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Freeriders and Underdogs: Participation in Corporate Voting

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Abstract

We document low discretionary participation in corporate voting: 24% in the U.S. and 5% outside the U.S. To interpret these patterns, we develop a rational-choice model where participation is shaped by committed regular voters. We show how this environment induces strategic substitution: shareholders with majority preferences (freeriders) abstain, relying on the votes of regulars, while those with minority preferences (underdogs) mobilize disproportionately. Structural estimation reveals that this asymmetry causes 14% of U.S. and 11% of non-U.S. proposals to fail to reflect the majority preference. Counterfactual analysis demonstrates that reducing voting costs can actually increase misrepresentation.

Keywords: voting participation, corporate governance, shareholder proposals, shareholder democracy, structural estimation

JEL Classifications: D72, G23, G34, G38

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Freeriders and Underdogs: Participation in Corporate Voting*

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Abstract

We document low discretionary participation in corporate voting: 24% in the U.S. and 5% outside the U.S. To interpret these patterns, we develop a rational-choice model where participation is shaped by committed regular voters. We show how this environment induces strategic substitution: shareholders with majority preferences (freeriders) abstain, relying on the votes of regulars, while those with minority preferences (underdogs) mobilize disproportionately. Structural estimation reveals that this asymmetry causes 14% of U.S. and 11% of non-U.S. proposals to fail to reflect the majority preference. Counterfactual analysis demonstrates that reducing voting costs can actually increase misrepresentation.

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1 Introduction

Corporate voting helps uphold managerial accountability, aligns governance with shareholder interests, and influences firm actions.[1] Shareholder voting support lends legitimacy to proposals in firms (Fisch, 2017) but also informs managers, regulators, and the greater public about shareholder preferences (Grewal et al., 2016; Hwang and Nili, 2020). This applies especially to controversial and partisan issues in today's increasingly polarized political landscape (Wu and Zechner, 2024; Ravina and Persico, 2025; Kempf and Tsoutsoura, 2024). For aggregating preferences in voting, majority rule is widely considered the most efficient method.[2] However, only in full participation does voting support equal the underlying shareholder preferences. In practice, participation is far from complete. In the United States, average participation is about 73% among all shareholders, but only 24% among shareholders who are neither insiders nor mutual funds. Because shareholders' participation decisions depend on the perceived costs and benefits of voting (Brav et al., 2022; Hafeez et al., 2022), regulators have sought to overcome the low participation rates by lowering voting costs or increasing voting benefits.[3]

Our paper challenges this policy intuition. We show that when committed support is asymmetric, lowering voting costs can paradoxically worsen misrepresentation—defined as the probability that the realized voting outcome differs from the *full-participation* benchmark implied by underlying shareholder preferences. This occurs because the presence of committed voters induces strategic substitution: minority-side shareholders mobilize disproportionately, while majority-side shareholders abstain. This insight motivates our structural approach. Assessing these dynamics requires recovering underlying preferences from observed votes—an inherently challenging task given the lack of polling data and the noise introduced by trading.[4] While insights from political elections suggest that reducing costs can increase turnout (Merlo and Palfrey, 2018), participation rates among certain shareholder groups remain persistently low, highlighting gaps in the understanding of corporate voter turnout (Nili and Kastiel, 2016; Hirst, 2017; Griffin, 2019; Ricci and Sautter,

[1] See evidence in Cuñat et al. (2012); Thomas and Cotter (2007); Del Guercio et al. (2008); Cai et al. (2009); Levit and Malenko (2011); Becht et al. (2016).

[2] Wu and Zechner (2024) show that the ownership-weighted average shareholder preference maximizes aggregate welfare in the presence of activists. See also Zytnick (2022) for a discussion.

[3] Historical examples for policy attempts are one-person-one-vote systems, voting caps, and policies favoring smaller shareholders (Dunlavy, 2006; Hirst, 2017; Haan, 2022). More recent efforts and suggestions have focused on improving accessibility, for example via electronic voting (Fisch, 2017).

[4] We provide a microfoundation in the Online Appendix, where opportunistic and noise trading prior to the record date generates dispersion in the record-date composition of discretionary holders. For broader analyses of the interaction between trading and voting, see Levit et al. (2024); Meirowitz and Pi (2022).

2022).

To quantify these distortions, we structurally estimate a model of corporate voting that explicitly accounts for ownership heterogeneity. We categorize shareholders into two distinct groups: *regular* and *discretionary* voters. Regular voters (e.g., insiders, index funds) are committed, in that they participate regardless of their perceived probability of affecting the outcome (i.e., their pivotal probability). In contrast, discretionary voters (e.g., active funds, retail investors) make a rational decision to vote only when the expected benefit exceeds the cost. Our model captures this heterogeneity. It enables us to analyze how a partisan base of regular voters—what we term the *cushion*—benefits the majority side and distorts the incentives of the discretionary electorate.

The model builds on the rational-choice framework (Riker and Ordeshook, 1968), where participation depends on the probability of being pivotal, the cost of voting, and the benefit of winning. We extend the political election model of Myatt (2015) to the corporate setting, demonstrating that the presence of regular voters generates distinctive equilibrium patterns not found in standard elections. These insights guide our empirical approach, where we test the model's predictions using shareholder voting data across proposal types, industries, and countries.

Our contribution is threefold. First, we develop a tractable equilibrium model of shareholder turnout that explicitly incorporates ownership heterogeneity. Second, we derive closed-form predictions linking participation asymmetries to observable partisan bases and benefit–cost ratios. Third, we provide structural evidence using large-scale global voting data that this relationship is non-monotonic: lowering voting costs can, under certain ownership structures, worsen misrepresentation before improving it.

The model highlights strategic substitution, manifested in two opposing behaviors: freeriding by majority-supporters, who rely on the cushion to secure their preferred outcome, and compensatory mobilization by minority-supporters, who participate aggressively to offset their disadvantage. Our main theoretical result is that reducing voting costs has a non-monotonic effect on misrepresentation. When costs are high (or the benefit-to-cost ratio is low), the electorate enters a *full-freeriding* phase: majority-supporters (freeriders) abstain completely, while minority-supporters (underdogs) participate. In this phase, lowering costs creates what we term a *paradox of mobilization*: it mobilizes only the underdogs, eroding the cushion's advantage and pushing the outcome away from the majority preference. However, once costs fall below a critical threshold, the system shifts to a *correction* phase: freeriders begin to participate, restoring the balance of power. Intuitively, cost reductions mobilize the minority side first because their pivotal probability is higher when they are disadvantaged; majority-side voters continue to abstain until incentives become strong enough to offset the cushion. This sequential mobilization drives the inverted-U relationship between incentives and misrepresentation. Thus, reforms that marginally lower costs may unintentionally worsen outcomes unless they are strong enough to mobilize the freeriders.

We solve the model to estimate the preferences of discretionary voters—both freeriders and underdogs—using data on shareholder proposals. This estimation quantifies how much observed misrepresentation arises from strategic selection rather than genuine preference differences. Under the uniform uncertainty specification—a tractable instance of our model—participation rates and equilibrium regions are available in closed form, ensuring computationally robust estimation.

For the estimation, we use a sample of 65,022 proposals voted on in U.S. firms (2003–2020), complemented by 98,242 proposals from non-U.S. firms (2013–2020). Average total participation is 72% for U.S. proposals (consistent with Brav et al. (2022) and Nili and Kastiel (2016)) and 42% outside the United States. The equivalent of regular voters in our data are insiders and investment funds, which in most jurisdictions have a fiduciary duty to vote. Crucially, discretionary participation rates (excluding these regular voters) are only 24% in the United States and 5% internationally.

To assess whether voting outcomes reflect the majority preference of the shareholder base, we estimate the likelihood that the minority preference prevails—our empirical measure of *misrepresentation*.[5] In our U.S. sample, we find that strategic selection generates a 14% probability of misrepresentation. This probability varies significantly across subsamples: it is highest for management proposals related to restructuring (26%) and lowest for proposals on takeover defenses (11%). Outside the United States, the likelihood of an unrepresentative outcome is 11%. These findings underscore the value of our structural framework, which allows us to disentangle whether these distortions arise from voting costs or from the composition of the shareholder base.

The estimated frequency of equilibria demystifies these strategic behaviors. Low participation is largely driven by full freeriding, which occurs in 83% of U.S. and 80% of non-U.S. proposals. In this equilibrium, majority-supporters (freeriders) abstain entirely, relying on the cushion, so lowering voting costs reduces representativeness by solely mobilizing the minority side (underdogs). Conversely, in 17% of the sample, we observe full

[5] Our empirical setup allows for more nuanced measures of the tension between insiders and dispersed shareholders, such as the difference in preferences between these groups or the likelihood that the majority of discretionary voters prevails. However, here, we focus on the broader measure of whether the outcome reflects the majority of the entire shareholder base.

minority mobilization, where minority-side voters (underdogs) turn out at a 100% rate despite their low probability of swinging the vote. Finally, the interior equilibrium typical of political models—where both sides participate partially—occurs in only 7% of U.S. proposals, underscoring the distinctiveness of corporate voting.

Because reducing voting costs may not improve representativeness, diagnosing the prevailing equilibrium is crucial for predicting outcomes and evaluating interventions (e.g., campaigns to reduce uncertainty (Lee and Souther, 2020), platforms like Moxy that lower voting costs, regulatory reforms such as the EU Shareholder Rights Directive (Pinto, 2009), or proposed changes to voting rules (VanWesep, 2014). To inform such decisions, we conduct a counterfactual analysis by varying the benefit-to-cost ratio per share. Consistent with our model, we find a non-monotonic relationship: for instance, reducing costs decreases misrepresentation in shareholder governance proposals but increases it in shareholder voting proposals, depending on whether the electorate starts in the full-freeriding or correction phase.

Our structural estimation provides a framework to interpret corporate voting outcomes by disentangling the role of preferences (popularity) from perceived benefits (importance). This distinction allows the model to explain cases where an important proposal receives low turnout due to consensus, while a low-stakes proposal attracts high participation due to disagreement. Using this framework, we recover otherwise unobservable parameters on preferences and the benefit-to-cost ratio to offer novel insights into voting patterns.

The key limitation of our approach is its reliance on a specific theoretical model. Two assumptions are particularly important. First, we assume participation is driven by preference heterogeneity (private values) rather than information heterogeneity (private information). While our model minimizes the role of information aggregation (Feddersen and Pesendorfer, 1996), we verify empirically that our results hold across subsamples where private information is likely to matter, such as in early-season meetings or for rare proposal types.

Second, to ensure identification, we impose specific functional forms in the main analysis. In the Online Appendix, however, we demonstrate that our central predictions are robust to relaxing these assumptions along three dimensions: uncertainty, valuation asymmetry, and cost heterogeneity. In three extensions, we systematically relax each of these assumptions: (1) generalized uncertainty (beta distributions), showing the stability of the underdog mechanism; (2) asymmetric valuations, showing that while misrepresentation may persist, the market often corrects for intensity to improve welfare; and (3) heterogeneous costs, verifying that the non-monotonic inverse-U (hump-shaped) relationship is robust to idiosyncratic cost variation (smoothing the corner solutions of the baseline). Across empirically relevant parameter regions, the equilibrium remains unique; in the beta-uncertainty extension we also derive a sharp sufficient condition for local stability.

These extensions demonstrate that the mechanism is theoretically robust, justifying our reliance on the simpler constant-cost model for structural estimation. To further validate this choice, we explicitly empirically compare it against the uniform-cost specification (from the third extension). We find that the baseline constant-cost model fits the data remarkably well and outperforms the more complex heterogeneous variant—which introduces estimation noise and computational costs without improving the fit—as well as reduced-form OLS regressions.

Finally, while our model focuses on corporate voting, it extends naturally to political elections. In that context, 'regular voters' correspond to citizens driven by civic duty or partisan mandates (Manning and Edwards, 2014; Coate and Conlin, 2004; Feddersen and Sandroni, 2006), who participate regardless of pivotality. Our framework shows that these committed participants do not merely add votes; they fundamentally alter the strategic landscape for the rest of the electorate. This implies that the non-monotonic relationship between voting costs and representativeness likely applies to democratic contests as well. Moreover, because the preferences of committed voters are often observable (e.g., through party registrations), our approach offers a promising direction for analyzing political turnout and electoral design.

Literature. Our paper contributes to several strands of literature. First, we contribute to the theoretical literature on corporate voting (for an overview, see Malenko (2023)). Most of this literature focuses on the aggregation of dispersed private information in a framework with a common value (i.e., heterogeneous information and homogeneous preferences) and no differences in the ownership structure (Maug and Yilmaz, 2002; Maug and Rydqvist, 2009; Bond and Eraslan, 2010; Levit and Malenko, 2011). The aforementioned papers do not allow for voter abstentions and hence are not apt for a study of voting participation.

Two theoretical papers relate closely to ours. Bar-Isaac and Shapiro (2020) assume heterogeneous information and homogeneous preferences but also consider differences in the ownership structure (i.e., blockholders and dispersed shareholders) and allow for abstention. They show that blockholders may abstain to assist the aggregation of information. Hence, their paper has normative implications for current U.S. regulation, which requires blockholders (i.e., regular voters in our terminology) to vote all their shares.[6]

In a departure from the literature, Levit et al. (2024) introduce heterogeneous preferences to study the interplay between trading and voting. They show that when voting rights are tradeable, the firm's stock price need not reflect aggregate shareholder welfare, as the preferences of the marginal trader may diverge from those of the pivotal voter (Levit et al., 2024, Section 7.3). Our framework complements this analysis by focusing on a different margin: rather than trading to vote, we study strategic abstention by discretionary shareholders in the presence of a fixed ownership structure with regular voters. In our setup, the expected capital-gain component of voting (post-vote trading) is common knowledge and incorporated into the participation benefit v. Pre-vote trading, when observable (e.g., through 13D or 13F filings), enters as a shift in ownership composition; when unobservable, it contributes to aggregate uncertainty over discretionary preferences.[7]

Second, we contribute to the literature on voting participation in political elections. Theoretical models of voter turnout in these elections (Downs, 1957; Riker and Ordeshook, 1968) conceptualize voting as a cost-benefit decision. One of the main paradigms is pivotal voting models (Palfrey and Rosenthal, 1983, 1985). These models explain turnout through the probability of being decisive but must confront the turnout paradox, as costly participation and low pivotal probabilities predict near zero turnout in large electorates. Introducing aggregate uncertainty about aggregate representation (Krishna and Morgan, 2012; Evren, 2012; Myatt, 2015) resolves the paradox of voting. Our work is primarily based on the framework in Myatt (2015), extending it to the corporate setting by incorporating ownership heterogeneity, which leads to richer and more realistic equilibria. This shows that aggregate uncertainty sustains turnout while accounting for institutional

[6] VanWesep (2014) takes a complementary approach by modifying the voting rule rather than participation incentives. He proposes an "Idealized Electoral College" mechanism that increases small shareholders' pivotal probabilities through random aggregation tiers, thereby encouraging participation even when voting costs are positive. In contrast, our model retains majority rule but endogenizes abstention through the interaction of regular and discretionary shareholders.

[7] Levit et al. (2023) study blockholders and the voting premium in a framework related to Levit et al. (2024), showing that minority blockholders can endogenously generate a voting premium by trading to influence the shareholder base, as dispersed shareholders free-ride on the blockholder's trades and the resulting liquidity of voting shares. See also Brav and Mathews (2011) and Zachariadis and Olaru (2017) on the separation of cash-flow and voting rights; Esô et al. (2014) on vote delegation to informed shareholders; Meirowitz and Pi (2022) on ex-post trading and information aggregation; and Casella et al. (2012) on vote trading in political elections. Formally, we analyze trading in the Online Appendix: pre–record-date trading and share lending (OA.4.1) provide a microfoundation for uncertainty in ownership composition, while post–record-date trading (OA.4.2) is neutral for equilibrium outcomes under our timing assumptions.

differences between firms.[8]

Empirical studies of voter turnout models show pivotal voter models predict turnout well but overestimate electoral closeness due to aggregate uncertainty (Coate and Conlin, 2004; Coate et al., 2008).[9] Merlo and Palfrey (2018) validate pivotal-voter models through structural estimation, demonstrating effective parameter recovery.[10] They also examine how reducing voting costs influences turnout, akin to our study of cost reductions and representativeness. Kawai and Watanabe (2013) highlight how turnout skews preference aggregation, as high-cost or low-intensity voters are underrepresented. Bursztyn et al. (2024) provide causal evidence from Swiss referenda showing that closer elections increase participation. We contribute by examining how aggregate uncertainty and heterogeneity affect turnout and representativeness in corporate voting, where increased participation does not always enhance representation.

Third, we contribute to the empirical literature on corporate voting participation. Nili and Kastiel (2016) document declining participation in U.S. corporate elections, despite technological advances and increasingly high-stakes proposals. Van der Elst (2011) finds that block ownership predicts participation, while Brav et al. (2022) show that retail investors vote more in smaller firms, when their stake is larger, and when they receive more agenda-related information.[11] We extend this literature by structurally estimating a model that identifies how ownership, preferences, and proposal characteristics shape voting outcomes.

Fourth, we contribute to the literature that estimates the benefits of voting. This literature has so far focused on the stock market reaction to the passage of proposals (Cuñat et al., 2012; Cuñat et al., 2020; Bach and Metzger, 2018; Gantchev and Giannetti, 2020), the market for votes in the equity loan market (Christoffersen et al., 2007; Aggarwal et al., 2015), the discrepancy between stock and option prices around voting (Kalay et al., 2014), and trading patterns following voting outcomes (Li et al., 2021). We develop an alternative method to estimate benefits that relies on the voting participation decision.

[8] Other turnout theories include altruistic models that account for spillover benefits (Palfrey and Prisbrey, 1997), expressive voting models that emphasize intrinsic satisfaction (Brennan and Lomasky, 1993; Riker and Ordeshook, 1968), and ethical voting models that highlight civic duty and collective welfare (Coate and Conlin, 2004; Feddersen and Sandroni, 2006). For overviews, see Feddersen (2004); Geys (2006); Merlo (2006).

[9] Our model mitigates this by incorporating regular voters, leading to equilibria where outcomes are not ties.

[10] Altruistic models perform similarly, ethical voting the worst, and expressive voting falls in between.

[11] Turnout determinants in political elections exhibit similar patterns, varying with institutional settings (Blais, 2006), voter characteristics (Wolfinger and Rosenstone, 1980), altruism (Blais, 2000), and education or candidate trains (Abramson et al., 1992).

Fifth, our study relates to papers that structurally estimate voting parameters in the corporate governance setting. Matvos and Ostrovsky (2010), in the context of director elections, show that (in the terminology of our paper) regular voters vote according to peer effects and heterogeneity in their management friendliness. Barry (2023) estimates the value of non-binding Say-on-Pay votes on CEO compensation, following the structural strand of the literature on CEO compensation (Taylor, 2010, 2013). Blonien et al. (2024) estimate errors in shareholder voting, and Pinnington (2023) studies the voting behavior of passive funds. We contribute by focusing on the participation decision and preferences of discretionary voters.

2 Voting in the United States

2.1 Data

Our voting outcome data is from ISS Voting Results, which covers Russell 3000 firms from 2003–2020. Following the literature on shareholder voting (Gordon and Pound, 1993; Cuñat et al., 2012; Bach and Metzger, 2018), we exclude routine proposals, director elections, and say-on-pay frequency proposals. The latter two also do not fit our framework as director elections do not provide "no" votes and hence abstentions have another interpretation (Matvos and Ostrovsky, 2010; Cai et al., 2013), and say-on-pay frequency proposals mostly offer a choice between one, two, and three years. In tune with our theoretical analysis, we focus on simple-majority elections. The source of individual investment fund votes is ISS Mutual Fund Voting, which draws its data from mandatory N-PX filings. We aggregate fund-level voting data at the corresponding fund-family level, following evidence that funds rarely vote differently than their family (Fichtner et al., 2017).

We obtain data on institutional ownership from Factset, which sources its information from 13F and other filings. Institutions that report 13F filings include investment funds, which also disclose their votes on the N-PX forms, as well as hedge funds and other asset managers. We complement this data with the ownership fraction of insiders from Worldscope, as used by Iliev et al. (2015). This measure tabulates shares held by insiders and specifically includes (i) shares held by officers, directors, and their immediate families; (ii) shares held in trusts; (iii) shares of the company held by any other corporation (except shares held in a fiduciary capacity by banks or other financial institutions); (iv) shares held by pension or benefit plans; and (v) shares held by individuals who own 5% or more of the outstanding shares. Importantly for our analysis, the measure explicitly excludes shares held in a fiduciary capacity by financial institutions that report their votes via N-PX forms.

Our sample includes 38,030 meetings. There are, on average, 1.7 proposals per meeting, and 65,022 proposals in total. (For a breakdown by year, see Table OA.1 in the Online Appendix.) Table 2 in Section A of the Appendix presents summary statistics. The sample firms are comparable to those used by other papers on shareholder meetings (Cvijanović et al., 2016), with an average market capitalization of $9.4 billion, leverage of 38%, and a market-to-book ratio of 3.7. The sample firms had, on average, 195 million outstanding shares, of which 39% reported their votes (N-PX shares). Another 12.5% was owned by insiders. There were on average 455 distinct institutional shareholders per voting event.

2.2 Regular Voters

In the United States, throughout our sample period (2003–2020), investment funds had a fiduciary duty to vote on behalf of their clients (SEC Final Rule IA-2106). This obligation applied to mutual funds and other registered investment management companies, which were required to disclose their proxy votes on Form N-PX.[12] Using voting data from Broadridge, the major vote tabulator, Zytnick (2022) shows that mutual funds exhibit virtually 100% turnout. Accordingly, we treat these funds as always voting and classify them as regular voters, together with insider holdings obtained from Worldscope. The latter category includes both voting trusts, which are legally required to vote, and other insiders who are not. We believe the assumption that insiders vote is reasonable, given their strong incentives to do so (for a stark example see Fos and Jiang (2015), who document cases in which CEOs exercise underwater options to obtain more votes).

To compute voting by discretionary voters, we subtract the votes cast by N-PX filers and insiders—whom we assume vote in support of management—from the aggregate vote counts in each category (for, against, and abstain). The remaining votes are attributed to discretionary voters, which include other institutional investors (such as hedge funds) as well as individual retail shareholders. We define discretionary participation as the number of discretionary votes divided by the total number of non-regular shares. Total participation is measured as the share of outstanding equity that is voted and equals the

[12] Disclosure of Proxy Voting Policies and Proxy Voting Records by Registered Management Investment Companies, Securities Act Release No. 8188, 68 Fed. Reg. 6564, 6565 (Feb. 7, 2003) (codified at 17 C.F.R. pts. 239, 249, 270, 274).

sum of discretionary and regular participation (100% by definition). Regular voters may also formally abstain, although such abstentions are rare, accounting for approximately 1% of votes. We include these official abstentions in the total number of votes cast when computing participation rates.

2.3 Voting Participation: Stylized Facts

To set the stage for our analysis, we show basic summary statistics for voting support (as a fraction of the valid base) and participation in Table 2. The valid base can be either the number of shares outstanding or the number of voting shares and depends on state laws and company charters (Bach and Metzger, 2018).

