbalanced number of DAOs. Of the 68 DAOs with classifiable governance texts, only 15 advertise decentralization and/or righteous management. As advertising varies at the DAO level, the first swaying majority

Table I.1 – First swaying majority voters and advertising

	Weekly cumulative abnormal returns (CAR)	
First swaying majority voter	−0.0813	−0.0859*
	(−1.606)	(−1.976)
First swaying majority voter × NLP	−0.2102**	−0.2492**
	(−1.997)	(−2.150)
Market and Proposal level controls	Yes	Yes
DAO × quarter fixed effects	Yes	No
DAO × year fixed effects	No	Yes
Observations	5741	5780
Adj R^2	0.351	0.200

Notes: Parentheses contain reported t-statistics ***, ** and * denote significance at 1%, 5%, and 10%; standard errors are clustered at DAO-quarter in (3) and DAO-year in (6). Singleton observations are excluded. Other voting indicators and interactions are included in the underlying regressions but are not individually displayed in the original table unless selected as significant lower-level effects.

voters is informed by only 15 events out of almost 6000 proposals. The magnitudes of the additional CAR response should consequently be interpreted cautiously.

Also, advertising is endogenous to the DAO's underlying governance environment and cannot be treated as an ex ante measure of shareholder conflictuality. Even when a text predates the first observed swaying event, its content is neither randomly assigned nor an objective observation of whether large and small shareholders' interests are aligned. Consequently, the event-study interactions identify conditional associations between advertised governance, market reactions, and observed first-swaying events, they do not identify the causal effect of advertising on investors' priors as an ex ante proxy for latent conflicts of interest.

I.5 Vocabulary used to classify governance texts with ABSA

The words on which the ABSA algorithm focuses for the classification of the DAOs is one that I selected and the terms are of this vocabulary are: dao, decentralized, community, transparency, and accountability, as well as management and concentration terms for the positive advertising of their insiders such as founders, developers, delegates, administrators, and council.