Average voting participation is nontrivial but closer to zero than to one. Total participation averages 72%, and discretionary participation averages 24%.[13] Management proposals receive on average more support than shareholder ones, with the highest support (91%) for Say-on-Pay proposals (see Section OA.5 for our classification of proposals). Shareholder proposals on corporate social responsibility (CSR) receive the least support (18%), consistent with the results in He et al. (2023). Discretionary voting participation does not align with support. It ranges from 14% in business-related management proposals to 57% in the very rare (11) CSR-related management proposals.

3 Model

In this section, we analyze the voting participation decision using a rational-choice framework that links participation to a voter's pivotal probability, the cost of participation, and the benefit derived from the preferred outcome's success (Riker and Ordeshook, 1968). Building on the political elections model of Myatt (2015), we extend the framework to incorporate heterogeneity in shareholder commitment—a defining feature of corporate elections. Unlike standard political models where all voters are discretionary, corporate electorates typically feature a mix of committed blockholders (regular voters) and dispersed shareholders (discretionary voters).

Crucially, our analysis decomposes the participation decision into two competing theoretical forces. We distinguish strategic substitution—which drives majority supporters to freeride and minority supporters to mobilize—from strategic complementarity, where

[13] Broker nonvotes, where shareholders give no voting instructions to their broker, typically count toward quorum. In our sample, 97% of proposals meet quorum with broker nonvotes, and 90% would without them. However, broker nonvotes do not affect nonroutine proposal outcomes.

a close race (high probability density of a tie) stimulates participation from all sides. While both forces are theoretically present, we show that in environments with diffuse beliefs—typical of opaque corporate elections—strategic substitution dominates.

The section proceeds in two steps. First, we derive general theoretical properties of corporate voting, establishing the existence of unique regimes such as full-freeriding. Second, we specialize this general framework to a tractable specification that yields closed-form expressions, providing the necessary tractable foundation for the structural estimation in Section 4.

3.1 Setup

Consider a corporate proposal up for a vote with two options, R and L. Shareholders have heterogeneous preferences over the proposal: if they vote, they do so according to a pre-determined preference type, R or L. In total, shareholders own $n+1$ voting shares, which are split between two groups.[14] A fraction $\gamma \in [0, 1)$ of the n shares belongs to regular voters, while the remaining $(1-\gamma)n+1$ belong to discretionary voters, with a single share and a single vote each.[15]

Regular voters always vote. We capture their voting preference by a constant q, which is the fraction of this group who vote for R and is common knowledge at the voting stage. We assume without loss of generality:

A0: $q \in (1/2, 1)$.

So R is the *favorite* among regular voters, and L is the *underdog*. This structural advantage creates an asymmetry in discretionary incentives. We henceforth refer to discretionary shareholders supporting R as *freeriders* (since they can rely on the regular votes) and those supporting L as *underdogs* (since they must participate to overcome the disadvantage). We can think of regular voters as either i) two subgroups (blockholders) with sizes q and $1-q$ supporting R and L, respectively; or, alternatively, ii) coalitions of dispersed shareholders, who always participate and vote in proportion q and $1-q$ for R and L.

Discretionary voters choose whether to vote. Their choice depends on a cost $c > 0$, which they face when they vote, regardless of the outcome, and an incremental benefit

[14] The number of voting shares n approximates the firm's market capitalization divided by average holdings. For example, a \$10 million market cap and \$10,000 average holdings yield $n = 1,000$. In our U.S. sample, the average number of institutional owners at a voting event is 455 (Table 2 Panel A).

[15] This classification mirrors the framework of VanWesep (2014), who distinguishes between a committed bloc of large shareholders and management (analogous to our regular voters) and dispersed small shareholders who face rational abstention (analogous to our discretionary voters).

$v > 0$, which represents the difference in \$/share accruing to a discretionary voter when her pre-determined type wins. For the baseline model and empirical estimation, we assume all discretionary voters are risk neutral and share the same c and v, regardless of their preference type R or L. However, we generalize this in Section 3.7 (and Online Appendix OA.3) to allow for heterogeneous costs and asymmetric valuations, discussing the implications for welfare and robustness.

Among discretionary voters, option R has popularity $p \in (0, 1)$. The crux of the model is that there is aggregate uncertainty: p is unknown with strictly positive continuous density f in $(l, h) \subseteq (0, 1)$, and F the corresponding distribution, where $\bar{p} \equiv \mathbb{E}[p]$.[16] Finally, we assume that discretionary voters face an availability shock: even if they decide to vote, they will ultimately cast a vote with probability a drawn from density g. This availability shock is in the context of voting what a liquidity shock is in the context of trading.[17]

Upon voting, the outcome is the simple majority of the votes cast, and in the case of a tie, a fair coin toss is the tie-breaker. The aforementioned structure is common knowledge. The only choice variable (strategy) is whether a discretionary voter votes. We look for symmetric strategies across preference types R or L of discretionary voters, and the solution concept is a Bayesian Nash Equilibrium. The model coincides with Myatt (2015) for $\gamma = 0$ (i.e., no regular voters), and hence we extend his for general $\gamma > 0$. Below we discuss the cost c and benefit v.

The cost c captures i) administrative costs such as fees charged by custodians (Strenger and Zetzsche, 2013), time and effort (Brav et al., 2022), the cost of establishing ownership or voting rights, especially through cross-border custodian chains (Lui, 2015; Strenger and Zetzsche, 2013) and the lack of electronic voting in some countries (Eckbo et al., 2010, 2011; Council of Institutional Investors, 2011), and ii) the opportunity cost to keeping one's shares and voting. A significant example of the latter is loan fees earned in the share lending market. As Porras Prado et al. (2016, pp. 3212-3213) mention "*Investors may trade off the income from lending with the potential risks of losing monitoring control through transferring shares to the equity lending market.*" Indeed, loan fees are higher

[16]Aggregate uncertainty over p is the key factor that overcomes the impossibility result of Palfrey and Rosenthal (1985), where costly voting leads to near-zero participation in large elections due to infinitesimal pivotal probabilities when p is a known constant.

[17]The availability shock aids in identifying unique pivotal probabilities. Following Myatt (2015), we initially assume a is a random probability within an interval and then take the limit as the interval collapses to a single point, yielding the degenerate case where $a = \mathbb{E}[a] = \bar{a}$. This shock also allows us to accommodate "never voters" among discretionary shareholders, where $1 - a$ represents the fraction of the electorate that fails to cast a vote regardless of strategic incentives.

around voting record dates (Aggarwal et al., 2015, Figure 1).

The benefit v is a private value to a discretionary voter. Possible sources of differences in private values among investors are i) incentives (Chevalier and Ellison, 1999; Cvijanović et al., 2022), ii) portfolio concerns (Matvos and Ostrovsky, 2010; Cohen and Schmidt, 2009; Bodnaruk and Rossi, 2016; He et al., 2019; Griffith and Lund, 2019; Anabtawi and Stout, 2008), iii) preferences (Bolton et al., 2020; Jackson and Zytnick, 2022; Zytnick, 2022; Dikolli et al., 2022; Jin and Noe, 2024; Bainbridge, 2005), iv) conflicts of interest (Davis and Kim, 2007; Ashraf et al., 2012; Butler and Gurun, 2012; Cvijanović et al., 2016; Griffith and Lund, 2019; Michaely et al., 2023), v) opinions (Harrison and Kreps, 1978; Li et al., 2021; Kakhbod et al., 2022), vi) extreme information/no learning (Feddersen and Pesendorfer, 1997; Yilmaz, 2000), vii) governance philosophy (Couvert, 2021; Bubb and Catan, 2022; Bolton et al., 2020), viii) separation of cash flow and voting rights (Burkart and Lee, 2008; Adams and Ferreira, 2008; Brav and Mathews, 2011; Zachariadis and Olaru, 2017), ix) time horizon (Bushee, 1998; Gaspar et al., 2005), and x) tax clienteles (Desai and Jin, 2011). Our model abstracts from how precisely these voting benefits materialize.

Not all proposals are binding. Empirical evidence, however, suggests that firms often face significant consequences for failing to abide by voting outcomes (Ferri, 2012; Levit and Malenko, 2011; Malenko, 2023). For shareholder proposals, the implementation rate of majority decisions is approximately 70%, and close votes are associated with positive abnormal returns (Ertimur et al., 2013; Denis et al., 2019; Larcker et al., 2015). Failure to abide by shareholder votes can lead to decreased CEO pay, increased CEO turnover, and adverse labor market outcomes (Del Guercio et al., 2008; Cai et al., 2009; Ertimur et al., 2018; Fos et al., 2017; Aggarwal et al., 2019). Moreover, a majority of firms adjust compensation following say-on-pay votes, with notable spillovers observed among related firms (e.g., with overlapping directors). For a further discussion of the model's assumptions, particularly in relation to our estimation, see Section 4.7.

We now formalize how these costs and benefits drive the participation decision.

3.2 Primitives

Let us consider a discretionary voter (shareholder) of either type $i \in \{R, L\}$. According to the rational choice theory (Riker and Ordeshook, 1968), she votes, abstains, or is indifferent, depending on whether the difference of expected benefit to cost $v \Pr[\text{Pivotal}|i] - c$ is positive, negative, or zero, respectively. The expression $\Pr[\text{Pivotal}|i]$ is her probability of being pivotal, that is, of affecting the outcome. We assume a symmetric participation strategy within each type $i \in \{R, L\}$ so that if we let t_i the turnout rate for i we have:

$$t_i = \begin{cases} 1, & \text{if } \Pr[\text{pivotal}|i] > c/v, \\ \in (0,1), & \text{if } \Pr[\text{pivotal}|i] = c/v, \\ 0, & \text{if } \Pr[\text{pivotal}|i] < c/v, \end{cases} \tag{1}$$

where, in turn, the three cases correspond to full, partial, and no participation, respectively. The following assumptions on model parameters ensure that discretionary participation is possible.

A1: $\gamma < 1/(2q)$.

A2: $v \geq c$.

Assumption 1 rules out the case in which either type of regular voter can decide the outcome unilaterally (it is sufficient, given A0; i.e., $q > 1/2$). In OA.6, we discuss how assumption 1 affects our estimation sample. Assumption 2 ensures that the cost should not exceed the benefit, so the inequalities in (1) are meaningful.[18]

Now, given any turnout rate t_i and a realization of support of R among discretionary voters p drawn from density f, the realized support for R is

$$\overbrace{\bar{a}(1-\gamma)pt_R}^{\text{discretionary support for } R} + \overbrace{\gamma q}^{\text{regular support for } R}, \tag{2}$$

where we indicate the corresponding discretionary and regular (voter) support in the sum. Similarly, discretionary and regular support for L is $\bar{a}(1-\gamma)(1-p)t_L + \gamma(1-q)$. Hence, the outcome is determined by the sign of

$$O_{\text{disc}}(p; t_L, t_R) \equiv \overbrace{\gamma q + \bar{a}(1-\gamma)pt_R}^{\text{total support for } R} - \overbrace{[\gamma(1-q) + \bar{a}(1-\gamma)(1-p)t_L]}^{\text{total support for } L}. \tag{3}$$

If the difference is positive, negative, or zero, R wins, L wins, or they tie, respectively. Define p^* as the probability for which the outcome is a tie; i.e., $O_{\text{disc}}(p^*; t_L, t_R) = 0$, such that from (3):

$$p^* \equiv \frac{t_L}{t_R + t_L} - \frac{(2q-1)\gamma}{1-\gamma} \frac{1}{\bar{a}(t_R + t_L)}. \tag{4}$$

[18] In Online Appendix OA.3.3 (Extension III), we relax the constant cost assumption to allow for heterogeneous-cost distributions $G(c)$. We show that our main theoretical results are robust to this generalization.

Then, since $O_{\text{disc}}(p; t_L, t_R)$ is increasing in p, R wins if $p > p^*$ and L if $p < p^*$.

The probability p^* plays an important role in the calculation of the pivotal probabilities in the next subsection, and we will also use it to express the probability of misrepresentation. To build intuition, it is useful to rewrite the cutoff p^* in terms of the participation rates of the two groups. Let $r \equiv t_R/t_L$ denote the turnout ratio and $S \equiv t_L + t_R$ denote total turnout. The condition (4) can be rearranged as:

$$p^* = \frac{1}{1+r} - \frac{B}{S}, \tag{5}$$

where $B \equiv (2q-1)\gamma/(\bar{a}(1-\gamma))$ represents the net partisan advantage or *cushion* provided by the regular voters; this structural advantage requires both the presence of regular voters ($\gamma > 0$) and a partisan asymmetry ($q > 1/2$).

Expression (5) highlights two distinct components driving the pivotal threshold. First, the term $1/(1+r)$ captures the balance of discretionary power. If the freeriders (R) mobilize relatively more voters ($r \uparrow$), the cutoff p^* falls, making it easier for R to win. In a purely symmetric contest ($r = 1$, $B = 0$), this term anchors the cutoff at 0.5. Second, the term B/S captures the dilution of the cushion. Since $B > 0$ (under Assumption A1), regular voters provide a structural head start that lowers the bar for R. Crucially, this advantage is diluted as total turnout S increases. When discretionary participation is low (small S), the fixed cushion B looms large; as $S \to 2$, the regular voters become marginal, and the outcome is determined solely by the turnout ratio. This decomposition will prove essential for understanding the non-monotonic dynamics of misrepresentation, which we explore in Section 3.5.

In order to express the probability of misrepresentation, let p^{full} be the pivotal cutoff that would prevail under full participation ($t_L = t_R = 1$). Economically, p^{full} represents the full-participation benchmark: it defines the threshold below which the discretionary favorite (R) holds a majority of outstanding shares. This benchmark is determined by the cushion B. In extreme cases, p^{full} may theoretically fall outside the support $[l, h]$ of p. For instance, if B is sufficiently large ($B \to 1$), R functions as a "structural winner" who prevails with probability one under full participation. In such a scenario, p^{full} drops below the lower bound l, implying that R wins solely due to their structural advantage, regardless of the realization of discretionary preferences.

The central economic tension of the model is that the equilibrium cutoff p^* does not necessarily align with this full-participation benchmark. The ranking between the two reveals the direction of the distortion. If the equilibrium cutoff p^* exceeds the benchmark

p^{full}, the bar for victory is set artificially high for the underdog (L). This implies that L-supporters are under-represented relative to their true numbers, allowing R to win in states where the majority preference actually favors L. Conversely, if p^* falls below p^{full}, the underdog is over-represented. This distortion—driven by strategic substitution—allows L to win elections even when they represent a minority of shares.

We define the *probability of misrepresentation* as the likelihood that the election produces a winner different from the full-participation benchmark. Formally, this occurs whenever the realized p falls into the gap between the equilibrium outcome and the benchmark. Using the CDF notation $F(p)$ to naturally handle cases where the benchmark falls outside the feasible support, we can express this probability as:

$$P^{\text{misrep}} \equiv \left| F(p^*) - F(p^{\text{full}}) \right| . \tag{6}$$

This formula quantifies the magnitude of the distortion: it represents the total probability mass of states where differential turnout flips the election result away from the majority preference. Note that P^{misrep} measures deviations from the outcome under full participation. While this is the relevant metric for our empirical estimation, it is distinct from aggregate *welfare*, especially if valuations are asymmetric. We discuss the welfare implications of misrepresentation in Section 3.7 and Online Appendix OA.3.2.

In the next subsection, we derive approximate closed-form expressions for $\Pr[\text{Pivotal}|i]$, for $i \in \{L, R\}$. Crucially, we then decompose these expressions to identify the two competing theoretical forces—the strategic substitution effect and the likelihood-of-a-tie (or complementarity) effect—that drive the equilibrium participation decisions.

3.3 Pivotal Probabilities and Incentives

To calculate the pivotal probabilities, let us first consider how a discretionary voter can affect the outcome. She can be pivotal if either i) her type is losing by one vote, she pushes the score to a tie, and the coin toss is favorable; or ii) there is already a tie, the coin toss is against her type, and with her vote she gives a clear majority to her type.

To simplify the combinatorial expressions for arbitrary n, we consider large n elections, adapting the methodology of Myatt (2015) to our $\gamma > 0$ setting.

Lemma 1 (Pivotal Probabilities). *Assume A1. Then the pivotal probabilities for L*

and R in large elections are approximately:

$$\Pr[\text{pivotal}|L] \approx \frac{1}{(1-\gamma)n}\frac{1}{\bar{a}(1-\bar{p})(t_R+t_L)}f(p^*)(1-p^*), \tag{7}$$

$$\Pr[\text{pivotal}|R] \approx \frac{1}{(1-\gamma)n}\frac{1}{\bar{a}\bar{p}(t_R+t_L)}f(p^*)\,p^*, \tag{8}$$

where p^* is defined in (4).

The proofs of this lemma and all other main results are in Section B of the Appendix. As expected, pivotality increases with i) fewer total voters n, ii) a smaller fraction of discretionary voters $1-\gamma$, and iii) lower availability $\bar{a}$. Even though (7) and (8) are approximations, we subsequently treat them as equalities.

Equation (7) reveals that the incentive to vote is driven by two distinct, often opposing, theoretical forces. By differentiating the pivotal probability for L with respect to the pivotal cutoff p^* (see Appendix B for the derivation), we can decompose the marginal impact of a shift in the election's competitiveness:

$$\frac{\partial \Pr[\text{pivotal}|L]}{\partial p^*} = \Pr[\text{pivotal}|L]\left[\underbrace{\frac{f'(p^*)}{f(p^*)}}_{\text{Likelihood-of-a-tie Effect}} - \underbrace{\frac{1}{1-p^*}}_{\text{Substitution Effect}}\right]. \tag{9}$$

The two terms represent the tension between the probability of a tie and the conditional necessity of a vote:

1. **Strategic Complementarity (Likelihood):** The first term captures the local slope of the belief distribution. If $f(p)$ is increasing at p^* (e.g., p^* is approaching the mode of a unimodal distribution), a shift in the cutoff raises the probability density of a decisive tie. This increases the marginal value of a vote, encouraging participation from all sides.

2. **Strategic Substitution:** The second term captures the voter's position relative to the winning threshold. As p^* increases, the probability mass favors L, making that alternative effectively safer. The term $-(1-p^*)^{-1}$ indicates that as the ex-ante likelihood of victory increases, the marginal necessity of an individual vote declines, discouraging participation (freeriding). Conversely, as the likelihood of victory falls, the marginal necessity increases, stimulating participation (underdog mobilization).

Crucially, the presence of regular voters ($\gamma > 0$) makes these forces lopsided. Because

R is the favorite (supported by the regular block), the pivotal cutoff p^* is shifted downward (see (4)). This means discretionary R-supporters are strategically positioned as freeriders: they face a high probability of winning even without voting, so the freeriding effect dominates their decision calculus. Conversely, L-supporters are underdogs: they face a structural disadvantage, keeping their pivotal probability (and incentive to participate) higher.

We formally define the *strategic substitution condition* as the regime where the substitution effect dominates the likelihood effect, such that participation decreases as one's side becomes stronger and increases as it becomes weaker ($\partial \Pr / \partial p^* < 0$). From (9), this requires $f'(p^*)/f(p^*) < 1/(1-p^*)$. While this condition technically depends on the endogenous equilibrium p^*, we can identify broad classes of informational environments where it holds globally, regardless of the outcome.

Intuitively, for distributions with "flat" or decreasing density slopes (so that f' is small), the substitution effect dominates everywhere on the support. In these environments, reaction functions are always downward-sloping (strategic substitutes), guaranteeing a unique equilibrium. Conversely, if beliefs are sufficiently "spiked" (high precision), the likelihood effect may dominate locally, triggering a *bandwagon* effect where voters participate more as their side becomes stronger. As is standard in coordination games, such strong strategic complementarities can lead to multiple equilibria or instability (Vives, 1990; Myatt, 2015).

The decomposition above highlights the general forces at play. While high-precision beliefs can generate complexity, the corporate voting environment—typically characterized by opacity and diffuse priors—naturally aligns with the stable underdog regime. For the specific case where f follows a beta distribution, we provide sufficient conditions on the primitives for the strategic substitution condition to hold globally (see Section 3.7 and Proposition OA.8 in Online Appendix OA.3.1).

In the following subsections, we establish that our core theoretical predictions—specifically the existence of full freeriding (Proposition 1) and the non-monotonicity of misrepresentation (Proposition 2)—are general properties that hold for a broad class of distributions. Consequently, we present these results first in their general form. We reserve the introduction of a specific distributional form (uniformity) until Section 3.6, where it serves as the canonical specification of the globally stable regime suitable for our structural estimation.

3.4 Equilibrium Existence and Full Freeriding

We now characterize the equilibrium participation rates. The values of t_L and t_R can range from zero to one (corner solutions) or lie anywhere in between (mixed strategies). To facilitate the discussion, we adopt a compact notation for these regimes: we denote an equilibrium by a pair xy where $x, y \in \{0, m, 1\}$ represent the participation of L and R respectively (0 for abstention, 1 for full participation, and m for mixing). For example, $m0$ denotes the regime where underdogs mix ($t_L \in (0, 1)$) and freeriders abstain ($t_R = 0$).

The next result formalizes the intuition that, unless regular voters already determine the outcome on their own, the underdog side must participate in equilibrium. Recall that $B = \frac{\gamma(2q-1)}{\bar{a}(1-\gamma)}$ measures the effective cushion provided by regular supporters of R. When $B < 1$, regulars cannot secure a win for R against unified discretionary opposition (i.e., if all discretionary voters supported L). In this case, discretionary L-voters always have some chance of being pivotal and hence cannot rationally abstain altogether.

Lemma 2 (Underdog Participation)**.** *Assume A0–A2, voting is costly ($c > 0$), and the cushion B is not outcome-determining (i.e., $B < 1$). In any responsive equilibrium, the underdogs always participate ($t_L > 0$).*

We restrict attention to *responsive* equilibria (Palfrey and Rosenthal, 1983), which rules out knife-edge coordination failures where zero pivotality sustains zero turnout.[19] The condition $B < 1$ ensures that the election is contestable: it implies the regular cushion cannot unilaterally dictate the outcome. If $B \geq 1$, the cushion alone guarantees a majority regardless of discretionary voting, rendering the strategic game trivial.

While the underdogs must always vote, the same is not true for the freeriders. Our next result shows that the ownership structure determines the boundaries of participation.

Proposition 1 (Full Freeriding iff $\gamma > 0$)**.** *Assume A0–A2, $c > 0$, and that f has strictly positive, continuous density on $(l, h) \subset (0, 1)$. Then:*

(i) (Sufficiency) *If $\gamma > 0$, there exists a range of primitives (in particular, a nonempty interval of benefit–cost ratios $v/(cn)$) for which a* responsive *equilibrium with full freeriding of the favorite exists, i.e., $t_R = 0$ and $t_L > 0$.*

(ii) (Necessity) *If $\gamma = 0$, there is no* responsive *equilibrium with full freeriding of either side; in particular, there is no responsive equilibrium with $t_R = 0$ and $t_L > 0$.*

[19] Non-responsive profiles with $t_L = t_R = 0$ can be sustained as coordination failures because pivotality is zero and abstention is a best response. We exclude such equilibria following Palfrey and Rosenthal (1983) and the large-election refinement in Myatt (2015, pp. 10–11).

Part (i) formalizes the role of the cushion B: when $\gamma > 0$ and $q > 1/2$, regulars provide a net vote margin that depresses the favorite's pivotality at low incentives, making $t_R = 0$ optimal over a nontrivial parameter region, while the underdog's pivotality remains positive so that $t_L > 0$. Part (ii) shows that without a regular block ($\gamma = 0$), such an asymmetric corner cannot arise in any responsive equilibrium: aggregate uncertainty then produces symmetric interior incentives (cf. Myatt 2015). This result will be key for the comparative statics and for explaining the non-monotonicity of misrepresentation in Section 3.5.

3.5 Misrepresentation Probability versus Benefit-to-Cost Ratio

In political elections, a higher benefit-to-cost ratio of voting typically leads to higher participation and reduced misrepresentation (Myatt, 2015). In corporate voting, however, this relationship need not be monotonic. We show that when a regular block exists ($\gamma > 0$) and turnout decisions are strategic substitutes (the strategic substitution condition in (9)), misrepresentation can initially *increase* before eventually falling.

Proposition 2 (Non-Monotonicity). *Suppose $\gamma > 0$, A0–A2 hold, f has strictly positive continuous density on $(l, h) \subset (0, 1)$, and the strategic-substitution (underdog) condition holds. Then, provided the benchmark $\mathrm{p}^{\mathrm{full}}$ lies sufficiently low in the support, there exist primitives and an interval of the benefit–cost ratio $v/(cn)$ (the incentive parameter) over which*

$$\frac{dP^{\mathrm{misrep}}(u)}{d\,(v/(cn))} \text{ changes sign from positive to negative.}$$

Economically, this non-monotonicity stems from a differential elasticity of participation: under strategic substitution, the underdog's turnout responds to incentives earlier than the favorite's. As the benefit–cost ratio u rises, the electorate transitions through distinct equilibrium regimes that generate the inverted-U shape:

1. **Paradox of Mobilization (Rising Misrepresentation):** At low $v/(cn)$, the electorate is in the *full-freeriding* phase ($m0$ regime). Increasing incentives mobilizes only the underdogs ($\partial t_L/\partial\,(v/(cn)) > 0$) while favorites continue to abstain ($t_R = 0$). This unilateral mobilization erodes the effective cushion B, driving the pivotal cutoff p^* away from the benchmark and worsening misrepresentation.

2. **Correction (Falling Misrepresentation):** Once incentives cross a critical threshold, the turnout gap narrows. This occurs either because freeriders begin to participate ($t_R > 0$) or because underdog mobilization saturates ($t_L = 1$, $1m$ regime). In

this phase, marginal increases in $v/(cn)$ primarily mobilize the majority, restoring the balance of power and reducing misrepresentation.

This mechanism is not an artifact of the homogeneous cost c. As shown in Section 3.7 and Online Appendix OA.3.3, the same pattern arises with heterogeneous voting costs and a positive mass of zero-cost "always voters." In that broader setting, the freeriders' turnout still adjusts less rapidly than the underdogs' when incentives are low, preserving the upward-sloping segment of the misrepresentation curve. The hump shape therefore reflects a general feature of strategic-substitution equilibria, not a corner-case artifact.

3.6 Specification for Empirical Estimation

While our general theory establishes the key forces at play, estimating the model requires a specification that maps observables to a unique equilibrium. General distributions can produce multiple equilibria if the likelihood-of-a-tie effect dominates, creating ambiguity that hinders structural estimation. To resolve this, we focus on the regime where strategic substitution prevails by introducing the following assumption:

A3: $p \sim \mathcal{U}[l, h]$.

By assuming a uniform distribution, we set $f'(p) = 0$. This eliminates the strategic complementarity forces identified in (9), leaving the substitution effect as the sole driver of participation. This simplification guarantees that the equilibrium for any set of parameters is unique and yields closed-form expressions, providing a stable foundation for our empirical analysis.

Under this specification, we can derive closed-form expressions for all possible equilibria. Table 1 summarizes these equilibrium regimes using the notation introduced in Section 3.4 (where $m, 1, 0$ denote mixed, full, and zero participation, respectively). The table specifies the exact parameter regions of γ and $v/(cn)$ where each equilibrium exists (Columns 5-6), with formal proofs provided in Online Appendix Sections OA.1–OA.2. To streamline our discussion, the final column groups these equilibria into three categories based on the behavior of the freeriders (R):

(i) **Full Freeriding:** R abstains completely ($m0, 10$).

(ii) **Partial Participation:** R participates with probability $\in (0, 1)$ ($mm, 1m$).

(iii) **No Freeriding:** R participates fully ($m1, 11$).

3.6.1 Equilibrium Structure and Misrepresentation

These explicit solutions allow us to partition the parameter space $\gamma \times v/(cn)$ into distinct, non-overlapping regions. In Figure 1 (a) and (c), we depict these regions for parameters motivated by our U.S. data ($h - l = 0.5, q = 0.8, \bar{a} = 1$). We show two cases: *Agreement ($\bar{p} = 0.7$):* The discretionary majority agrees with the regular voters ($q = 0.8$). Here, the cushion B is reinforced, making freeriding pervasive. *Disagreement ($\bar{p} = 0.3$):* The discretionary majority opposes the regular voters. This increases the pivotal probability for R, shrinking the freeriding regions. Panels (b) and (d) reproduce these plots with equilibria re-labeled by the extent of freeriding. Notably, for any fixed ownership structure γ, increasing the benefit-to-cost ratio $v/(cn)$ moves the system sequentially from full freeriding $\to$ partial participation $\to$ no freeriding. This transition affects outcomes, shifting from an (expected) R victory (under full freeriding) to a tie or potentially an L victory as participation increases.

This sequential transition generates the distinct patterns of misrepresentation illustrated in Figure 2. Panels (a)–(b) plot the pivotal cutoff p^* against incentives $v/(cn)$ for the Agreement case. As incentives rise, p^* first increases (in $m0$), stays constant (in mm), decreases (in $1m$), and stabilizes (in 11). The corresponding misrepresentation probability P^{misrep} (Panel c) reveals the predicted inverted-U shape. Misrepresentation peaks in the mm regime where the outcome is (on average) a tie. Crucially, in the low-incentive $m0$ region, increasing incentives raises misrepresentation because only the underdogs (L) mobilize, pulling the outcome away from the full-participation benchmark. Panel (g) shows the Disagreement case. Here, p^* starts closer to the benchmark, so the curve is largely monotonic.

These findings have critical implications for regulatory interventions. Consider a regulator attempting to reduce misrepresentation under Agreement (Panel c) when $v/(cn) = 0.25$. The plot shows that halving costs (doubling the ratio to 0.5) would be ineffective, as P^{misrep} remains unchanged in the flat mm region. Effective intervention requires knowledge of the specific regime, which our structural estimation aims to recover.

3.7 Other Theoretical Considerations

While Propositions 1 and 2 establish that freeriding and non-monotonicity are general properties of the corporate voting environment, the specification used for our empirical estimation (Section 3.6) imposes specific constraints—uniform uncertainty, symmetric valuations, and homogeneous costs—to ensure unique identification. In this section, we examine the theoretical implications of these constraints, exploring the limits of the strategic mechanism and the distinction between representation and welfare.

3.7.1 Limits of the Strategic Substitution Effect (Beta Distribution)

The strategic substitution condition derived in Section 3.3 (see (9)) requires that the strategic substitution incentive outweighs the strategic complementarity incentive (likelihood-of-a-tie). While this holds globally for the uniform distribution used in our estimation, it is not a universal law.

In Online Appendix OA.3.1, we generalize the model to a scaled Beta(α, β) distribution on (l, h) to characterize the boundaries of the theory. We establish two key stability results (Proposition OA.1). First, we find that for any distribution with "flat" or decreasing density slopes (specifically where $\alpha \leq 1$ and $\beta \geq 1$), the strategic substitution condition holds globally, regardless of the equilibrium outcome. This finding is particularly relevant because it confirms that our baseline mechanism is robust to the low-precision information environments typical of opaque corporate elections.

Second, we consider the case of highly "spiked" beliefs (where $\alpha > 1$). In these high-precision environments, the mechanism can theoretically flip to a bandwagon effect (strategic complementarity) in the left tail. However, we derive a sharp, closed-form sufficient condition, $\underline{p}(l, h, \alpha, \beta)$, and show that the stable underdog regime persists as long as the support of discretionary preferences does not extend into this extreme tail (specifically, if $l \geq \underline{p}$).

Taken together, these results imply that the uniform specification in our empirics effectively identifies the model within the globally stable regime of strategic substitution, avoiding the potential multiplicity associated with high-precision beliefs in extreme tails.

3.7.2 Welfare versus Misrepresentation

Our structural estimation focuses on P^{misrep}, which measures how often the voting outcome deviates from the full-participation benchmark. We prioritize this metric because it aligns with the regulatory ideal of shareholder democracy and is constructed directly from observable voting data. However, it is important to contrast this with welfare—maximizing aggregate value—which is a distinct economic objective.

If shareholders have symmetric valuations $v = v_L = v_R$, as we have assumed thus far, minimizing misrepresentation generally aligns with maximizing welfare.[20] However, if

[20]Strictly speaking, P^{misrep} targets the full-participation outcome, while welfare targets the median

valuations are asymmetric, the two metrics diverge. To illustrate this, consider the welfare of discretionary voters alone (abstracting from regular voters) in a skewed electorate where the minority group (L) cares twice as much about the outcome as the majority group (R), i.e., $v_L = 2, v_R = 1$. Under a simple majority rule, L should only win if they command more than 50% of the vote. However, maximizing aggregate welfare requires L to win whenever they hold more than 33% of the shares (since $2 \times 1/3 = 1 \times 2/3$). In the range between 33% and 50%, an L victory constitutes "misrepresentation" of the majority preference, yet it is welfare-maximizing.

Generally, efficiency dictates that R should win only if the expected total value of their victory exceeds that of L:

$$p \cdot v_R > (1-p) \cdot v_L \quad \iff \quad p > \frac{1}{1+\kappa},$$

where $\kappa \equiv v_R/v_L$. In Online Appendix OA.3.2, we show that the voting equilibrium exhibits an inherent tendency toward this efficient outcome. Because relative turnout scales with relative valuation ($t_R/t_L \propto \kappa$), the high-valuation group participates more aggressively, shifting the pivotal cutoff p^* in their favor. Consequently, a high estimated P^{misrep} may reflect the voting mechanism correctly weighting intense preferences, rather than a failure to represent the shareholder base. While we retain P^{misrep} as our primary measure of democratic distortion, this distinction highlights that deviations from the median discretionary voter are not synonymous with deadweight loss. A full exploration of this normative distinction is an interesting direction for future research.

3.7.3 Robustness to Cost Heterogeneity

Finally, we verify that the non-monotonicity of misrepresentation (Proposition 2) is not an artifact of the homogeneous-cost assumption used to generate the full-freeriding corner solution ($m0$). In Online Appendix OA.3.3, we introduce a continuous distribution of idiosyncratic costs. We show that while the strict zero-participation (full freeriding) corner equilibrium disappears (as there are always zero-cost or always-voters), the mechanism of differential elasticity persists. The cushion B ensures that the freeriders' participation remains less elastic to incentives than the underdogs', preserving the inverted-U hump shape of the homogeneous-cost model.

discretionary voter. These coincide exactly only if the environment is structurally balanced (i.e., regular voters are neutral, $q = 1/2$ so that the cushion $B = 0$). If regular voters introduce a bias, the "representative" outcome may differ from the utilitarian optimum even with symmetric valuations. See Online Appendix OA.3.2 for details.

3.7.4 Ex-Ante and Ex-Post Trading

Our analysis takes the distribution of shares and preferences at the record date as a primitive. Practically, this uncertainty can be micro-founded by ex-ante trading that occurs before the record date. As in Kyle (1985), random liquidity shocks generate turnover that reshuffles the shareholder base; the resulting mix of initial holders and new entrants generates the continuous aggregate uncertainty $f(p)$ assumed in our model. We formally derive this in OA.4.1, where higher trading volatility maps to more diffuse beliefs.

Conversely, in OA.4.2 we discuss how ex-post trading that occurs after the vote is neutral in our static framework. Agents form participation strategies based on the total expected value of the outcome v (incorporating anticipated capital gains) at the moment of decision. Because secondary-market trades occur after the vote is cast, their realization cannot retroactively alter the participation condition ($v \cdot \Pr[\text{Pivotal}] \gtrless c$), under our assumptions. Thus, ex-post trading leaves equilibrium turnout and the pivotal cutoff unchanged. While exploring the full dynamic feedback between market microstructure and voting mechanics is an interesting direction for future research, it is outside the scope of this paper.

4 Empirics

Having established the general theoretical mechanisms—specifically the existence of full-freeriding regimes and the non-monotonicity of misrepresentation—we now turn to the data. Our goal is to quantify these effects in real corporate elections.

To bridge the gap between general theory and structural estimation, we must address identification. While our extensions (Section 3.7 and Online Appendix OA.3) demonstrate that the core economic forces hold under general uncertainty (e.g., beta distributions), such flexibility can introduce multiple equilibria via the bandwagon effect. For structural estimation, a one-to-one mapping from parameters to outcomes is essential. Therefore, we proceed with the uniform specification (A3) established in Section 3.6. As shown, this assumption shuts down strategic complementarities and yields closed-form solutions, ensuring that observed voting patterns map directly to a unique set of structural parameters.

4.1 Identification

Our identification strategy exploits the structural relationship between observable voting outcomes and unobservable participation incentives. While we observe the *votes cast* (discretionary support), we do not directly observe the *underlying preferences* (the full population of potential supporters). The model allows us to disentangle these by linking the variation in realized votes to the specific equilibrium regimes ($m0, 1m,$ etc.) derived in Table 1.

Let $dSuL$ and $dSuR$ denote the observed discretionary support for underdog L and freerider R, respectively, expressed as a fraction of the total discretionary voter base $1-\gamma$. Given equilibrium participation rates and a realization of the latent support p, the observed votes are simply the realized support scaled by participation (see (2)):

$$dSuL = t_L(1-p), \quad dSuR = t_R p. \tag{10}$$

The central challenge is that participation rates (t_L, t_R) are *onto* but not one-to-one functions of the model parameters. As shown in Table 1, the rates are continuous and differentiable almost everywhere, but they exhibit "flat" regions in the corner solutions.

Consider two distinct benefit-to-cost ratios, $v/(cn)$ and $v'/(cn)$. If both values lie within the region V_{10} (where the cushion B is large enough to drive t_R to 0 while t_L remains at 1), they produce identical observed behavior: $t_L = 1, t_R = 0$. In such cases, the data can only tell us that the benefit-to-cost ratio lies within the *interval* V_{10}, not its precise point value. To accommodate this, we define the vector of parameters to estimate as:

$$\boldsymbol{\theta} \equiv \left(v/(cn)_{\text{lower}}, v/(cn)_{\text{upper}}, \bar{p}, \text{std}(p)\right),$$

where the bounds collapse to a single value in mixed-strategy regimes but remain distinct in corner regimes, following the set identification framework of Molinari (2020).

Our identification relies on grouping voting events into bins where structural characteristics are similar. We assume that within each estimation bin, the structural parameters $\boldsymbol{\theta}$ and observables $\boldsymbol{x} = (\gamma, q)$ are constant. Consequently, the equilibrium participation rates (t_L, t_R) are fixed for that bin. Under this *identification assumption*, the only source of variation in the observed votes $(dSuL, dSuR)$ is the random perturbation of the latent support p across different proposals. By matching the empirical moments (means and variances of discretionary support) to the theoretical moments of the uniform distribution of p, we can disentangle the strategic participation (t_L, t_R) from the underlying preference distribution $(\bar{p}, \mathrm{std}(p))$.

4.2 The Estimation Problem

We now describe how moment conditions on the observed support for each voting option allow us to estimate the unobserved parameters. The goal is to estimate $\boldsymbol{\theta}$ by GMM using the following moment conditions, where the expectations are with respect to the density of p:

$$\begin{aligned}
\mathbb{E}[dSuL] &= t_{L}(\boldsymbol{x}, \boldsymbol{\theta})(1-\overline{p}), \ \mathbb{E}[dSuR] = t_{R}(\boldsymbol{x}, \boldsymbol{\theta})\,\overline{p}, \\
\mathbb{E}[dSuL^2] &= t_{L}^2(\boldsymbol{x}, \boldsymbol{\theta})\,\mathrm{std}(p)^2 + t_{L}^2(\boldsymbol{x}, \boldsymbol{\theta})(1-\overline{p})^2, \ \mathbb{E}[dSuR^2] = t_{R}^2(\boldsymbol{x}, \boldsymbol{\theta})\,\mathrm{std}(p)^2 + t_{R}^2(\boldsymbol{x}, \boldsymbol{\theta})\,\overline{p}^2.
\end{aligned}$$

Let $\boldsymbol{m} \equiv (dSuL, dSuR, dSuL^2, dSuR^2)$ and

$$\boldsymbol{g}(\boldsymbol{m}, \boldsymbol{\theta}) \equiv \begin{pmatrix} dSuL - t_{L}(\boldsymbol{x}, \boldsymbol{\theta})(1-\overline{p}) \\ dSuR - t_{R}(\boldsymbol{x}, \boldsymbol{\theta})\,\overline{p} \\ dSuL^2 - t_{L}^2(\boldsymbol{x}, \boldsymbol{\theta})\,\mathrm{std}(p)^2 - t_{L}^2(\boldsymbol{x}, \boldsymbol{\theta})(1-\overline{p})^2 \\ dSuR^2 - t_{R}^2(\boldsymbol{x}, \boldsymbol{\theta})\,\mathrm{std}(p)^2 - t_{R}^2(\boldsymbol{x}, \boldsymbol{\theta})\,\overline{p}^2 \end{pmatrix}.$$

Then $\mathbb{E}[\boldsymbol{g}(\boldsymbol{m}, \boldsymbol{\theta})] = 0$ is the moment condition used for defining the GMM estimator for $\boldsymbol{\theta}$. Here, our nonlinear system is exactly identified, with four moment conditions to estimate four parameters. Per standard practice, for a sample $(p_1, \ldots, p_s)$ of iid realizations of discretionary support for the favorite p, we take averages $\boldsymbol{g}_s(\boldsymbol{\theta}) = \sum_{i=1}^{s} \boldsymbol{g}(\boldsymbol{m}_i, \boldsymbol{\theta})/s$, where we explicitly denote the moments' dependence on the realization of p. Then our estimation problem is

$$\min_{\boldsymbol{\theta}} \boldsymbol{J}(\boldsymbol{\theta}) = s g_s(\boldsymbol{\theta})' \boldsymbol{W} g_s(\boldsymbol{\theta}), \tag{11}$$

where $\boldsymbol{W}$ is 4×4, positive-definite, and a symmetric weight matrix. In our estimation, we perform a two-step GMM (Hansen, 1982; Hansen and Singleton, 1982). In the first step, we take $\boldsymbol{W} = \boldsymbol{I}$, the identity matrix, and obtain estimates $\hat{\boldsymbol{\theta}}$. In the second, we use $\hat{\boldsymbol{W}} = \left(\sum_{i=1}^{s} \boldsymbol{g}(\boldsymbol{m}_i, \hat{\boldsymbol{\theta}}) \boldsymbol{g}(\boldsymbol{m}_i, \hat{\boldsymbol{\theta}})'/s\right)^{-1}$. Standard errors are computed using the delta method (Wooldridge, 2010, pp. 44-45).[21] Next, we describe how we implement the estimation of $\boldsymbol{\theta}$.

[21] In particular, let $\boldsymbol{\Delta_i} \equiv [\partial\theta_\mathbf{i}/\partial\overline{\mathbf{m}}_\mathbf{1}, \partial\theta_\mathbf{i}/\partial\overline{\mathbf{m}}_\mathbf{2}, \partial\theta_\mathbf{i}/\partial\overline{\mathbf{m}}_\mathbf{3}, \partial\theta_\mathbf{i}/\partial\overline{\mathbf{m}}_\mathbf{4}]$, the sensitivity of parameters $\{\theta_i\}_{i=1}^4$ to sample averages of moments $\overline{\mathbf{m}}$. And let $\boldsymbol{S}$ the variance-covariance matrix of $\boldsymbol{g}(\boldsymbol{x}, \boldsymbol{\theta})$, where θ is the second-step estimate. Then, the variance of our error in estimating parameter θ_i is given by $\boldsymbol{\Delta}_i \times \boldsymbol{S} \times \boldsymbol{\Delta}_i'$, for $i = \{1, 2, 3, 4\}$.

4.3 Implementation

To satisfy our identifying assumption, we arrange our data into bins to have a meaningful unit of estimation. Each bin quadruple sorts our data on i) the fraction of regular voters, γ; ii) numbers of shares, n; iii) proposal type; and iv) the fraction of regular voters with preference for R (the favorite), q (see Table OA.3 Panel B for a description of the variables). There are 17 proposal types, and for each of γ, q, and n, we split the data into terciles; so the theoretically possible number of bins is $17 \times 3 \times 3 \times 3 = 621$. Proposals in our sample exist in 300 of these bins.

For each bin, we compute the sample averages $\boldsymbol{g}_s(\boldsymbol{\theta})$. To solve (11), we perform an exhaustive search in a dense grid of points in the permissible space of the unobservable parameters $\boldsymbol{\theta}$. For each point, we compute the predicted discretionary support per preference type and for each equilibrium. Within each bin, we then pick the point in the grid of $\boldsymbol{\theta}$ with the lowest estimation error value $\boldsymbol{J}$.

Finally, we estimate P^{misrep} from the expression in (6), using the estimated parameters $\boldsymbol{\theta}_{\text{est}}$ and observed sample averages $\overline{\boldsymbol{x}}$ for each bin.

4.4 Estimates

In Table 3, we report our parameter estimates. We report averages weighted by the number of observations, i.e., actual proposals voted upon, in each bin (our estimation unit). In total, we obtain equilibrium estimates for 22,520 proposals after excluding those that do not fulfill A1 (the assumption that regular voters do not unilaterally decide the voting outcome - see section OA.6) or those that do not match to any equilibrium. In Panel A, we show parameter estimates for all equilibria, whereas in Panel B, we split them by equilibrium.

Misrepresentation. We estimate a nontrivial probability P^{misrep} of a minority win of 13.7%, with a narrow 95% confidence interval between 12.9% and 14.3%. This average masks substantive heterogeneity (see Figure OA.8). In terms of proposal types, the minority is least likely to win in proposals on takeover defense and most likely in restructuring-related management proposals (Panels (a)-(c)). Proxy contests have a P^{misrep} (14%) close to the sample average; that probability is much higher in special meetings (32%, Panel (d)). Agriculture (SIC code first digit 1), manufacturing (4) and construction (3) are the industries with the highest P^{misrep} and transportion (5) the lowest (Panel (e)). We report estimates separately for the most politically charged industries (according to Hong and Kostovetsky (2012)). These have very low P^{misrep} with the exception of oil, which has one of 16% (Panel (f)). P^{misrep} does not show any particular time trend but fluctuates throughout the years (Figure OA.9).

Benefits and cost of voting. The average benefit-to-cost ratio per share, $v/(cn)$, is 0.36 with a 95% confidence interval of 0.23 to 0.49 (Table 3, Panel A). Under rather primitive assumptions, we show, in Section OA.8, that these number are roughly comparable to the literature. In Figure OA.8, we report the estimates for different subsamples. Shareholder proposals have greater $v/(cn)$ than management proposals, possibly reflecting that only the most material shareholder proposals make it to the ballot, while management must obtain formal votes on certain matters even if shareholders do not regard them as important in all firms (Panel (a)). The proposals with the highest $v/(cn)$ are shareholder proposals related to the board structure (Panel (c)); the lowest are management proposals related to board matters (Panel (b)). The management proposals with the highest $v/(cn)$ are related to business matters. Proxy contests have a higher $v/(cn)$ than special meetings, although both have lower $v/(cn)$ than typical meetings, perhaps reflecting the higher costs of voting outside regular meetings. The broader industries do not differ much in terms of benefit-to-cost ratios of voting, but defense and resources exhibit high benefit-to-cost ratios of voting, consistent with Hong and Kostovetsky (2012). $v/(cn)$ is broadly increasing over time, consistent with the recent general interest in shareholder voting.

Strategic substitution: freeriders and underdogs. Our estimate for participation rates (Table 3, Panel A) is 65% for L, which is by magnitudes larger than the 2% for R, the side aligned with the majority of regular voters. Indeed, according to our estimates, L is not only the minority among regular voters but on average also the minority preference among discretionary voters: we estimate a 0.56 mean and a 0.25 standard deviation for the distribution of p, the fraction of discretionary voters for R. With an estimate of $\overline{p}$ higher than 0.5, the average case is one of agreement (as in Figures 1– 2). The low participation by the majority corresponds to the prevalence (77%) of full-freeriding equilibria ($m0$ and 10), with no participation by R (Panel B). Further, 23% are in an equilibrium with partial freeriding (mm and $1m$), and almost none (0.1%) in one with zero participation ($m1$ and 11). This ranking contrasts with political elections, where the mostly observed equilibrium is mm with partial participation from both sides.

Selection by equilibrium. The selection effects differ between equilibria (Panel B). While, by definition, P^{misrep} is zero under full participation from both sides (equilibrium 11), it is 11% in mm, where both sides partially participate, and 18% in $m0$, the most frequent equilibrium with full freeriding. The $v/(cn)$, as predicted by our theoretical model, is lower in equilibria with more freeriding and the highest in the equilibrium with no freeriding. The corner solutions with full or no participation drive the overall participation rates. The low average turnout by R reflects the prevalence of freeriding. Even in the partial freeriding equilibria, turnout by R is as low as 17% –these are more comparable to equilibria with full freeriding than those with no freeriding (or full participation from R). In contrast, the minority side L participates 51% in $m0$, the equilibrium where the R side freerides fully. In the mixed equilibrium mm, the L side turns out 70%. The large difference in participation between discretionary voters of L and R implies that selection moves the voting outcome away from the population's preference.

4.5 International Evidence

Administrative costs of voting are likely to be small in the United States, as most firms in the United States support electronic voting and do not require cumbersome paperwork to prove ownership or pre-register for voting. To explore selection effects for different levels of the voting costs, we extend our sample to firms outside the United States in this section and link misrepresentation probability estimations to institutional determinants of the costs and benefits of voting.

Data. For non-U.S. firms, we collect data on meetings and proposals from ISS for 2013–2020, along with ownership data from Factset and shareholder-level voting data from Diligent.[22] Analogous to the U.S. sample, we exclude routine proposals, director elections, and say-on-pay frequency proposals, yielding 98,242 proposals from 93 countries. Because variation in q is very small, we divide the proposals to bins representing terciles of γ, and n and proposal types. Proposals in our sample exist in 166 of these bins. Excluding proposals that violate A1 (the assumption that regular voters do not unilaterally decide the voting outcome - see discussion in section OA.6) and those that do not match any equilibrium, we obtain estimates for 30,104 proposals.

Sample. The average firm outside the United States is smaller, with a market capitalization of \$1.3 billion (see Table 4). Ownership by N-PX filers and other mutual funds is substantially lower outside the United States—9% compared with 39% in the United States. (Panel A of Table 4). In contrast, insider ownership is much higher, averaging 43% versus 13% in the United States. Overall participation is lower by a full order of magnitude, at 40% compared with 73% in the United States, while discretionary participation

[22]Formerly known as Insightia and ProxyInsight, Diligent Market Intelligence collects information on votes from public sources, including NP-X files and mutual fund websites. See Michaely et al. (2023) for a more detailed description of its U.S. data.

is only 5%, relative to 24% in the United States. Shareholder-sponsored proposals are rare, accounting for roughly 1% of the sample, and most proposals pass, with an average of 79% of votes cast in favor.

Estimates. Despite the vastly smaller participation rates, the distribution of equilibria and resulting representativeness resemble those in the United States (Table 4 Panel B). As in the United States, the majority of proposals outside the United States (80% compared to 83% in the United States) exhibit full freeriding, followed by partial freeriding equilibria (20% compared to 17% in the United States - see Panel C). No-freeriding equilibria occur more often than in the United States, with 11% (vs. 0.03% in the United States). This distribution results in participation of 52% by the underdog (L, compared to 65% in the United States) and 2% by the majority (R, compared to also 2% in the United States). The likelihood of a minority win is 11%, very similar to the 14% in the United States. In contrast, the estimated benefit-to-cost ratio is with 0.23 by magnitudes smaller than in the United States (0.36), likely reflecting the higher costs of voting.

4.6 Counterfactuals

To guide regulatory or corporate policy to improve representativeness, we report the sign of the average effect of changes in the benefits or costs of voting on representativeness, in Table 5.

Proposals and meetings. In Figure OA.11, we depict the relationship between implied P^{misrep} and counterfactual $v/(cn)$ for each proposal type for U.S. proposals. An increase in $v/(cn)$ will reduce P^{misrep} for proposals on board composition, business matters, other governance, and restructuring, management proposals on voting, and shareholder proposals on CSR. In contrast, it will increase P^{misrep} (and hence will harm representativeness) for say-on-pay proposals, and shareholder proposals on compensation and voting. In management proposals on compensation and defense, misrepresentation would first become more common before falling again upon increases in $v/(cn)$. We depict counterfactuals for meeting types outside the traditional annual general meeting in Figure OA.12. For both proxy contests and special meetings, increases in the benefit-to-cost ratio are associated with decreases in P^{misrep} and hence more representativeness.

Trends. Figure OA.15 repeats the analysis for U.S. proposals by year. In most of the first five years of the sample, the derivatives are negative, indicating that increasing the benefits of voting or reducing its costs would have lowered the incidence of misrepresentation. Between 2009 and 2011, however, these effects change: initially, such changes would have increased misrepresentation, before eventually reducing it. The opposite pattern emerges from 2012 to 2018, when the derivatives are negative but become positive, implying that modest reductions in voting costs improve representativeness, while larger reductions worsen it. In the final years of the sample (2018–2020), the derivatives are positive but again turn negative, signaling another reversal in the effect of voting costs on representativeness.

Industries. In Figure OA.13, we show counterfactuals across SIC-1 digit industry averages for U.S. proposals. Decreasing the cost of voting (and thus increasing the benefit-to-cost ratio) will benefit the representativeness of proposals in construction, manufacturing and wholesale but harm it in transportation. Derivatives are negative (less misrepresentation) first but turning positive in finance and retail; and positive (more misrepresentation) first but turning negative in agriculture and mining. We repeat the analysis for the most controversial industries: for defense and resources, the current equilibrium represents a minimum in the probability of misrepresentation. In contrast, increasing the benefit-to-cost ratio would increase representativeness in oil and decrease it in tobacco.

4.7 Discussion and Robustness

To facilitate the interpretation of the estimations, we now point out the limitations imposed by the model's assumptions for the empirical analysis. Our model focuses on the strategic decision of whether to participate in voting while taking other potential decisions as given. In particular, the model abstracts from why shareholders make certain proposals as well as how they obtain their shares, choose their preference type, and arrive at their common knowledge of the model's parameters. In reality, however, these decisions are likely to be endogenous, and hence the participation decision may depend on factors outside of our model.

Of particular interest is how shareholders obtain decision-relevant information. In the model, discretionary voters observe the parameters: $\{\gamma, q, \overline{p}, \text{std}(p), v, c, n, \overline{a}\}$.[23] Much of the information is easy to access due to disclosure regulations: the ownership structure (γ, n), which is disclosed in the invitation to vote; voting manifestos by institutional investors (q); and recommendations of proxy advisors, such as ISS and Glass Lewis (Iliev and Lowry, 2014; Malenko and Shen, 2016), which can proxy for average investor prefer-

[23] Our estimates already take into account any actions by major stakeholders to affect those parameters. For example, investors buying shares to vote or managerial actions to affect the outcome (including campaigning or picking the location of the meeting). In essence, our identifying assumption requires that these parameters are fixed until voting is over.

ences $\overline{p}$. Also, it is reasonable to assume that voters know their cost of voting c.

Other information can still be costly to acquire. For example, subscription services like Diligent provide aggregate voting predictions using the past voting of institutional investors. Here, shareholders can acquire costly information about the benefits of the proposals (i.e., v), the (dispersion of) preferences of the other shareholders (i.e., std(p)), or both. From the perspective of our model, any information acquisition cost is sunk at the stage of the participation decision. Moreover, our key assumption is not that discretionary voters have perfect information but that they are homogeneous in their amount of information. Absent heterogeneity in information, the channel we shut down is information aggregation. To assess the robustness of our results to this channel, we re-estimate our models separately for proposals that are more and less information-intensive. Specifically, we distinguish between proposals in meetings with only one nonroutine proposal and those in meetings with multiple proposals, as well as between meetings held early in the proxy season and those held later, when emerging proposal trends are more widely understood (see OA.OA.9.3). Across all subsamples, our qualitative results remain unchanged.

To verify that our specific functional forms do not drive the empirical results, we estimate the *uniform-cost* specification derived from the theoretical extension in Section 3.7 (and OA.3.3) as a tractable benchmark. This version maintains all other baseline assumptions but replaces the constant cost with a uniformly distributed cost of voting,[24] allowing for investor heterogeneity (e.g., between hedge funds and retail groups) including effectively costless voters. Despite this additional flexibility, estimation errors are higher than under the homogeneous-cost baseline, which attests to the empirical discipline and strong fit of the simpler closed-form model—whose analytical tractability avoids the numerical approximation and computational noise required by the more general variants.

Equity lending is another practical concern. Aggarwal et al. (2015) report a 1.9 percentage point rise in recalls by institutions around record dates, leading to a reduced supply and higher fees. In the presence of such a market, discretionary voters may decide to lend their shares instead of voting, effectively increasing the opportunity cost component of c. If voting constitutes a significant factor in the equity lending market, the demand, supply, and interest should be endogenous to shareholder preferences and the voting decision. Given that the expected benefits of voting are greater for shareholders with a preference for the underdog, they should be willing to pay more to borrow shares. This will allow them to acquire more votes, which will lead to closer votes than would occur in a world without equity lending. Closer votes can lead to a higher incidence of

[24] In the notation of OA.3, this corresponds to parameters $\delta = 1, \kappa = 1, p \sim \mathcal{U}[l, h], v_R = v_L = v$.

the incomplete participation equilibrium mm. However, the additional borrowing demand around the record date is small, with estimates around 0.2% (Christoffersen et al., 2007) to 0.3% (Aggarwal et al., 2015). Consistent with these magnitudes, our estimates do not change qualitatively even in the top quintiles of equity demand and supply (see Section OA.9.3).

We also make procedural assumptions that are standard in the literature (see Heard and Sherman (1987); Monks and Minow (2003) for further details about the mechanics of proxy voting.) First, we assume that voting occurs simultaneously. In practice, there might be instances of early access to tabulations (Bach and Metzger, 2018). However, most voters and brokers submit their votes at the deadline to prevent access to such information and to avoid having to change their votes should they change their opinion. Second, we assume that regular voters never abstain from voting, which is consistent with the data with fewer than 1% of empty votes cast within our sample. Third, our model assumes that the vote is for a single issue/proposal—i.e., it abstracts from bundling, which occurs in reality. To address this, in Section OA.9.3, we show that our results hold qualitatively in meetings with more proposals. Section OA.9.2 discusses robustness to alternative estimation choices.

Finally, not all proposals are binding. Of exception (in the United States) are management proposals on most governance related changes as well as restructuring-related issues such as equity issuance and acquisitions financed with stock (Tallarita, 2022). We do not model explicitly whether proposals are binding. Levit and Malenko (2011) show that non-binding (so-called precatory) proposals can still be effective at influencing management and (Cai and Walkling, 2011; Correa and Lel, 2016; Cuñat et al., 2015) document empirically effects of non-binding Say-on-Pay votes. In our data, if non-binding proposals were ignored by management altogether, we should observe a low estimated benefit-to-cost ratio for those. Empirically, this is not the case: restructuring-related management proposals have no higher benefit-to-cost estimate (0.16, compared to an average of 0.32 for management proposals) than other proposals. One potential explanation for the higher benefit-to-cost estimate for non-binding proposals is that only the most important issues are selected to be voted upon (as in the argument by Barry (2023)), while restructuring rules mean that all related matters must be voted on.

5 Conclusion

We analyze corporate voting as a reflection of shareholder preferences and as a strategic trade-off shaped by ownership structure. We demonstrate that the presence of committed *regular voters* (such as insiders and blockholders) induces strategic substitution: shareholders with majority preferences (*freeriders*) abstain as they can rely on regular votes, while those with minority preferences (*underdogs*) participate disproportionately. This asymmetric selection creates a systematic wedge between observed voting outcomes and the underlying majority preference. We estimate that this mechanism leads to unrepresentative outcomes in 14% of U.S. and 11% of non-U.S. proposals.

Our approach offers a key advantage over reduced-form models: it disentangles unobservable preferences (popularity) from intensity (benefits), substantially improving predictive accuracy. This decomposition reveals a policy implication: reducing voting costs does not monotonically enhance representativeness. In the prevalent full-freeriding regime, lower costs can trigger a paradox of mobilization, where participation rises but representativeness declines as only the minority mobilizes. By identifying these regimes, our framework provides firms and regulators with a diagnostic tool to assess when voting outcomes reflect genuine shareholder will and when they arise from strategic selection. In doing so, it lays the foundation for a richer understanding of shareholder representation.

Our framework captures a generic equilibrium feature of collective decision-making: when a subset of agents participates irrespective of pivotality—akin to committed bases in political elections—strategic abstention among others can drive non-monotonic—with respect to the benefit-to-cost ratio of voting—representativeness. Our theoretical extensions confirm that this mechanism is robust to heterogeneous costs, generalized beliefs, and asymmetric valuations, providing a versatile foundation for future research. Broadening this approach to analyze welfare in settings with intensity differences, or to explore how committed minorities shape outcomes in institutional design and public choice, offers a promising direction for future work.

APPENDIX

A. Figures and Tables

Figure 1: **Equilibrium regions** under Agreement and Disagreement between regular and discretionary voters ($\overline{a} = 1$, $h - l = 0.5$, $q = 0.8$, $p \sim \mathcal{U}[l, h]$). (a) and (c) splits the regions based on the specific equilibrium, while (b) and (d) groups them based on the extent of freeriding.

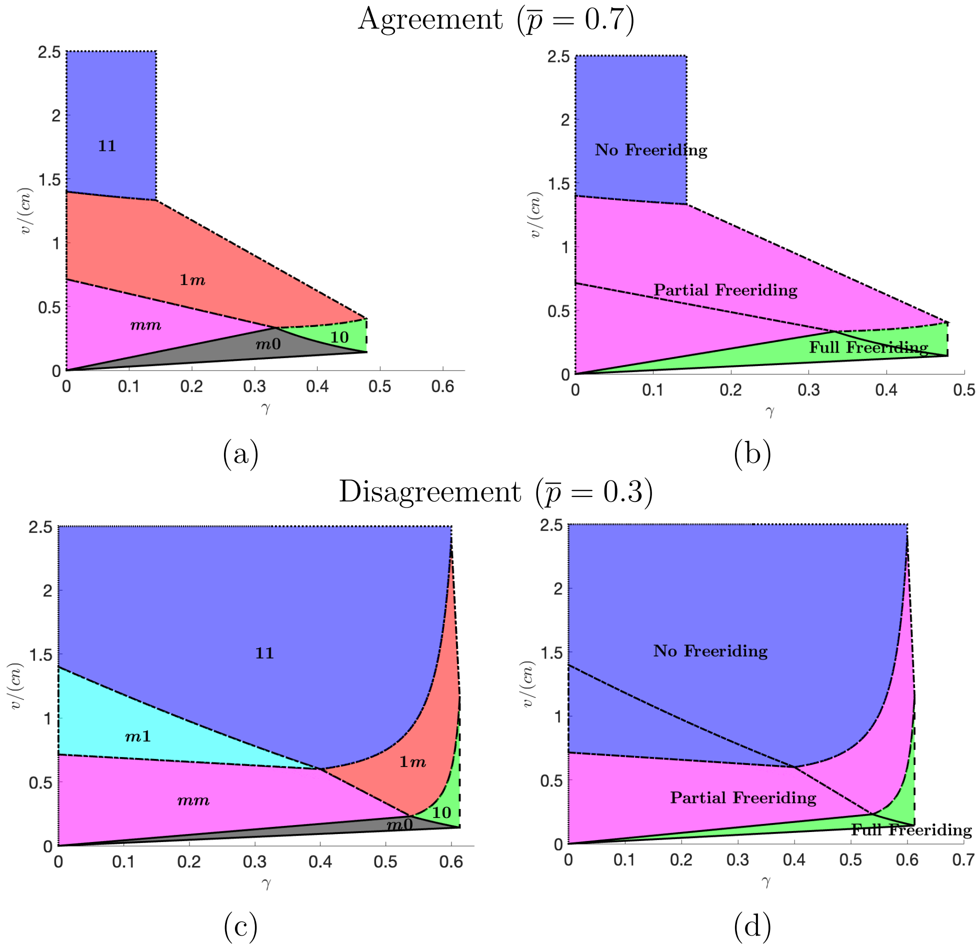

Figure 2: **Probabilities** p^* (top panels (a)–(b) & (e)–(f)) and P^{misrep} (bottom panels (c)–(d) & (g)–(h)) vs $v/(cn)$ under Agreement and Disagreement between the two groups of voters ($\gamma = 0.1$, $\overline{a} = 1$, $h - l = 0.5$, $q = 0.8$, $p \sim \mathcal{U}[l, h]$). In the top panels the black dashed line is $p^{\text{full}} \approx 0.47$ and the red dashed line is $\overline{p}$. The corresponding equilibria ((a), (c), (e), (g)) or the extent of freeriding ((b), (d), (f), (h)) are also mentioned on the graphs.

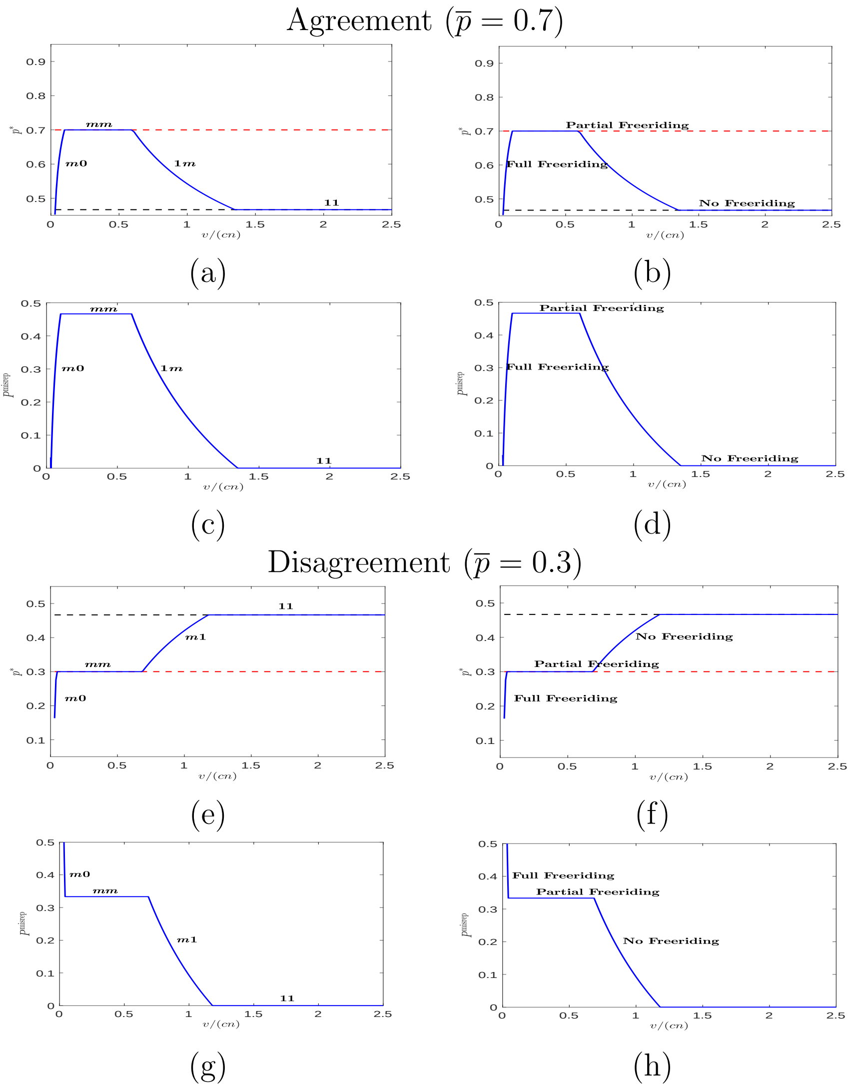

Table 1: **All possible equilibria.** Column 1 identifies each equilibrium, with notation indicating L's and R's participation levels (m for mixed, 1 for full, 0 for none). Column 2 cites the relevant proposition, while columns 3 and 4 provide t_L and t_R, referencing explicit formulas where applicable. Columns 5 and 6 outline the parameter regions for γ, Γ and $v/(cn), V$. Column 7 reports the average outcome based on $\overline{p} - p^*$. Column 8 classifies equilibria by the extent of freeriding among R-supporters: full $(m0, 10)$, partial $(mm, 1m)$, and none $(m1, 11)$.

(1) Eqm.	(2) Prop.	(3) t_L	(4) t_R	(5) $\gamma \in$	(6) $v/(cn) \in$	(7) Avg. outcome	(8) Freeriding
$m0$	OA.7	$\in (0,1)$, (OA.36)	$=0$	Γ_{m0}, (OA.34)	V_{m0}, (OA.35)	Right	Full
10	OA.4	$=1$	$=0$	Γ_{10}, (OA.24)	V_{10}, (OA.25)	Right	Full
mm	OA.1	$\in (0,1)$, (OA.4)	$\in (0,1)$, (OA.5)	Γ_{mm}, (OA.2)	V_{mm}, (OA.3)	Tie	Partial
$1m$	OA.3	$=1$	$\in (0,1)$, (OA.22)	Γ_{1m}, (OA.20)	V_{1m}, (OA.21)	Tie/Right	Partial
$m1$	OA.6	$\in (0,1)$, (OA.32)	$=1$	Γ_{m1}, (OA.30)	V_{m1}, (OA.31)	Left	No
11	OA.5	$=1$	$=1$	Γ_{11}, (OA.27)	V_{11}, (OA.28)	Left/Tie/Right	No

Table 2: **Univariate Statistics** for a sample of proposals voted upon in U.S. firms 2003–2020. Panel A shows firm characteristics (at the firm-year level), statistics for ownership of voting shares (at the meeting level), and for participation (at the proposal level). Panel B table shows univariate statistics by proposal type.

Panel A: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Firm-year level					
Market capitalization ($M)	33038	9040	37400	0	1360000
Meeting level					
N-PX	37933	0.39	0.26	0	1
Closely held	32568	12.5	16.7	0	97.3
Shares outstanding (M)	38030	195	621	0.10	29100
n	38030	455	628	0	14060
Proposal level					
Participation (all)	64840	0.72	0.19	0	1
Participation (voluntary)	64998	0.24	0.3	0	1

Panel B: Participation (%)

	Shareholder Proposals				**Management Proposals**			
Proposal type	Frequency	Support (%)	Participation		Frequency	Support (%)	Participation	
			Total	Discretionary			Total	Discretionary
Board	1028	0.29	0.71	0.41	604	0.9	0.77	0.15
Business	83	0.2	0.62	0.31	425	0.89	0.63	0.15
CSR	2980	0.18	0.65	0.34	11	0.82	0.85	0.57
Compensation	1322	0.3	0.69	0.37	21341	0.87	0.72	0.23
Defense	159	0.58	0.7	0.44	285	0.8	0.68	0.24
Governance	256	0.36	0.62	0.28	1090	0.84	0.74	0.23
Restructuring	276	0.29	0.72	0.41	7176	0.84	0.69	0.29
SOP	0				24388	0.91	0.74	0.19
Voting	2494	0.5	0.73	0.39	1104	0.89	0.78	0.18
Total	8598	0.32	0.69	0.37	56424	0.88	0.73	0.22

Table 3: **Selection.** This table shows estimates for proposals voted upon in U.S. firms 2003–2020. Panel A includes statistics for the whole sample, Panel B the mean by equilibrium.

Panel A: Parameter estimates

Estimate	N	Mean	Confidence Interval	Std.	Min	Max
P^{misrep}	22,520	0.137	[0.129-0.143]	0.126	0	0.5
s.e.		[0.003-0.004]				
$v/(cn)$ Benefit-cost ratio	22,520	0.36	[0.233;0.491]	0.438	0.015	3.533
s.e.		[0.067-0.065]				
t_L Participation rate L	22,520	0.648	[0.642;0.662]	0.262	0.029	1
s.e.		[0.007-0.003]				
t_R Participation rate R	22,520	0.02	[0.016;0.027]	0.067	0	1
s.e.		[0.004-0.002]				
$\bar{p}$ Mean	22,520	0.558	[0.518;0.592]	0.053	0.025	0.785
s.e.		[0.017-0.02]				
std(p)	22,520	0.254	[0.243;0.269]	0.03	0.01	0.288
s.e.		[0.008-0.006]				

Panel B: By equilibrium

	mm	$1m$	10	11	$m1$	$m0$	Full Freeriding	Partial Freeriding	No Freeriding
N	894	4,214	0	2	12	1,7398	17,398	5,108	3,175
(as a fraction of N)	4%	19%	0%	0%	0%	77%	77%	23%	14%
P^{misrep}	0.11	0.05	0	0	0	0.18	0.17	0.07	0
$v/(cn)$	0.72	1.79	0.16	2.05	0	0.15	0.15	1.38	2.05
t_L Participation rate L	0.7	1	1	1	0	0.51	0.52	0.89	1
t_R Participation rate R	0.29	0.1	0	1	0	0	0	0.17	1

Table 4: **International.** This table shows in Panel A univeriate statistics for a sample of non-U.S. proposals from 2013–2020. Panels B and C shows estimates for proposals voted upon in U.S. firms 2003–2020 excluding observations that do not match an equilibrium or do not satisfy A1 (see Table OA.3. Panel B includes the mean, confidence interval, standard deviation, minimum, and maximum for the whole sample. Panel C shows the mean for each equilibrium.

Panel A: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Firm-year level					
Market capitalization ($M)	27,264	1,330	1,600	2.16	4,710
Meeting level					
N-PX shares	33,005	0.09	0.17	0	1
Closely held	31,726	0.43	0.25	0	1
Proposal level					
Participation (all)	97,040	0.42	0.36	0	1
Participation (voluntary)	97,199	0.05	0.17	0	1
Management proposals	98,242	0.99	0.11	0	1
Votes for	95,749	79.4	38.41	0	100

Panel B: Parameter estimates outside the United States

Estimate	N	Mean	Confidence Interval	Std.	Min	Max
P^{misrep}	30104	0.109	[0.092-0.128]	0.118	0	0.398
s.e.		[0.009-0.009]				
$v/(cn)$ Benefit-cost ratio	30104	0.231	[-0.53;0.305]	0.272	0.023	1.238
s.e.		[0.038-0.388]				
t_L Participation rate L	30104	0.519	[0.502;0.536]	0.316	0.049	1
s.e.		[0.009-0.009]				
t_R Participation rate R	30104	0.024	[0.022;0.026]	0.068	0	0.578
s.e.		[0.001-0.001]				
$\bar{p}$ Mean	30104	0.589	[0.056;1.027]	0.085	0.289	0.848
s.e.		[0.223-0.272]				
std(p)	30104	0.229	[-0.079;0.481]	0.04	0.085	0.288
s.e.		[0.129-0.157]				

Panel C: By equilibrium

	mm	$1m$	10	11	$m1$	$m0$	Full Freeriding	Partial Freeriding	No Freeriding
N	3,840	2,151	1,024	0	0	23,089	24,113	5,991	3,175
(as a fraction of N)	13%	7%	3%	0%	0%	77%	80%	20%	11%
P^{misrep}	0.11	0.05	0	0	0	0.18	0.13	0.04	0
$v/(cn)$	0.72	1.79	0.16	2.05	0	0.15	0.14	0.61	0.81
t_L Participation rate L	0.7	1	1	1	0	0.51	0.51	0.48	1
t_R Participation rate R	0.29	0.1	0	1	0	0	0	0.12	0.02

Table 5: **Counterfactuals** – change in misrepresentation given a change in the benefits or costs of voting. This table shows the sign of the derivatives of P^{misrep} by increasing $v/(cn)$ in Panel A and by P^{misrep} by decreasing $v/(cn)$ in Panel B. This has the maximum $v/(cn)$ so the entry refers to the sign as we approach the current level of the benefit cost ratio per share.

Panel A: increasing $v/(cn)$

Subsample	-	+	-, turning +	+, turning -
Management Proposals	Board Business Governance Restructuring Voting	Say-On-Pay		Compensation Defense
Shareholder Proposals	Board Business CSR Governance Restructuring	Compensation Voting		
Meeting types	Proxy contests Special meetings			
Industry	Construction Manufacturing Wholesale	Transportation	Finance Retail	Agriculture Mining
Years	2003-08		2012-17	2009-11; 2018-20

Panel B: decreasing $v/(cn)$

Subsample	-	+	-, turning +	+, turning -
Management Proposals	Compensation Defense	Board Say-On-Pay Voting		Business
Shareholder Proposals		Board Business Compensation CSR Voting	Restructuring	Governance
Meeting types		Proxy contests Special meetings		
Industry	Agriculture Services	Retail Transportation	Mining	Construction Finance Manufacturing Wholesale
Years			2009-20	2003-08

B. Proofs of Main Results

Proof of Lemma 1. Define $u_R \equiv apt_R$ and $u_L \equiv a(1-p)t_L$, the actual voting probabilities for R and L among discretionary voters, respectively, and the probability of absentee votes $u_0 \equiv 1 - u_R - u_L$. Vector $u \equiv (u_R, u_L, u_0)$ lives in the two-dimensional unit simplex Λ. Beliefs regarding u are represented by continuous and bounded density $h(\cdot|i)$, for $i \in \{R, L\}$. Then the number of discretionary votes b_R, b_L, and $(1-\gamma)n - b_R - b_L$ follow a multinomial distribution, with probabilities $u \in \Lambda$. Hence, by adapting Myatt (2015, Eqs (4) & (5)) for our purposes, we calculate the probability of a tie with x discretionary votes for R by taking the following expectation over u:

$$
\begin{aligned}
\Pr\left[b_R = x, b_L = x + (2q-1)\gamma n \middle|\, h(\cdot|i)\right] &= \\
\int_\Lambda \frac{((1-\gamma)n)!\, {u_R}^x {u_L}^{x+(2q-1)\gamma n} {u_0}^{(1-2q\gamma)n-2x}}{x!(x+(2q-1)\gamma n)!((1-2q\gamma)n-2x)!} h(u|i)du &\approx \\
h\left(\frac{x}{(1-\gamma)n}, \frac{x}{(1-\gamma)n} + \frac{(2q-1)\gamma}{(1-\gamma)}, \frac{1-2q\gamma}{1-\gamma} - 2\frac{x}{(1-\gamma)n}\middle| i\right) \frac{\Gamma\left((1-\gamma)n+1\right)}{\Gamma\left((1-\gamma)n+3\right)} &\approx \\
\frac{1}{(1-\gamma)n} \frac{h\left(\frac{x}{(1-\gamma)n}, \frac{x}{(1-\gamma)n} + \frac{(2q-1)\gamma}{(1-\gamma)}, \frac{1-2q\gamma}{1-\gamma} - 2\frac{x}{(1-\gamma)n}\middle| i\right)}{(1-\gamma)n},
\end{aligned}
$$

for $i \in \{R, L\}$, where the first equality follows from the multinomial distribution. The first approximation relies on the observation that, for n large, most of the distribution will be concentrated at its mode and uses properties of the Dirichlet density. The second approximation follows from the definition of $\Gamma(y+1) = y!$, for $y \in \mathbb{N}$, and that, for n large, $(1-\gamma)n + 1 \approx (1-\gamma)n$, $(1-\gamma)n + 2 \approx (1-\gamma)n$. Hence, summing over all possible x, the overall probability of a tie is:

$$
\sum_{x=0}^{n/2-q\gamma n} \Pr\left[b_R = x, b_L = x + (2q-1)\gamma n \middle|\, h(\cdot|i)\right],
$$

where we assume for simplicity, in the context of this proof, that both $n/2$ and $\gamma q n$ are integers. Given the above approximations, for n large, the sum can be approximated by the integral

$$
\frac{1}{(1-\gamma)n} \int_0^{\frac{1/2-q\gamma}{1-\gamma}} h(y, y + (2q-1)\gamma/(1-\gamma), (1-2q\gamma)/(1-\gamma) - 2y|i)dy.
$$

Therefore, by employing Myatt (2015, Lemma 2), the probability of a tie and a near tie are equal for a large n and hence for $i \in \{R, L\}$:

$$\Pr[\text{Pivotal}|i] \quad \approx \quad \frac{1}{(1-\gamma)n}\int_0^{\frac{1/2-q\gamma}{1-\gamma}} h(y, y+(2q-1)\gamma/(1-\gamma), (1-2q\gamma)/(1-\gamma)-2y|i)dy. \tag{12}$$

Below, we revert the above expressions from vector u to vector (p, a) so that we can transition from density h to densities f and g. Recall that $u_R = apt_R$, and $u_L = a(1-p)t_L$; hence, the Jacobian $\partial(u_R, u_L)/\partial(p, a)$ has a determinant equal to $at_R t_L$. Moreover, note that each shareholder updates her beliefs based on her own availability, and so

$$h(x, y, 1-x-y|i) = \frac{f\,(p(x,y)|i)\, g\,(a(x,y)|\text{available})}{a(x,y)t_L t_R},$$

for any $x, y \in (0,1)$ and $i \in \{R, L\}$, where

$$g\,(a|\text{available}) = \frac{g(a)a}{\bar{a}},\ f(p|L) = f(p)\frac{1-p}{1-\bar{p}},\ f(p|R) = f(p)\frac{p}{\bar{p}}.$$

Hence, for $u_R = y$ and $u_L = y + (2q-1)\gamma/(1-\gamma)$ from (12), after some simple algebra, we define

$$\begin{aligned} p(a) &\equiv \frac{t_L}{t_R+t_L} - \frac{(2q-1)\gamma}{1-\gamma}\frac{1}{a(t_R+t_L)}, \\ a(y) &\equiv \frac{y(t_R+t_L)}{t_R t_L} + \frac{(2q-1)\gamma}{1-\gamma}\frac{1}{t_L}, \end{aligned}$$

so that $p(\bar{a}) = p^*$ (see (4)). By substituting all the above in the integrand of (12), we have

$$\begin{aligned} &h(y, y+(2q-1)\gamma/(1-\gamma), (1-2q\gamma)/(1-\gamma)-2y|R) \\ =\ &\frac{f\,(p(a(y)))\, g\,(a(y))\, a(y)p\,(a(y))}{a(y)t_R t_L \bar{a}\bar{p}} = p\,(a(y))\, f\,(p(a(y)))\, g\,(a(y))\, \frac{1}{t_R t_L \bar{a}\bar{p}},\ \text{and} \end{aligned} \tag{13}$$

$$\begin{aligned} &h(y, y+(2q-1)\gamma/(1-\gamma), (1-2q\gamma)/(1-\gamma)-2y|L) \\ &\quad = (1-p\,(a(y)))\, f\,(p(a(y)))\, g\,(a(y))\, \frac{1}{t_R t_L \bar{a}(1-\bar{p})}. \end{aligned} \tag{14}$$

Now, to calculate the integral in (12), we change the variable from y to $a = a(y)$. We have $da = dy(t_R + t_L)/(t_R t_L)$ and

$$\begin{aligned} a(0) &= \frac{(2q-1)\gamma}{1-\gamma}\frac{1}{t_L}, \\ a\left((1/2 - q\gamma)/(1-\gamma)\right) &= \frac{t_R\left(1/2 - \gamma(1-q)\right) + t_L\left(1/2 - \gamma q\right)}{(1-\gamma)t_R t_L}. \end{aligned}$$

Then we have:

$$\begin{aligned} \Pr[\text{Pivotal}|R] &\approx \frac{1}{(1-\gamma)n}\int_0^{\frac{1/2-q\gamma}{1-\gamma}} h(y, y + (2q-1)\gamma/(1-\gamma), (1-2q\gamma)/(1-\gamma) - 2y|R)dy.dy \\ &= \frac{1}{(1-\gamma)n}\frac{1}{\bar{a}\bar{p}(t_R + t_L)}\int_{a(0)}^{a((1/2-q\gamma)/(1-\gamma))} f(p(a))p(a)g(a)da, \end{aligned} \tag{15}$$

where, in the second line, we substituted from (13) as well as using (14)

$$\Pr[\text{Pivotal}|L] = \frac{1}{(1-\gamma)n}\frac{1}{\bar{a}(1-\bar{p})(t_R + t_L)}\int_{a(0)}^{a((1/2-q\gamma)/(1-\gamma))} f(p(a))(1-p(a))g(a)da. \tag{16}$$

To develop a simple formula for estimation purposes, we assume that a follows a degenerate distribution around its mean; that is, $g(a) = \delta(a - \bar{a})$, where δ is the Dirac function. Then, to have a strictly positive probability of being pivotal, we need:

$$a(0) < \bar{a} < a\left((1/2 - q\gamma)/(1-\gamma)\right) \iff \frac{(2q-1)\gamma}{1-\gamma}\frac{1}{t_L} < \bar{a} < \frac{t_R\left(1/2 - \gamma(1-q)\right) + t_L\left(1/2 - \gamma q\right)}{(1-\gamma)t_R t_L}. \tag{17}$$

The above is a restriction on equilibrium t_R, t_L. Let us start with the lower bound on $\bar{a}$ in (17). This restriction can be equivalently written as:

$$\bar{a}t_L(1-\gamma) + (1-q\gamma) > q\gamma.$$

In words, this says that, if all expected support for R is zero (i.e., $\bar{p} = 0$), then there is t_L so that L wins. This has to be true in any equilibrium for discretionary supporters of L to participate. Now the restriction imposed by the upper bound in (17) can be equivalently written as:

$$t_R\left(1/2 - \gamma(1-q)\right)(\bar{a}t_L - 1) + t_L\left(1/2 - \gamma q\right)(\bar{a}t_R - 1) < 0,$$

which is always true as (from $q > 1/2$ and A1): $\gamma(1-q) < \gamma q < 1/2$; $\bar{a} \leq 1$; and $t_{R,L} \leq 1$. Hence, (17) will always be satisfied in equilibrium. Also, note that, for (15) and (16) not to be zero, we need $p(\bar{a}) = p^* \in (l, h)$, which we will check for each equilibrium separately. Therefore, given $g(a) = \delta(a - \bar{a})$ and A1, we have that (16) leads to (7), and, similarly, (15) becomes (8), where p^* is given by (4). ■

Proof of Equation (9): Decomposition of Incentives. Let $K_L \equiv \frac{1}{(1-\gamma)n\bar{a}(1-\bar{p})(t_R+t_L)}$ be the positive scale factor in Equation (16). The pivotal probability can thus be written as $\Pr[\text{Pivotal}|L] \approx K_L f(p^*)(1-p^*)$. Differentiating with respect to the tie-point p^*:

$$\begin{aligned}
\frac{\partial \Pr[\text{Pivotal}|L]}{\partial p^*} &= K_L \frac{\partial}{\partial p^*}\left[f(p^*)(1-p^*)\right] \\
&= K_L \left[f'(p^*)(1-p^*) - f(p^*)\right] \\
&= K_L f(p^*)(1-p^*)\left[\frac{f'(p^*)}{f(p^*)} - \frac{1}{1-p^*}\right] \\
&= \Pr[\text{Pivotal}|L]\left[\underbrace{\frac{f'(p^*)}{f(p^*)}}_{\text{Likelihood-of-a-tie effect}} - \underbrace{\frac{1}{1-p^*}}_{\text{Freeriding effect}}\right].
\end{aligned}$$

A symmetric derivation for R (where $\Pr[\text{Pivotal}|R] \approx K_R f(p^*)p^*$) yields:

$$\frac{\partial \Pr[\text{Pivotal}|R]}{\partial p^*} = \Pr[\text{Pivotal}|R]\left[\frac{f'(p^*)}{f(p^*)} + \frac{1}{p^*}\right].$$

In this case, the second term ($1/p^*$) is positive. Since p^* increases when R becomes weaker (requiring higher support to win), this positive derivative represents strategic substitution, while the first term remains the source of strategic complementarity. ■

Proof of Lemma 2. Suppose $t_L = 0$. If also $t_R = 0$, pivotal probabilities are zero due to the cushion B. While abstention is then a best response (a trivial coordination failure), we follow Palfrey and Rosenthal (1983) and focus on responsive equilibria. If instead $t_R > 0$, the cushion B guarantees that R wins with probability one because the required vote share $p^* = -B/t_R$ is negative. Thus $\Pr(\text{pivotal} \mid R) = 0$. Since $c > 0$, R's best response is to abstain, contradicting $t_R > 0$. Hence $t_L = 0$ cannot occur in any responsive equilibrium, implying $t_L > 0$. ■

Proof of Proposition 1. *(i) Sufficiency,* $\gamma > 0$. Fix $\gamma > 0$ and $q > 1/2$ (A0), and write $B \equiv \frac{\gamma(2q-1)}{\bar{a}(1-\gamma)} > 0$. Consider candidate profiles with $t_R = 0$ and $t_L \in (0, 1]$. From (4),

$$p^* \;=\; \frac{t_L}{t_L} - \frac{(2q-1)\gamma}{1-\gamma}\frac{1}{\bar{a}\,t_L} \;=\; 1 - \frac{B}{t_L}.$$

Hence p^* is strictly increasing in t_L and satisfies $p^* \to -\infty$ as $t_L \downarrow 0$. Because f has positive density on (l, h), we can select $t_L \in (0, 1]$ such that $p^* \in (l, h)$, provided the cushion B is not prohibitively large (specifically $1 - B > l$). Under $t_R = 0$, the pivotal probability for R is (Lemma 1)

$$\Pr(\text{pivotal} \mid R) \;=\; \frac{1}{(1-\gamma)n} \cdot \frac{1}{\bar{a}\,\bar{p}\,t_L}\, f(p^*)\, p^*,$$

which can be made arbitrarily small by reducing $v/(cn)$ (to reduce equilibrium t_L) or by taking parameters such that p^* is close to l. Thus, for any $c > 0$ there exists a nonempty interval of $v/(cn)$ such that

$$v \cdot \Pr(\text{pivotal} \mid R) \;<\; c,$$

so $t_R = 0$ is a best response. For L, with the same $t_R = 0$ we have

$$\Pr(\text{pivotal} \mid L) \;=\; \frac{1}{(1-\gamma)n} \cdot \frac{1}{\bar{a}\,(1-\bar{p})\,t_L}\, f(p^*)\,(1-p^*),$$

which is strictly positive for $p^* \in (l, h)$. By choosing $v/(cn)$ within an interval satisfying

$$v \cdot \Pr(\text{pivotal} \mid L) = c \quad (\text{or } > c \text{ if } t_L = 1),$$

we obtain a responsive best reply for L with $t_L > 0$. Hence, there exists a responsive equilibrium with $t_R = 0$ and $t_L > 0$.

(ii) Necessity, $\gamma = 0$. If $\gamma = 0$, then (4) reduces to $p^* = \frac{t_L}{t_R + t_L}$. Suppose, toward a contradiction, that there is a responsive equilibrium with $t_R = 0$ and $t_L > 0$. Then $p^* = 1$. Since f is supported on $(l, h) \subset (0, 1)$, the cutoff $p^* = 1$ lies strictly outside the support. Thus, R never wins, ties occur with probability zero, and both pivotal probabilities are zero. With $c > 0$, abstention is a best response for both sides; in particular, $t_L > 0$ cannot be a best response in a *responsive* equilibrium. Thus no responsive equilibrium can have full freeriding when $\gamma = 0$. ■

Proof of Proposition 2 (Non-Monotonicity). Let $u \equiv v/(cn)$ denote the incentive parameter. For any equilibrium at u, let $p^*(u)$ be the pivotal cutoff and p^{full} the full-participation benchmark (independent of u). With F the CDF of f,

$$P^{\text{misrep}}(u) = \big|F(p^*(u)) - F(p^{\text{full}})\big|. \tag{18}$$

Whenever $p^*(u) \neq p^{\text{full}}$ and $p^*(u) \in (l, h)$, differentiation gives

$$\frac{dP^{\text{misrep}}}{du} = \operatorname{sgn}\big(p^*(u) - p^{\text{full}}\big)\, f(p^*(u))\, \frac{dp^*}{du}. \tag{19}$$

Hence the sign of $\frac{dP^{\text{misrep}}}{du}$ is governed by $\frac{dp^*}{du}$.

Step 1 (Equilibrium path). By Proposition 1(i), there exists a nonempty interval of small u with at least one responsive equilibrium in regime $m0$ ($t_R = 0$, $t_L > 0$). As u increases, the continuity of the pivotal?probability functions (implied by the continuous density f) ensures that best responses vary continuously in u, yielding a locally continuous equilibrium path through regimes $m0 \to mm \to 1m$ (under A3, uniform uncertainty, this equilibrium is actually unique for each u).

Step 2 (Regime $m0$: Rising Misrepresentation). Here $p^* = 1 - B/t_L$, so $\frac{dp^*}{dt_L} > 0$. The equilibrium condition $u\,\Pr(\text{pivotal} \mid L) = 1$ implies, under strategic substitution, that $\Pr(\text{pivotal} \mid L)$ decreases in t_L (Myatt, 2015). Thus $dt_L/du > 0$. Hence $\frac{dp^*}{du} = \frac{dp^*}{dt_L}\frac{dt_L}{du} > 0$. Because the cushion supports R, p^{full} lies low so $p^* > p^{\text{full}}$; therefore by (19), $\frac{dP^{\text{misrep}}}{du} > 0$: increasing incentives raises misrepresentation.

Step 3 (Regime mm: Flat). When both sides mix, the ratio of FOCs yields $p^* = \bar{p}$, constant in u. Hence $dp^*/du = 0$ and $\frac{dP^{\text{misrep}}}{du} = 0$ within this interior region (up to kinks at regime boundaries).

Step 4 (Regime $1m$: Falling Misrepresentation). Now $t_L = 1$ and $p^* = (1 - B)/(1 + t_R)$, so $\frac{dp^*}{dt_R} < 0$. Under strategic substitution, $\Pr(\text{pivotal} \mid R)$ decreases in t_R, so $dt_R/du > 0$; thus $\frac{dp^*}{du} < 0$. Since p^* falls toward p^{full}, $\frac{dP^{\text{misrep}}}{du} < 0$.

Step 5 (Sign change). Combining Steps 2–4, $\frac{dP^{\text{misrep}}}{du}$ is positive in $m0$, zero in mm, and negative in $1m$. The equilibrium path therefore implies a sign change from positive to negative, establishing the claim. ■

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Online Appendix for: "Freeriders and Underdogs: Participation in Corporate Voting"

Konstantinos E. Zachariadis, Dragana Cvijanović, and Moqi Groen-Xu

The Online Appendix provides supplementary theoretical and empirical material supporting the main text. Sections OA.1 and OA.2 contain the detailed derivations for the equilibrium regions listed in Table 2 of the main text. In particular, Section OA.1 establishes the equilibrium conditions for incomplete participation from both sides (mm), while Section OA.2 extends this analysis to equilibria where at least one side fully participates or abstains ($1m$, 10, 11, $m1$, $m0$). Throughout these derivations, we maintain assumptions A0–A2, assume $p \in (l, h) \subseteq (0, 1)$, $\bar{a} \in (0, 1]$, g is degenerate (so $a = \bar{a}$), and let $d \equiv h - l$.

Section OA.3 generalizes the model's theoretical mechanisms beyond the baseline assumptions used for estimation. We first explore the general conditions for strategic substitution versus bandwagon incentives (strategic complementarity) using a flexible beta distribution (OA.3.1). We then analyze the welfare implications of asymmetric valuations relative to representativeness (OA.3.2). Finally, we demonstrate the robustness of the non-monotonicity by introducing heterogeneous voting costs (OA.3.3).

Section OA.4 analyzes ex-ante and ex-post trading around the record date, showing how pre-record trading micro-foundations generate aggregate uncertainty and why post-record trading is neutral under our timing assumptions.

Section OA.5 categorizes and describes the proposals, while Section OA.6 describes the estimation sample satisfying our assumptions. Section OA.7 evaluates the model's fit by benchmarking its predictions against reduced-form estimates. Section OA.8 interprets the estimated benefit-to-cost ratios in terms of return on investment from a successful vote. Section OA.9 presents robustness checks, including alternative estimation assumptions, the role of equity lending, and variation in the availability of shares for voting. Additional tables and figures supporting the empirical results appear at the end of the appendix.

OA.1 Equilibrium with Internal Participation

Proposition OA.2 contains the necessary and sufficient conditions for the existence of equilibrium mm for an arbitrary number of voters n. Proposition OA.1, which we present first, is the restriction of Proposition OA.2 to large n (case (b), which is the only one that survives as $n \to \infty$).

Proposition OA.1 (**Equilibrium** mm)**.** *If*

$$n \in N_{mm} \equiv \left(\frac{f(\overline{p})\left(\overline{a}(1-\overline{p})+2q-1\right)}{\overline{a}(2q-1)}, \infty \right), \tag{OA.1}$$

$$\gamma \in \Gamma_{mm} \equiv \left(\frac{f(\overline{p})(1-\overline{p})}{n(2q-1)}, \frac{\overline{a}(1-\overline{p})}{\overline{a}(1-\overline{p})+2q-1} \right), \tag{OA.2}$$

$$\frac{v}{cn} \in V_{mm} \equiv \left(\frac{\gamma(2q-1)}{f(\overline{p})(1-\overline{p})}, \min\left\{ \frac{\left(\overline{a}-\gamma\left(\overline{a}-1+2q\right)\right)}{f(\overline{p})\overline{p}}, \frac{\left(\overline{a}-\gamma\left(\overline{a}+1-2q\right)\right)}{f(\overline{p})(1-\overline{p})} \right\} \right) \tag{OA.3}$$

then there exists an equilibrium with incomplete participation by both types; that is, t_L, $t_R \in (0,1)$ *given by*

$$t_L = \frac{f(\overline{p})\overline{p}}{(1-\gamma)\overline{a}} \frac{v}{cn} + \frac{(2q-1)\gamma}{(1-\gamma)\overline{a}}, \tag{OA.4}$$

$$t_R = \frac{f(\overline{p})(1-\overline{p})}{(1-\gamma)\overline{a}} \frac{v}{cn} - \frac{(2q-1)\gamma}{(1-\gamma)\overline{a}}. \tag{OA.5}$$

Furthermore, in equilibrium, the probability that either L or R is pivotal is equal to the common cost-to-benefit ratio c/v (1), and the total expected votes for L and R are equal

$$\overline{a}(1-\gamma)p^* t_R + \gamma q = \overline{a}(1-\gamma)(1-p^*)t_L + \gamma(1-q), \tag{OA.6}$$

i.e., $p^* = \overline{p}$*, so that the expected outcome is a tie.*

Proposition OA.2 (**Equilibrium** mm **for any** n)**.** *Assume that*

$$\frac{v}{c} < \min\left\{ \frac{n\left(\overline{a}-\gamma\left(\overline{a}-1+2q\right)\right)}{f(\overline{p})\overline{p}}, \frac{n\left(\overline{a}-\gamma\left(\overline{a}+1-2q\right)\right)}{f(\overline{p})(1-\overline{p})} \right\}.$$

In addition, consider the following disjoint parameter regions:

(a) Small regular block size:

$$\frac{v}{c} \geq 1, \quad n > \frac{f(\overline{p})\overline{p}}{\overline{a}}, \text{ and}$$

(i) Many voters, high availability:

$$n > \frac{f(\overline{p})(1-\overline{p})}{\overline{a}}, \overline{a} > 2q-1, \text{ and}$$
$$0 \leq \gamma < \min\left\{ \frac{\overline{a}n - f(\overline{p})(1-\overline{p})}{\left(\overline{a}+1-2q\right)n}, \frac{\overline{a}n - f(\overline{p})\overline{p}}{\left(\overline{a}-1+2q\right)n}, \frac{f(\overline{p})(1-\overline{p})}{n(2q-1)} \right\}, \text{ or}$$

(ii) Many voters, low availability:

$$n > \frac{f(\overline{p})(1-\overline{p})}{\overline{a}},\ \overline{a} < 2q-1,\ \textit{and}\ 0 \leq \gamma < \min\left\{\frac{\overline{a}n - f(\overline{p})\overline{p}}{(\overline{a}-1+2q)\,n}, \frac{f(\overline{p})(1-\overline{p})}{n(2q-1)}\right\},\ \textit{or}$$

(iii) Few voters, low availability:

$$\frac{f(\overline{p})\left(\overline{a}(1-\overline{p})+2q-1\right)}{\overline{a}(2q-1)} < n < \frac{f(\overline{p})(1-\overline{p})}{\overline{a}},\ \overline{a} < 2q-1,\ \overline{p} < \frac{1}{2},\quad \textit{and}$$
$$\frac{\overline{a}n - f(\overline{p})(1-\overline{p})}{(\overline{a}+1-2q)\,n} < \gamma < \frac{\overline{a}n - f(\overline{p})\overline{p}}{(\overline{a}-1+2q)\,n}.$$

(b) Large regular block size (many voters, any availability):

$$\frac{v}{c} > \frac{n\gamma(2q-1)}{f(\overline{p})(1-\overline{p})},\quad n > \frac{f(\overline{p})\left(\overline{a}(1-\overline{p})+2q-1\right)}{\overline{a}(2q-1)},\ \textit{and}$$
$$\frac{f(\overline{p})(1-\overline{p})}{n(2q-1)} < \gamma < \frac{\overline{a}(1-\overline{p})}{\overline{a}(1-\overline{p})+2q-1}.$$

These conditions are necessary and sufficient for the existence of an incomplete participation equilibrium by both types—that is, $t_L, t_R \in (0,1)$, which are given by equations (OA.4) and (OA.5). Finally, in such an equilibrium, the probability of being pivotal for either R of L is equal to the common cost-to-benefit ratio c/v (1), and the expected votes for R and L are equal (OA.6); i.e., $p^* = \overline{p}$.

Proof. We proceed in two steps. In the first, we derive the expressions for the rates, and in the second, we determine the feasible parameter regions.

Step 1: Derivation of Rates Given the expressions for the pivotal probabilities, we now seek to determine whether an equilibrium exists with incomplete participation for both L and R (i.e., $t_L, t_R \in (0,1)$). From (1), we know that, since the cost-to-benefit ratio is the same for both types, the pivotal probabilities should also be the same for both. Hence, using (8) and (7), in equilibrium, we must have:

$$p^* = \overline{p}, \tag{OA.7}$$

which, given (OA.6), means that at equilibrium the total average supports for L and R are equal. Hence, the expected outcome is a tie. From (OA.7), the pivotal probabilities in equilibrium are:

$$\Pr[\text{Pivotal}|R] = \Pr[\text{Pivotal}|L] = \frac{1}{(1-\gamma)n}\frac{1}{\overline{a}(t_R+t_L)}f\left(p^*\right).$$

Moreover, the pivotal probability for type R is equal to her cost-to-benefit ratio (1) in the equilibrium with incomplete participation; hence,

$$t_R + t_L \quad = \quad \frac{1}{(1-\gamma)n\overline{a}} f(\overline{p}) \frac{v}{c}. \tag{OA.8}$$

Furthermore, according to the definition of p^* (4) and the fact that it is equal to $\overline{p}$ (OA.7), after some simple algebra, we have

$$t_L \quad = \quad (t_R + t_L)\overline{p} + \frac{(2q-1)\gamma}{1-\gamma} \frac{1}{\overline{a}}. \tag{OA.9}$$

Using (OA.8) with (OA.9), we derive the equilibrium t_L and t_R, as given in (OA.4) and (OA.5).

Step 2: Bounds on the Parameters Incomplete participation means that $(t_L, t_R) \in (0,1)$. To ensure this, we now derive the restrictions on the parameters of the model—in particular, n, γ and v/c or equivalently $v/(cn)$. By definition, what we need for incomplete participation is $(t_L, t_R) \in (0,1)$. According to (OA.4), it is evident that $t_L > 0$ for all parameter values. The condition $t_L < 1$ is equivalent to:

$$\gamma \quad < \quad \frac{\overline{a}}{2q-1+\overline{a}}, \text{ and} \tag{OA.10}$$

$$\frac{v}{c} \quad < \quad \frac{n\left(\overline{a} - \gamma\left(\overline{a} - 1 + 2q\right)\right)}{f(\overline{p})\overline{p}}. \tag{OA.11}$$

Given our assumption that $q > 1/2$, the upper bound on γ in (OA.10) takes precedence over A1 (i.e., $\gamma < 1/(2q)$). Now, the condition $t_R > 0$ is equivalent to:

$$\frac{v}{c} \quad > \quad \frac{n\gamma(2q-1)}{f(\overline{p})(1-\overline{p})}. \tag{OA.12}$$

For (OA.12) to define the relevant lower bound on v/c given A2 (i.e., $v/c \geq 1$), we need a lower bound on the regular block size and the number of voting shares,

$$\gamma \quad > \quad \frac{f(\overline{p})(1-\overline{p})}{n(2q-1)}, \text{ and} \tag{OA.13}$$

$$n \quad > \quad \frac{2qf(\overline{p})(1-\overline{p})}{2q-1}; \tag{OA.14}$$

otherwise, we need to impose $v/c \geq 1$ from A2. Finally, the condition $t_R < 1$ is equivalent to:

$$\frac{v}{c} \quad < \quad \frac{n\left(\overline{a} - \gamma\left(\overline{a} + 1 - 2q\right)\right)}{f(\overline{p})(1-\overline{p})}. \tag{OA.15}$$

Hence, for the benefit-to-cost ratio v/c, we have two possible upper bounds: (OA.11) and (OA.15). Either can be relevant, depending on the parameter values. Therefore, the upper bound on v/c is

$$\frac{v}{c} \quad < \quad \min\left\{\frac{n\left(\overline{a}-\gamma\left(\overline{a}-1+2q\right)\right)}{f(\overline{p})\overline{p}}, \frac{n\left(\overline{a}-\gamma\left(\overline{a}+1-2q\right)\right)}{f(\overline{p})(1-\overline{p})}\right\}. \tag{OA.16}$$

For v/c, we also have a lower bound, which is either (OA.12), if γ satisfies (OA.13), or one. In either case, we need to ensure that the lower bound is smaller than the upper bound on v/c in (OA.16). Let us look at each case in turn.

Case A: If (OA.13) holds, then to ensure that the upper bounds on v/c in (OA.16) are larger than the lower bound in (OA.12), we have another restriction on γ,

$$\gamma \quad < \quad \frac{\overline{a}(1-\overline{p})}{\overline{a}(1-\overline{p})+2q-1}. \tag{OA.17}$$

From the two possible upper bounds of γ in (OA.10) and (OA.17), we can show that, for $q > 1/2$, the relevant bound is condition (OA.17). Finally, we need to ensure that the lower bound of γ in (OA.13) is lower than the upper bound in (OA.17). This puts a lower bound on the number of voting shares:

$$n \quad > \quad \frac{f(\overline{p})\left(\overline{a}(1-\overline{p})+2q-1\right)}{\overline{a}(2q-1)},$$

which supersedes the other lower bound of (OA.14).

Case B: If (OA.13) does not hold, then to ensure that the upper bound on v/c in (OA.16) exceeds the lower bound imposed by A2, we add the following two restrictions on γ,

$$n(\overline{a}-(2q-1))\gamma \quad < \quad \overline{a}n - f(\overline{p})(1-\overline{p}), \text{ and } n(\overline{a}+(2q-1))\gamma < \overline{a}n - f(\overline{p})\overline{p}. \tag{OA.18}$$

For these to be satisfied, we need $n > f(\overline{p})\overline{p}/\overline{a}$. Observe also that the second restriction in (OA.18) implies the upper bound in (OA.10), so this latter bound can be ignored in what follows. Then we have the following subcases:

i) If $n > f(\overline{p})(1-\overline{p})/\overline{a}$ and $\overline{a} < 2q-1$, then the only other restriction on γ (i.e., other than $\gamma < f(\overline{p})(1-\overline{p})/(n(2q-1)))$ can be written as $\gamma < \left(\overline{a}n - f(\overline{p})\overline{p}\right) / \left(\left(\overline{a}-1+2q\right)n\right)$.

ii) If $n > f(\overline{p})(1-\overline{p})/\overline{a}$ and $\overline{a} > 2q-1$, then the added restriction on γ can be written as

$$\gamma < \min\left\{\frac{\overline{a}n - f(\overline{p})(1-\overline{p})}{\left(\overline{a}+1-2q\right)n}, \frac{\overline{a}n - f(\overline{p})\overline{p}}{\left(\overline{a}-1+2q\right)n}\right\}.$$

iii) If $n < f(\overline{p})(1-\overline{p})/\overline{a}$ and $\overline{a} > 2q-1$, then there is no equilibrium with incomplete participation.

iv) If $n < f(\overline{p})(1-\overline{p})/\overline{a}$, $\overline{a} < 2q-1$, and $\overline{p} < 1/2$, then we need

$$\frac{\overline{a}n - f(\overline{p})(1-\overline{p})}{(\overline{a}+1-2q)\,n} < \gamma < \frac{\overline{a}n - f(\overline{p})\overline{p}}{(\overline{a}-1+2q)\,n}, \text{ for } \frac{f(\overline{p})\,(\overline{a}(1-\overline{p})+2q-1)}{\overline{a}(2q-1)} < n < \frac{f(\overline{p})(1-\overline{p})}{\overline{a}}.$$

We summarize all the above in the statement of Proposition OA.2. ■

OA.2 Equilibria with Corner Participation

In this section, we present the propositions and corresponding proofs for the equilibria where at least one type of discretionary voter has a corner participation rate.

Proposition OA.3 (Equilibrium $1m$)**.** *Assume that $p \sim \mathcal{U}[l,h]$. If and only if*

$$n \in N_{1m} \equiv \left(\max\left\{\frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{4(1-\gamma)^2\overline{a}^2\overline{p}d}, \frac{1}{\overline{p}d}\frac{l^2}{(1-\gamma)\overline{a}-(2q-1)\gamma}\right\}, \infty\right) \tag{OA.19}$$

$$\gamma \in \Gamma_{1m} \equiv \left(\frac{\overline{a}(1-2\overline{p})}{\overline{a}(1-2\overline{p})+2q-1}\mathbb{I}\left(\overline{p} < \frac{1}{2}\right), \frac{\overline{a}(1-l)}{2q-1+\overline{a}(1-l)}\right), \tag{OA.20}$$

$$\frac{v}{cn} \in V_{1m} \equiv \left(\max\left\{\frac{(1-\gamma)^2\overline{a}^2\overline{p}d}{(1-\gamma)\overline{a}-(2q-1)\gamma}, \frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{\overline{p}}d, \frac{1}{n}\right\},\right.$$
$$\left.\min\left\{\frac{4(1-\gamma)^2\overline{a}^2\overline{p}d}{(1-\gamma)\overline{a}-(2q-1)\gamma}, \frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{l^2}\overline{p}d\right\}\right), \tag{OA.21}$$

where $\mathbb{I}$ is the indicator function, there exists an equilibrium with $t_L = 1$ and $t_R \in (0,1)$ given by

$$t_R = \frac{1}{(1-\gamma)\overline{a}}\sqrt{\frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{d\overline{p}}\frac{v}{cn}} - 1. \tag{OA.22}$$

Proposition OA.4 (Equilibrium 10)**.** *If and only if*

$$n \in N_{10} \equiv \left(\frac{f(p^*)\,p^*}{(1-\gamma)\overline{ap}}, \infty\right), \tag{OA.23}$$

$$\gamma \in \Gamma_{10} \equiv \left(\frac{(1-\overline{p})\overline{a}}{2q-1+(1-\overline{p})\overline{a}}, \frac{\overline{a}(1-l)}{2q-1+\overline{a}(1-l)}\right), \tag{OA.24}$$

$$\frac{v}{cn} \in V_{10} \equiv \left(\max\left\{\frac{1}{n}, \frac{(1-\gamma)\overline{a}(1-\overline{p})}{f(p^*)\,(1-p^*)}\right\}, \frac{(1-\gamma)\overline{ap}}{f(p^*)\,p^*}\right), \tag{OA.25}$$

there exists an equilibrium with $t_L = 1$ and $t_R = 0$, where from (4) $p^* = 1-(2q-1)\gamma/((1-\gamma)\overline{a})$.

Proposition OA.5 (Equilibrium 11). *If and only if $l < 1/2$ and*

$$n \in N_{11} \equiv (0, \infty), \tag{OA.26}$$

$$\gamma \in \Gamma_{11} \equiv \left(\max\left\{ 0, \frac{\overline{a}(1-2h)}{\overline{a}(1-2h)+2q-1} \mathbb{I}\left(h < \frac{1}{2}\right) \right\}, \frac{\overline{a}(1-2l)}{\overline{a}(1-2l)+2q-1} \right), \tag{OA.27}$$

$$\frac{v}{cn} \in V_{11} \equiv \left(\max\left\{ \frac{(1-\gamma)\overline{a}\overline{p}}{f(p^*)\frac{p^*}{2}}, \frac{(1-\gamma)\overline{a}(1-\overline{p})}{f(p^*)\frac{1-p^*}{2}}, \frac{1}{n} \right\}, \infty \right), \tag{OA.28}$$

where $\mathbb{I}$ is the indicator function, there exists an equilibrium with $t_L = 1$ and $t_R = 1$, where from (4) $p^* = 1/2 - (2q-1)\gamma / (2(1-\gamma)\overline{a})$.

Proposition OA.6 (Equilibrium $m1$). *Assume that $p \sim \mathcal{U}[l, h]$. If and only if $\overline{p} < 1/2$ and*

$$n \in N_{m1} \equiv \left(\max\left\{ \frac{(1-\gamma)\overline{a}+(2q-1)\gamma}{4d(1-\gamma)^2\overline{a}^2(1-\overline{p})}, \frac{(1-h)^2}{d(1-\overline{p})\left((1-\gamma)\overline{a}+(2q-1)\gamma\right)} \right\}, \infty \right), \tag{OA.29}$$

$$\gamma \in \Gamma_{m1} \equiv \left(0, \frac{\overline{a}(1-2\overline{p})}{\overline{a}(1-2\overline{p})+2q-1} \right), \tag{OA.30}$$

$$\begin{aligned} \frac{v}{cn} \in V_{m1} \equiv & \left(\max\left\{ \frac{1}{n}, d\frac{(1-\gamma)\overline{a}+(2q-1)\gamma}{(1-\overline{p})} \right\}, \right. \\ & \left. \min\left\{ d\frac{4(1-\gamma)^2\overline{a}^2(1-\overline{p})}{(1-\gamma)\overline{a}+(2q-1)\gamma}, d\frac{(1-\overline{p})((1-\gamma)\overline{a}+(2q-1)\gamma)}{(1-h)^2} \right\} \right), \end{aligned} \tag{OA.31}$$

there exists an equilibrium with $t_R = 1$ and $t_L \in (0, 1)$ given by

$$t_L = \frac{1}{(1-\gamma)\overline{a}} \sqrt{\frac{(1-\gamma)\overline{a}+(2q-1)\gamma}{d(1-\overline{p})} \frac{v}{cn}} - 1. \tag{OA.32}$$

Proposition OA.7 (Equilibrium m0). *Assume that $p \sim \mathcal{U}[l, h]$. If and only if*

$$n \in N_{m0} \equiv \left(\max\left\{ \frac{(2q-1)\gamma}{d(1-\gamma)^2\overline{a}^2(1-\overline{p})}, \frac{1-\overline{p}}{d(2q-1)\gamma} \right\}, \infty \right), \tag{OA.33}$$

$$\gamma \in \Gamma_{m0} \equiv \left(0, \frac{\overline{a}(1-l)}{2q-1+\overline{a}(1-l)} \right), \tag{OA.34}$$

$$\frac{v}{cn} \in V_{m0} \equiv \left(\max\left\{ \frac{1}{n}, \frac{d(2q-1)\gamma(1-\overline{p})}{(1-l)^2} \right\}, \min\left\{ d\frac{(1-\gamma)^2\overline{a}^2(1-p)}{(2q-1)\gamma}, \frac{d(2q-1)\gamma}{1-\overline{p}} \right\} \right), \tag{OA.35}$$

there exists an equilibrium with $t_R = 0$ *and* $t_L \in (0,1)$ *given by*

$$t_L \;\; = \frac{1}{(1-\gamma)\overline{a}}\sqrt{\frac{(2q-1)\gamma}{d(1-\overline{p})}\frac{v}{cn}}. \tag{OA.36}$$

OA.2.1 Proofs of Propositions OA.3–OA.7

Given Lemma (2) that t_L cannot be zero in any equilibrium, the equilibria we need to inquire about—other than mm in Proposition OA.1, presented in the previous section—are as follows:

$$\begin{aligned} t_L = 1, t_R &\in (0,1), & (1m)\\ t_L = 1, t_R &= 0, & (10)\\ t_L = 1, t_R &= 1, & (11)\\ t_L \in (0,1), t_R &= 1, & (m1)\\ t_L \in (0,1), t_R &= 0. & (m0) \end{aligned}$$

We begin with equilibria $1m$, 10, and 11 where $t_L = 1$. Let:

$$K \equiv 1 - \frac{(2q-1)\gamma}{(1-\gamma)\overline{a}}, \tag{OA.37}$$

so from (4), in those equilibria, $p^* = K/(1+t_R)$. Given this, we need $K > 0$, or else $p^* < 0$; i.e.,

$$1 > \frac{(2q-1)\gamma}{(1-\gamma)\overline{a}} \iff \overline{a} - \overline{a}\gamma > (2q-1)\gamma \iff \overline{a} > (2q-1+\overline{a})\gamma \iff \gamma < \frac{\overline{a}}{2q-1+\overline{a}}. \tag{OA.38}$$

This upper bound on γ takes precedence over A1 (i.e., $\gamma < 1/(2q)$), since $\overline{a} < 1$.

We also need $p^* < 1$; i.e.,

$$K\frac{1}{1+t_R} < 1 \iff t_R > K - 1,$$

which is always true since $K < 1$ (see (OA.37)).

Moreover, for $t_L = 1$, we must have:

$$\begin{aligned} \mathbb{P}\left[\text{pivotal}|L\right] > \frac{c}{v} &\iff \frac{1}{(1-\gamma)n}\frac{1}{\overline{a}(1-\overline{p})}\frac{f(p^*)(1-p^*)}{1+t_R} > \frac{c}{v} \iff \frac{f(p^*)(1-p^*)}{1+t_R} > \frac{c}{v}(1-\gamma)n\overline{a}(1-\overline{p})\\ &\iff f\left(K\frac{1}{1+t_R}\right)\frac{1+t_R-K}{(1+t_R)^2} > \frac{c}{v}(1-\gamma)n\overline{a}(1-\overline{p}), \end{aligned} \tag{OA.39}$$

where in the second inequality we substituted for the pivotal probability from (7).

Now we focus on each of the equilibria with $t_L = 1$ in turn. The aim of the proofs is to derive the regions of n, γ, and $v/(cn)$ so that, given $t_L = 1$, we have that $t_R \in (0,1)$ and probability $p^* \in (l,h)$ (while also respecting assumptions A1 and A2).

Equilibrium $\boldsymbol{1m}$: Deriving the expression for t_R: For $t_R \in (0,1)$, we must have:

$$\mathbb{P}\left[\text{pivotal}|R\right] = \frac{c}{v} \iff \frac{1}{(1-\gamma)n}\frac{1}{\overline{ap}}\frac{f(p^*)p^*}{1+t_R} = \frac{c}{v} \iff f\left(K\frac{1}{1+t_R}\right)\frac{K}{(1+t_R)^2} = \frac{c}{v}(1-\gamma)n\overline{ap}, \tag{OA.40}$$

where, in the second equality, we substituted for the pivotal probability from (8) and, in the third, for $p^* = K/(1+t_R)$. Let us assume that $p \sim \mathcal{U}[l,h], 0 \le l < h \le 1$, and $p^* \in (l,h)$, which we check below; then $\overline{p} = (h+l)/2, f(p^*) = 1/(h-l) = 1/d$, and (OA.40) becomes:

$$\frac{1}{d}\frac{K}{(1+t_R)^2} = \frac{c}{v}(1-\gamma)n\overline{ap} \iff (1+t_R)^2 = \frac{K}{\frac{dc}{v}(1-\gamma)n\overline{ap}} = \frac{1-\dfrac{(2q-1)\gamma}{(1-\gamma)\overline{a}}}{\frac{dc}{v}(1-\gamma)n\overline{ap}},$$

which, if we solve, yields (OA.22), where in the last equality we substituted for K from (OA.37).
Checking that $t_R \in (0,1)$: We need to ensure that

$$t_R < 1 \iff \frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{\frac{dc}{v}n\overline{p}}\frac{1}{(1-\gamma)^2\overline{a}^2} < 4 \iff \frac{v}{c} < nd\frac{4(1-\gamma)^2\overline{a}^2\overline{p}}{(1-\gamma)\overline{a}-(2q-1)\gamma}, \tag{OA.41}$$

where, in the second inequality, we substituted from (OA.22); and, similarly,

$$t_R > 0 \iff \frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{\frac{dc}{v}n\overline{p}} > (1-\gamma)^2\overline{a}^2 \iff \frac{v}{c} > nd\frac{(1-\gamma)^2\overline{a}^2\overline{p}}{(1-\gamma)\overline{a}-(2q-1)\gamma}. \tag{OA.42}$$

In addition, from (OA.39), for $p \sim \mathcal{U}[l,h]$ we have:

$$\begin{aligned} &\frac{1}{d}\frac{1+t_R-K}{(1+t_R)^2} > \frac{c}{v}(1-\gamma)n\overline{a}(1-\overline{p}) \iff \frac{1}{1+t_R} - \frac{K}{(1+t_R)^2} > \frac{dc}{v}(1-\gamma)n\overline{a}(1-\overline{p}) \\ \iff &\sqrt{\frac{\frac{dc}{v}n\overline{p}}{(1-\gamma)\overline{a}-(2q-1)\gamma}}(1-\gamma)\overline{a} - \frac{dc}{v}(1-\gamma)n\overline{ap} > \frac{dc}{v}(1-\gamma)n\overline{a}(1-\overline{p}) \\ \iff &\sqrt{\frac{v}{dcn}\frac{\overline{p}}{(1-\gamma)\overline{a}-(2q-1)\gamma}} > \overline{p}+1-\overline{p} \iff \frac{v}{c} > nd\frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{\overline{p}}, \end{aligned} \tag{OA.43}$$

where, in the third inequality, we substituted for t_R from (OA.22).

Now we compare the two lower bounds on v/c (OA.42), and (OA.43), to see whether they either of them can be relevant:

$$(1-\gamma)^2\overline{a}\overline{p}^2 > [(1-\gamma)\overline{a}-(2q-1)\gamma]^2 \iff \overline{a}(1-\overline{p}) < \gamma\left[\overline{a}(1-\overline{p})+2q-1\right]$$
$$\iff \gamma > \frac{\overline{a}(1-\overline{p})}{\overline{a}(1-\overline{p})+2q-1}.$$

Is this last requirement consistent with the current lower bound on γ (OA.38)?

$$\frac{\overline{a}(1-\overline{p})}{\overline{a}(1-\overline{p})+2q-1} < \frac{\overline{a}}{2q-1+\overline{a}} \iff (1-\overline{p})(2q-1)+(1-\overline{p})\overline{a} < \overline{a}(1-\overline{p})+2q-1 \iff \overline{p} > 0,$$

which is always true; hence, either of (OA.42) and (OA.43) can be relevant.

Moreoever, for existence of equilibrium $1m$, we need to check that the upper bound on v/c in (OA.41) is larger than both the two possible lower bounds in (OA.42) and (OA.43). First, from (OA.41) and (OA.43), we have existence if and only if

$$4(1-\gamma)^2\overline{a}^2\overline{p}^2 > [(1-\gamma)\overline{a}-(2q-1)\gamma]^2 \iff 2(1-\gamma)\overline{a}\overline{p} > (1-\gamma)\overline{a}-(2q-1)\gamma$$
$$\iff (1-\gamma)\overline{a}(1-2\overline{p})-(2q-1)\gamma < 0 \iff \overline{a}(1-2\overline{p}) < \gamma\left[\overline{a}(1-2\overline{p})+2q-1\right]. \tag{OA.44}$$

We inquire on the validity of (OA.44) by considering the following cases:
Case A: If $1-2\overline{p} > 0 \iff \overline{p} < 1/2$, then from (OA.44) we need:

$$\gamma > \frac{\overline{a}(1-2\overline{p})}{\overline{a}(1-2\overline{p})+2q-1}. \tag{OA.45}$$

For this to be consistent with the current upper bound on γ (OA.38), we further need:

$$\frac{\overline{a}}{2q-1+\overline{a}} > \frac{\overline{a}(1-2\overline{p})}{\overline{a}(1-2\overline{p})+2q-1} \iff \overline{a}(1-2\overline{p})+2q-1 > (1-2\overline{p})(2q-1)+\overline{a}(1-2\overline{p})$$
$$\iff \overline{p} > 0,$$

which is always true.
Case B: If $1-2\overline{p} < 0 \iff \overline{p} > 1/2$ and $\overline{a}(1-2\overline{p})+2q-1 > 0 \iff \overline{p} < (2q-1)/(2\overline{a})+1/2$; i.e., if $1/2 < \overline{p} < (2q-1)/(2\overline{a})+1/2$, then (OA.44) is true without any further restrictions.
Case C: If $\overline{p} > (2q-1)/(2\overline{a})+1/2$ for (OA.44) to be true we need:

$$\overline{a}(2\overline{p}-1) > \gamma\left[\overline{a}(2\overline{p}-1)-(2q-1)\right] \iff \gamma < \frac{\overline{a}(2\overline{p}-1)}{\overline{a}(2\overline{p}-1)-(2q-1)}. \tag{OA.46}$$

We need to check how the above compares with the current upper bound on γ (OA.38):

$$\frac{2\overline{p}-1}{\overline{a}(2\overline{p}-1)-(2q-1)} < \frac{1}{2q-1+\overline{a}} \iff (2\overline{p}-1)(2q-1)+(2\overline{p}-1)\overline{a} < (2\overline{p}-1)\overline{a}-(2q-1)$$
$$\iff 2\overline{p}-1 < -1 \iff \overline{p} < 0,$$

which is false, so (OA.46) is weaker than (OA.38) and does not take precedence.

Second, the lower bound on v/c in (OA.42) is smaller than the upper bound in (OA.41).

Let us summarize our findings up to this point: An equilibrium with $t_L = 1, t_R \in (0,1)$ given by (OA.22) exists if:

$$\max\left\{\frac{(1-\gamma)^2\overline{a}^2 n\overline{p}d}{(1-\gamma)\overline{a}-(2q-1)\gamma}, \frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{\overline{p}}nd\right\} \tag{OA.47}$$

$$< \frac{v}{c} <$$

$$nd\frac{4(1-\gamma)^2\overline{a}^2\overline{p}}{(1-\gamma)\overline{a}-(2q-1)\gamma}, \tag{OA.48}$$

$$\text{and} \qquad \frac{\overline{a}(1-2\overline{p})}{\overline{a}(1-2\overline{p})+2q-1}\mathbb{I}(\overline{p}<1/2) < \gamma < \frac{\overline{a}}{2q-1+\overline{a}}, \tag{OA.49}$$

where $\mathbb{I}$ is the indicator function.

Checking assumptions A1 and A2: As mentioned, for all equilibria with $t_L = 1$, the upper bound in (OA.38) takes precedence over the one in A1. We continue with the requirement of A2 that $v/c \geq 1$. Hence, for an equilibrium to exist, we need that expression (OA.48) (the current upper bound) exceeds one:

$$d4(1-\gamma)^2\overline{a}n\overline{p} > (1-\gamma)\overline{a}-(2q-1)\gamma \iff n > \frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{4(1-\gamma)^2\overline{a}^2\overline{p}d}. \tag{OA.50}$$

This implies a lower bound on the number of voters n. Next we compare the lower bound imposed by A2 with the current ones in (OA.47). In turn we have:

i) For the lower bound (OA.42) to be the relevant one, we need:

$$\text{relative to `1'} \rightarrow \quad n > \frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{(1-\gamma)^2\overline{a}^2\overline{p}d},$$

$$\text{and relative to (OA.43)} \rightarrow \quad \gamma > \frac{\overline{a}(1-\overline{p})}{\overline{a}(1-\overline{p})+2q-1}.$$

ii) For the lower bound (OA.43) to be the relevant one, we need:

$$\text{relative to '1'} \rightarrow \quad n > \frac{\overline{p}}{d\left[(1-\gamma)\overline{a}-(2q-1)\gamma\right]},$$
$$\text{and relative to (OA.42)} \rightarrow \quad \gamma < \frac{\overline{a}(1-\overline{p})}{\overline{a}(1-\overline{p})+2q-1}.$$

iii) For the lower bound in A2 (i.e., 1) to be the relevant one, we need:

$$\text{relative to (OA.42)} \rightarrow \quad n < \frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{(1-\gamma)^2\overline{a}^2\overline{p}d},$$
$$\text{and relative to (OA.43)} \rightarrow \quad n < \frac{\overline{p}}{\left[(1-\gamma)\overline{a}-(2q-1)\gamma\right]d}.$$

Hence, depending on the parameters, any of the three lower bounds on v/c can be relevant. Checking that $p^* \in (l,h)$: Since $p \in [l,h]$, we also need to check that $l < p^* < h$. Recall that, for the equilibrium under consideration (i.e., $1m$), $p^* = K/(1+t_R)$, where K is given by (OA.37) and t_R by (OA.22). Hence, after some algebra, we write the requirement on p^* as:

$$l < p^* < h \iff \frac{1}{h^2} < \frac{1}{p^{*2}} < \frac{1}{l^2} \iff \frac{1}{h^2} < \frac{v}{nc}\frac{1}{d\overline{p}}\frac{1}{\left[(1-\gamma)\overline{a}-(2q-1)\gamma\right]} < \frac{1}{l^2}$$

$$\iff \frac{nd\overline{p}[(1-\gamma)\overline{a}-(2q-1)\gamma]}{h^2} \tag{OA.51}$$
$$< \frac{v}{c} <$$
$$\frac{nd\overline{p}[(1-\gamma)\overline{a}-(2q-1)\gamma]}{l^2}. \tag{OA.52}$$

How do these reconcile with the existing bounds (OA.47) and (OA.48)? In turn, we have: *i)* (OA.51) versus the second part of the maximum in the lower bound (OA.47) (i.e., the right-hand-side (RHS) of (OA.43)):

$$\frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{\overline{p}}d > d\overline{p}\frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{h^2} \iff \frac{1}{\overline{p}} > \frac{\overline{p}}{h^2} \iff \overline{p} < h,$$

which is always true; hence, (OA.51) is never the relevant lower bound.
ii) (OA.52) versus the upper bound in (OA.48):

$$\frac{d\overline{p}\left[(1-\gamma)\overline{a}-(2q-1)\gamma\right]}{l^2} > \frac{4(1-\gamma)^2\overline{a}^2\overline{p}d}{(1-\gamma)\overline{a}-(2q-1)\gamma} \iff \left[(1-\gamma)\overline{a}-(2q-1)\gamma\right]^2 > 4(1-\gamma)^2\overline{a}^2l^2$$
$$\iff (1-\gamma)\overline{a}-(2q-1)\gamma > 2(1-\gamma)\overline{a}l \iff (1-2l)\overline{a} > (2q-1+\overline{a}(1-2l))\gamma. \tag{OA.53}$$

To inquire on the validity of (OA.53), we need to consider the following cases:
Case A: If $1-2l>0 \iff l<1/2$, then we need $\gamma<(1-2l)\overline{a}(2q-1+\overline{a}(1-2l))$ for the current upper bound on v/c in (OA.48) to be the relevant one. Otherwise, (OA.52) takes precedence. Note that the above upper bound on γ is lower than our current one in (OA.49) and so is in the feasible region.
Case B: If $1-2l<0 \iff l>1/2$, then:
B-1) If $2q-1+\overline{a}(1-2l)>0 \iff \overline{a}<(2q-1)/(2l-1)$, (OA.52) is the relevant upper bound.
B-2) If $2q-1+\overline{a}(1-2l)<0 \iff \overline{a}>(2q-1)/(2l-1)$, then we need $\gamma>(2l-1)\overline{a}/(1-2q+\overline{a}(2l-1))$ for the current upper bound on v/c in (OA.48) to be the relevant one. Otherwise, (OA.52) takes precedence. Note that again the above upper bound on γ is lower than our current one in (OA.49) and so is in the feasible region.

Therefore, (OA.52) can be the relevant upper bound, and hence we need to ensure that it is larger than the existing possible lower bounds on v/c in (OA.47) and A2. We have, in turn:
i) Comparing (OA.52) versus 1 (in A2), leads to

$$\frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{l^2}n\overline{p}d>1 \iff n>\frac{1}{\overline{p}d}\frac{l^2}{(1-\gamma)\overline{a}-(2q-1)\gamma}. \tag{OA.54}$$

How does (OA.54) compare with the existing lower bound on n in (OA.50)?

$$\frac{1}{\overline{p}d}\frac{l^2}{(1-\gamma)\overline{a}-(2q-1)\gamma}>\frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{4(1-\gamma)^2\overline{a}^2\overline{p}d} \iff 2l(1-\gamma)\overline{a}>(1-\gamma)\overline{a}-(2q-1)\gamma$$
$$\iff (1-\gamma)\overline{a}(1-2l)<(2q-1)\gamma.$$

Hence, if $1-2l<0 \iff l>1/2$, then the above is always true, and (OA.54) takes precedence. While if $1-2l>0 \iff l<1/2$, then we need: $\gamma>\overline{a}(1-2l)/(2q-1+\overline{a}(1-2l))$, which is within the feasible interval for γ, since $l>0$. Therefore, for $l<1/2$, either of (OA.54) and (OA.50) can be the relevant lower bound on n. This results in region N_{1m} defined in (OA.19).
ii) Comparing (OA.52) to the first term in the maximum for the lower bound in (OA.47), implies

$$\frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{l^2}n\overline{p}d>\frac{(1-\gamma)^2\overline{a}^2n\overline{p}d}{(1-\gamma)\overline{a}-(2q-1)\gamma} \iff (1-\gamma)\overline{a}-(2q-1)\gamma>(1-\gamma)\overline{a}l$$
$$\iff (1-\gamma)\overline{a}(1-l)>(2q-1)\gamma \iff \overline{a}(1-l)>[2q-1+\overline{a}(1-l)]\gamma \iff \gamma<\frac{\overline{a}(1-l)}{2q-1+\overline{a}(1-l)}. \tag{OA.55}$$

Now, the upper bound in (OA.55) is lower than the one in (OA.49), so it takes precedence (and it is also larger than the current lower bound in (OA.49), since $\overline{p}>l$). This together with the lower bound in (OA.49), results in region Γ_{1m} defined in (OA.20).
iii) Comparing (OA.52) versus the second term in the maximum for the lower bound in

(OA.48):

$$\frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{l^2}n\overline{p}d > \frac{(1-\gamma)\overline{a}-(2q-1)\gamma}{\overline{p}}nd \iff \overline{p} > l,$$

which is always true. Hence, the upper bound in (OA.48) needs to be amended to include (OA.52). While, as mentioned before, the lower bounds in (OA.47) need to be amended to include the bound imposed by A2. These result in region V_{1m} defined in (OA.21) (where we further divide all expressions by n). This concludes the proof of Proposition OA.3. ■

Equilibrium 10. Drawing inferences from the values of t_L, t_R: For $t_L = 1$ and $t_R = 0$, we have that $p^* = K/(1+t_R) = K$, where K is defined in (OA.37). Moreover, no discretionary participation of R means that (adapting (OA.40)) we have:

$$\mathbb{P}\left[\text{pivotal}|R\right] < \frac{c}{v} \iff \frac{1}{(1-\gamma)n}\frac{1}{\overline{a}\overline{p}}\frac{f(p^*)p^*}{1+0} < \frac{c}{v} \iff \frac{v}{c} < \frac{(1-\gamma)n\overline{a}\overline{p}}{f(K)K}. \tag{OA.56}$$

While for full discretionary participation of L, we need from (OA.39):

$$\frac{v}{c} > \frac{(1-\gamma)n\overline{a}(1-\overline{p})}{f(K)(1-K)}. \tag{OA.57}$$

For existence of equilibrium, we need the lower bound on v/c in (OA.57) to be smaller than the upper bound implied by (OA.56). Hence,

$$\frac{(1-\gamma)n\overline{a}(1-\overline{p})}{(1-\gamma)n\overline{a}\overline{p}} < \frac{f(K)(1-K)}{f(K)K} \iff 1-\overline{p}-\frac{(2q-1)\gamma}{(1-\gamma)\overline{a}} < 0 \iff \gamma > \frac{(1-\overline{p})\overline{a}}{2q-1+(1-\overline{p})\overline{a}}, \tag{OA.58}$$

where, in the second inequality, we substituted for K from (OA.37) and canceled common terms. Is this new lower bound smaller than the current upper bound in (OA.38)? Existence requires:

$$\frac{(1-\overline{p})\overline{a}}{2q-1+(1-\overline{p})\overline{a}} < \frac{\overline{a}}{2q-1+\overline{a}} \iff (1-\overline{p})\overline{a}\left[2q-1+\overline{a}\right] < (2q-1+(1-\overline{p})\overline{a})\overline{a}$$
$$\iff (1-\overline{p}-1)\overline{a}(2q-1) < 0 \iff -\overline{p}\overline{a}(2q-1) < 0,$$

which is always true, so the lower bound in (OA.58) is in the feasible region of γ without further parameter restrictions.
Checking assumptions A1 and A2: As mentioned for all the equilibria with $t_L = 1$, the upper bound in (OA.38) takes precedence over the one in A1. What about A2 that $v/c \geq 1$? For existence, we need 1 to be smaller than the current upper bound in

(OA.56):

$$1 \leq \frac{(1-\gamma)n\overline{ap}}{f(K)K} \iff n \geq \frac{f(K)K}{(1-\gamma)\overline{ap}}, \tag{OA.59}$$

which imposes a lower bound on the number of voters. This bound defines N_{10} in (OA.23). Then the lower bound of v/c in (OA.57) together with 1 and the upper bound in (OA.56) define V_{10} in (OA.25) (where we further divide all expressions by n).

Checking that $p^* \in (l,h)$: Since $p \in [l,h]$, we also need to check that $l < p^* < h$ or, for equilibrium 10, $l < K < h$. Substituting for K from (OA.37) and after a bit of algebra, we arrive at:

$$\frac{\overline{a}(1-h)}{2q-1+\overline{a}(1-h)} \tag{OA.60}$$
$$< \gamma <$$
$$\frac{\overline{a}(1-l)}{2q-1+\overline{a}(1-l)}. \tag{OA.61}$$

How does (OA.60) compare with the current lower bound in (OA.58)?

$$\frac{\overline{a}(1-h)}{2q-1+\overline{a}(1-h)} < \frac{\overline{a}(1-\overline{p})}{2q-1+\overline{a}(1-\overline{p})} \iff \frac{2q-1}{\overline{a}(1-h)} > \frac{2q-1}{\overline{a}(1-\overline{p})} \iff \overline{p} < h,$$

which is always true, and therefore the current lower bound stands.

How does (OA.61) compare with the current upper bound in (OA.38)?

$$\frac{\overline{a}}{2q-1+\overline{a}} < \frac{\overline{a}(1-l)}{2q-1+\overline{a}(1-l)} \iff \frac{2q-1}{\overline{a}} > \frac{2q-1}{\overline{a}(1-l)} \iff l < 0,$$

which is never true, and so (OA.61) takes precedence. So these upper and lower bounds in (OA.58) define region Γ_{10} in (OA.24), concluding the proof of Proposition OA.4. ■

Equilibrium 11. Drawing inferences from the values of t_L, t_R: For $t_R = 1$ we have $p^* = K/2$, and we need (adapting (OA.40)):

$$\mathbb{P}\left[\text{pivotal}|R\right] > \frac{c}{v} \iff \frac{1}{(1-\gamma)n}\frac{1}{\overline{ap}}\frac{f(p^*)p^*}{2} > \frac{c}{v}, \iff \frac{v}{c} > \frac{(1-\gamma)n\overline{ap}}{f\left(\frac{K}{2}\right)\frac{K}{4}}. \tag{OA.62}$$

For $t_L = 1$, we have from (OA.39):

$$f\left(\frac{K}{2}\right)\frac{2-K}{4} > \frac{c}{v}(1-\gamma)n\overline{a}(1-\overline{p}) \iff \frac{v}{c} > \frac{(1-\gamma)n\overline{a}(1-\overline{p})}{f\left(\frac{K}{2}\right)\frac{2-K}{4}}. \tag{OA.63}$$

Depending on parameter values, either of (OA.62) or (OA.63) can be the relevant lower bound.

Checking assumptions A1 and A2: As mentioned for all the equilibria with $t_L = 1$, the upper bound in (OA.38) takes precedence over the one in A1. Now lower bounds (OA.62) and (OA.63), together with 1 from A2 define region V_{11} in (OA.28) (where we divide all expressions by n). Note that there is no upper bound on v/c in equilibrium 11.
Checking that $p^* \in (l, h)$: Since $p \in [l, h]$, we also need to check that $l < p^* < h$. Using that now $p^* = K/2$ and (OA.37) for K we arrive at the

$$1 - 2h \leq \frac{2q-1}{\overline{a}} \frac{\gamma}{1-\gamma} \leq 1 - 2l. \tag{OA.64}$$

Therefore, for an equilibrium to exist, we need $1 - 2l \geq 0 \iff l \leq 1/2$, and this is part of the requirements in the statement of Proposition OA.5. Given this from the second inequality in (OA.64), we have the requirement:

$$\frac{2q-1}{\overline{a}} \frac{\gamma}{1-\gamma} \leq 1 - 2l \iff \gamma \leq \frac{(1-2l)\overline{a}}{(1-2l)\overline{a} + 2q - 1}, \tag{OA.65}$$

which as an upper bound takes precedence over the current one in (OA.38). Now, for $1 - 2h$, we consider two cases:
Case A: If $1 - 2h < 0 \iff h > 1/2$, then the first inequality in (OA.64) is trivially true without further restrictions on parameters.
Case B: If $1 - 2h > 0 \iff h < 1/2$, then we also need:

$$\gamma \geq \frac{(1-2h)\overline{a}}{(1-2h)\overline{a} + 2q - 1}. \tag{OA.66}$$

The lower bound on γ in (OA.66) is always smaller than the current upper bound in (OA.65); putting them together leads to region Γ_{11} is (OA.27). Note that we do not have any restriction on the number of voters n, and hence the region N_{11} in (OA.26) is the entire positive half-line. This concludes the proof of Proposition OA.5. ■

Below we move on to the proofs pertaining to equilibria where $t_L < 1$, i.e., $m1$ and $m0$. Again, the main goal is to derive the regions of n, γ, and $v/(cn)$ so that, given $t_R = 1$ or 0, we have that $t_L \in (0, 1)$ and probability $p^* \in (l, h)$ (while still requiring A1 and A2).

Equilibrium $m1$. Deriving p^*: Here we inquire whether $t_L \in (0, 1)$, $t_R = 1$ can be an equilibrium. First, from (4), we have:

$$p^* = \frac{t_L}{1+t_L} - \frac{(2q-1)\gamma}{(1-\gamma)\overline{a}} \frac{1}{1+t_L} \iff 1 - p^* = \frac{1}{1+t_L}\left[1 + \frac{(2q-1)\gamma}{(1-\gamma)\overline{a}}\right]. \tag{OA.67}$$

The term in the square brackets is positive so $p^* < 1$ but we further need that

$$p^* > 0 \iff 1 - p^* < 1 \iff 1 + t_L > 1 + \frac{(2q-1)\gamma}{(1-\gamma)\overline{a}} \iff t_L > \frac{(2q-1)\gamma}{(1-\gamma)\overline{a}}. \tag{OA.68}$$

So, for an equilibrium where L play a mixed strategy to exist we must have:

$$\frac{(2q-1)\gamma}{(1-\gamma)\overline{a}} < 1 \iff (2q-1+\overline{a})\gamma < \overline{a} \iff \gamma < \frac{\overline{a}}{2q-1+\overline{a}}, \tag{OA.69}$$

which is the same as (OA.38), and so this new upper bound on γ takes precedence over the one required by A1 (i.e., $\gamma < 1/(2q)$).

Deriving the expression for t_L: For $t_L \in (0,1)$, $t_R = 1$ to be an equilibrium, we must have that the pivotal probabilities in (7) and (8), respectively, satisfy:

$$\mathbb{P}\left[\text{pivotal}|L\right] = \frac{c}{v} \iff \frac{1}{(1-\gamma)n}\frac{1}{\overline{a}(1-\overline{p})(1+t_L)}f(p^*)(1-p^*) = \frac{c}{v}, \tag{OA.70}$$

$$\mathbb{P}\left[\text{pivotal}|R\right] > \frac{c}{v} \iff \frac{1}{(1-\gamma)n}\frac{1}{\overline{ap}(1+t_L)}f(p^*)p^* > \frac{c}{v}. \tag{OA.71}$$

Assume that $p \sim \mathcal{U}[l,h]$, so that, provided that $p^* \in (l,h)$ (which we check below), we have $f(p^*) = 1/d$, where $d = h - l$; then (OA.70) becomes:

$$\frac{1}{(1-\gamma)n}\frac{1}{\overline{a}(1-\overline{p})}\frac{1}{(1+t_L)}\frac{1}{d}\frac{1+\dfrac{(2q-1)\gamma}{(1-\gamma)\overline{a}}}{1+t_L} = \frac{c}{v} \iff (1+t_L)^2 = \frac{1+\dfrac{(2q-1)\gamma}{(1-\gamma)\overline{a}}}{\dfrac{dc}{v}(1-\gamma)n\overline{a}(1-\overline{p})},$$

which, if we solve, yields (OA.32), where, in the first equality, we also substituted for $1-p^*$ from (OA.67).

Checking that $t_L \in (0,1)$: We need to ensure that, given (OA.32):

$$t_L < 1 \iff \sqrt{\frac{(1-\gamma)\overline{a}+(2q-1)\gamma}{\frac{dc}{v}n(1-\overline{p})}}\frac{1}{(1-\gamma)\overline{a}} < 2 \iff \frac{v}{c} < d\frac{4(1-\gamma)^2\overline{a}^2n(1-\overline{p})}{(1-\gamma)\overline{a}+(2q-1)\gamma}, \tag{OA.72}$$

$$t_L > 0 \iff \frac{(1-\gamma)\overline{a}+(2q-1)\gamma}{\frac{dc}{v}n(1-\overline{p})} > (1-\gamma)^2\overline{a}^2 \iff \frac{v}{c} > d\frac{(1-\gamma)^2\overline{a}^2n(1-\overline{p})}{(1-\gamma)\overline{a}+(2q-1)\gamma}. \tag{OA.73}$$

Clearly, the upper bound on v/c imposed by (OA.72) is larger than the lower bound in (OA.73).

Drawing inferences from the values of t_L, t_R: In addition, from (OA.71), we have for $p \sim$

$\mathcal{U}[l,h]$:

$$\frac{1}{(1-\gamma)n}\frac{1}{\overline{ap}(1+t_{\scriptscriptstyle L})^2}\frac{1}{d}\left(t_{\scriptscriptstyle L}-\frac{(2q-1)\gamma}{(1-\gamma)\overline{a}}\right)>\frac{c}{v}\iff\left(\frac{1}{1+t_{\scriptscriptstyle L}}-\frac{L}{(1+t_{\scriptscriptstyle L})^2}\right)>\frac{dc}{v}(1-\gamma)n\overline{ap}$$
$$\iff\sqrt{\frac{\frac{dc}{v}n(1-\overline{p})}{(1-\gamma)\overline{a}+(2q-1)\gamma}}(1-\gamma)\overline{a}-\frac{dc}{v}(1-\gamma)n\overline{a}(1-\overline{p})>\frac{dc}{v}(1-\gamma)n\overline{ap}$$
$$\iff\sqrt{\frac{\frac{v}{cdn}(1-\overline{p})}{(1-\gamma)\overline{a}+(2q-1)\gamma}}>1\iff\frac{v}{c}>nd\frac{(1-\gamma)\overline{a}+(2q-1)\gamma}{1-\overline{p}},\tag{OA.74}$$

where, in the second line, we substituted for the computed $t_{\scriptscriptstyle L}$ from (OA.32). Let us also see how (OA.68) changes in terms of $t_{\scriptscriptstyle L}$. Substituting we have:

$$\sqrt{\frac{(1-\gamma)\overline{a}+(2q-1)\gamma}{\frac{dc}{v}n(1-\overline{p})}}\frac{1}{(1-\gamma)\overline{a}}-1>\frac{(2q-1)\gamma}{(1-\gamma)\overline{a}}\iff\quad\frac{v}{c}>nd(1-\overline{p})\left[(2q-1)\gamma+(1-\gamma)\overline{a}\right].\tag{OA.75}$$

Note that, since $1/(1-\overline{p})>1-\overline{p}$, (OA.74) always supersedes (OA.75) as a lower bound on v/c. How about ranking the lower bounds on v/c imposed by (OA.73) and (OA.74)? We have:

$$(1-\gamma)^2\overline{a}^2(1-\overline{p})^2>\left[(1-\gamma)\overline{a}+(2q-1)\gamma\right]^2\iff(1-\gamma)\overline{a}(1-\overline{p})>(1-\gamma)\overline{a}+(2q-1)\gamma$$
$$\iff(1-\gamma)\overline{a}(1-\overline{p}-1)>(2q-1)\gamma\iff-(1-\gamma)\overline{ap}>(2q-1)\gamma,$$

which is not true for any parameter value; therefore, (OA.74) supersedes (OA.73) and is the (up to now) relevant lower bound on v/c.

Now we need to check whether the upper bound on v/c in (OA.72) exceeds the lower bound in (OA.74); otherwise equilibrium $m1$ does not exist. We have:

$$4(1-\gamma)^2\overline{a}^2(1-\overline{p})^2>\left[(1-\gamma)\overline{a}+(2q-1)\gamma\right]^2\iff 2(1-\gamma)\overline{a}(1-\overline{p})>(1-\gamma)\overline{a}+(2q-1)\gamma$$
$$\iff(1-\gamma)\overline{a}(2-2\overline{p}-1)>(2q-1)\gamma\iff\overline{a}(1-2\overline{p})>\gamma\left[\overline{a}(1-2\overline{p})+2q-1\right].\tag{OA.76}$$

We consider the following cases to inquire on the validity of (OA.76).
Case A: If $1-2\overline{p}>0\iff\overline{p}<1/2$; then, we need:

$$\gamma<\frac{\overline{a}(1-2\overline{p})}{\overline{a}(1-2\overline{p})+2q-1}.\tag{OA.77}$$

How does this compare with the current upper bound on γ in (OA.69)?

$$\frac{\overline{a}}{2q-1+\overline{a}}>\frac{\overline{a}(1-2\overline{p})}{\overline{a}(1-2\overline{p})+2q-1}\iff\overline{p}>0,$$

which is always true; therefore, (OA.77) supersedes (OA.69) in this case. Hence, for $\overline{p} < 1/2$ and for γ less than the bound in (OA.77), inequality (OA.76) holds and equilibrium exists.

Case B: If $1-2\overline{p} < 0 \iff \overline{p} > 1/2$ and $\overline{a}(1-2\overline{p})+2q-1 > 0 \iff \overline{p} < 1/2+(2q-1)/(2\overline{a})$, then inequality (OA.76) does not hold for any $\gamma > 0$. Hence, equilibrium does not exist.

Case C: If $1-2\overline{p} < 0 \iff \overline{p} > 1/2$ and $\overline{a}(1-2\overline{p})+2q-1 < 0 \iff \overline{p} > 1/2+(2q-1)/(2\overline{a})$, then, we need

$$\overline{a}(2\overline{p}-1) < \gamma\left[\overline{a}(2\overline{p}-1)-(2q-1)\right] \iff \gamma > \frac{\overline{a}(2\overline{p}-1)}{\overline{a}(2\overline{p}-1)-(2q-1)}.$$

For an equilibrium to exist, we need that this lower bound be smaller than the current upper bound of γ in (OA.69); that is,

$$\frac{\overline{a}(2\overline{p}-1)}{\overline{a}(2\overline{p}-1)-(2q-1)} < \frac{\overline{a}}{2q-1+\overline{a}} \iff (2q-1)2\overline{p} < 0, \tag{OA.78}$$

which is never true, so also in this case inequality (OA.76) does not hold, and this equilibrium does not exist.

Therefore, equilibrium $m1$ only exists for $\overline{p} < 1/2$, and so we add this restriction in the statement of Proposition OA.6. Additionally, we need the upper bound on γ in (OA.77) that hence defines region Γ_{m1} in (OA.30).

<u>Checking assumptions A1 and A2</u>: As mentioned, the upper bound on γ in (OA.77) supersedes the one in (OA.69), which, in turn, supersedes the bound imposed by A1 (i.e., $\gamma < 1/(2q)$). Therefore, for $\overline{p} < 1/2$, where an equilibrium exists, (OA.77) is the relevant bound. How about A2 that $v/c \geq 1$? We check with the current upper bound in (OA.72) for existence:

$$1 < d\frac{4(1-\gamma)^2\overline{a}^2 n(1-\overline{p})}{(1-\gamma)\overline{a}+(2q-1)\gamma} \iff n > \frac{(1-\gamma)\overline{a}+(2q-1)\gamma}{4d(1-\gamma)^2\overline{a}^2(1-\overline{p})}. \tag{OA.79}$$

So this imposes a lower bound on the number of voters n. How does 1 compare with the lower bound in (OA.74)? If

$$n > \frac{(1-\overline{p})}{d\left[(1-\gamma)\overline{a}+(2q-1)\gamma\right]},$$

(OA.74) is relevant; otherwise, 1 is relevant.

<u>Checking that $p^* \in (l,h)$</u>: Since $p \in [l,h]$, we also need to check that $l < p^* < h$. For the case $t_L \in (0,1), t_R = 1$, we have from (4):

$$p^* = \frac{t_L}{1+t_L} - \frac{(2q-1)\gamma}{(1-\gamma)\overline{a}}\frac{1}{1+t_L} \iff 1-p^* = \frac{1}{1+t_L} + \frac{(2q-1)\gamma}{(1-\gamma)\overline{a}}\frac{1}{1+t_L}$$

$$\iff 1-p^* = \sqrt{\frac{dcn}{v}(1-\overline{p})\left((1-\gamma)\overline{a}+(2q-1)\gamma\right)}, \tag{OA.80}$$

where, in the last equality, we used expression (OA.32) for t_L and did a bit of algebra. Using (OA.80) the requirement that $l < p^* < h$, becomes:

$$1-h < 1-p^* < 1-l \iff (1-h)^2 < \frac{dcn}{v}(1-\overline{p})\left((1-\gamma)\overline{a}+(2q-1)\gamma\right) < (1-l)^2$$

$$\iff \frac{nd(1-\overline{p})\left((1-\gamma)\overline{a}+(2q-1)\gamma\right)}{(1-l)^2} \tag{OA.81}$$

$$< \frac{v}{c} <$$

$$\frac{nd(1-\overline{p})\left((1-\gamma)\overline{a}+(2q-1)\gamma\right)}{(1-h)^2}. \tag{OA.82}$$

We now compare the lower bound in (OA.81) with the current one in (OA.74):

$$\frac{(1-\gamma)\overline{a}+(2q-1)\gamma}{1-\overline{p}} > \frac{(1-\overline{p})\left[(1-\gamma)\overline{a}+(2q-1)\gamma\right]}{(1-l)^2} \iff (1-l)^2 > (1-\overline{p})^2 \iff l < \overline{p},$$

which is always true; therefore, (OA.74) supersedes the bound in (OA.81) and remains the relevant lower bound on v/c.

How about (OA.82) versus the current upper bound on v/c in (OA.72)? We have:

$$\frac{4(1-\gamma)^2\overline{a}^2(1-\overline{p})}{(1-\gamma)\overline{a}+(2q-1)\gamma} < \frac{(1-\overline{p})((1-\gamma)\overline{a}+(2q-1)\gamma)}{(1-h)^2}$$
$$\iff 2(1-\gamma)\overline{a}(1-h) < (1-\gamma)\overline{a}+(2q-1)\gamma$$
$$\iff (1-\gamma)\overline{a}\left[2(1-h)-1\right] < (2q-1)\gamma \iff \left[2(1-h)-1\right]\overline{a} < \left[2q-1+(2(1-h)-1)\,\overline{a}\right]\gamma.$$

The sign of the above inequality depends on whether: $2(1-h)-1>0 \iff h<1/2$ or not. Hence, either of (OA.82) or (OA.72) can be the relevant bound, depending on the parameters.

We need to ensure that the new possible upper bound in (OA.82) exceeds the existing lower bounds: the one in A2 (i.e., $v/c \geq 1$) and the one in (OA.74). We have in turn:
i) Comparing (OA.82) vs 1, leads to:

$$\frac{(1-\overline{p})((1-\gamma)\overline{a}+(2q-1)\gamma)}{(1-h)^2}nd > 1 \iff n > \frac{(1-h)^2}{d(1-\overline{p})((1-\gamma)\overline{a}+(2q-1)\gamma)}. \tag{OA.83}$$

How does (OA.83) compare with the existing lower bound on n in (OA.79)? We have:

$$\frac{(1-h)^2}{d(1-\overline{p})((1-\gamma)\overline{a}+(2q-1)\gamma)} > \frac{(1-\gamma)\overline{a}+(2q-1)\gamma}{4d(1-\gamma)^2\overline{a}^2(1-\overline{p})} \iff (1-\gamma)\overline{a}(1-2h) > (2q-1)\gamma.$$

Hence, if $1-2h<0 \iff h>1/2$, then the current bound (OA.79) is the relevant one.

While, if $1-2h>0 \iff h<1/2$, then the current bound holds if and only if:

$$(1-\gamma)\overline{a}(1-2h)<(2q-1)\gamma \iff \gamma>\frac{\overline{a}(1-2h)}{2q-1+\overline{a}(1-2h)}.$$

How does this lower bound on γ compare with our current one in (OA.77)?

$$\frac{\overline{a}(1-2h)}{2q-1+\overline{a}(1-2h)}<\frac{\overline{a}(1-2\overline{p})}{2q-1+\overline{a}(1-2\overline{p})} \iff h>\overline{p},$$

which is always true. Therefore, either of the lower bounds on n in (OA.83) and (OA.79) can be relevant for $h<1/2$. And they are necessary for an equilibrium to exist. These two lower bounds together define interval N_{m1} in (OA.29).
ii) Comparing (OA.82) vs (OA.74), leads to:

$$\frac{(1-\overline{p})((1-\gamma)\overline{a}+(2q-1)\gamma)}{(1-h)^2}nd>nd\frac{(1-\gamma)\overline{a}+(2q-1)\gamma}{(1-\overline{p})} \iff \overline{p}<h,$$

which is again always true, so (OA.82) exceeds (OA.74) without any further restrictions. So either of (OA.82) and (OA.72) can be the relevant upper bound on v/c, consistent with the possible lower bounds from A2 (i.e., 1) and in (OA.74). These bounds define interval V_{m1} in (OA.21). This concludes the proof of Proposition OA.6. ■

Equilibrium *m*0. Deriving p^*: Now we inquire about the existence of equilibrium with $t_L\in(0,1)$ and $t_R=0$. Then p^* in (4) becomes:

$$p^*=1-\frac{(2q-1)\gamma}{1-\gamma}\frac{1}{\overline{a}t_L} \iff 1-p^*=\frac{(2q-1)\gamma}{1-\gamma}\frac{1}{\overline{a}t_L}. \tag{OA.84}$$

We have $1-p^*>0$ but also need:

$$1-p^*<1 \iff (2q-1)\gamma<(1-\gamma)\overline{a}t_L \iff t_L>\frac{(2q-1)\gamma}{(1-\gamma)\overline{a}}, \tag{OA.85}$$

and, for equilibrium $m0$ to exist, the right hand side in (OA.85) cannot exceed one, which yields:

$$\gamma<\frac{\overline{a}}{2q-1+\overline{a}}, \tag{OA.86}$$

which is the same as (OA.69) and so, like there, this new upper bound on γ takes precedence over the one required by A1.
Deriving the expression for t_L: For $t_L\in(0,1)$, $t_R=0$ to be an equilibrium we must have

that the pivotal probabilities in (7) and (8), respectively, satisfy:

$$\mathbb{P}\left[\text{pivotal}|R\right] < \frac{c}{v} \iff \frac{1}{(1-\gamma)n\overline{a}\overline{p}}\frac{1}{t_{\scriptscriptstyle L}}f(p^*)p^* < \frac{c}{v}, \tag{OA.87}$$

$$\mathbb{P}\left[\text{pivotal}|L\right] = \frac{c}{v} \iff \frac{1}{(1-\gamma)n\overline{a}(1-\overline{p})}\frac{1}{t_{\scriptscriptstyle L}}f(p^*)(1-p^*) = \frac{c}{v}. \tag{OA.88}$$

Assume that $p \sim \mathcal{U}[l,h]$, so that if $p^* \in (l,h)$ (which we check below), then $f(p^*) = 1/d$, where $d = h - l$; then (OA.88) becomes:

$$\frac{1}{(1-\gamma)^2 n\overline{a}^2(1-\overline{p})}\frac{1}{t_{\scriptscriptstyle L}^2}\frac{1}{d}(2q-1)\gamma = \frac{c}{v} \iff t_{\scriptscriptstyle L} = \sqrt{\frac{(2q-1)\gamma}{n(1-\overline{p})d\frac{c}{v}}}\frac{1}{(1-\gamma)\overline{a}},$$

which coincides with (OA.36).

<u>Checking that $t_{\scriptscriptstyle L} \in (0,1)$</u>: We need to ensure that, given (OA.36):

$$t_{\scriptscriptstyle L} < 1 \iff \frac{(2q-1)\gamma}{n(1-\overline{p})d\frac{c}{v}} < (1-\gamma)^2\overline{a}^2 \iff \frac{v}{c} < d\frac{(1-\gamma)^2\overline{a}^2 n(1-\overline{p})}{(2q-1)\gamma}, \tag{OA.89}$$

and $t_{\scriptscriptstyle L} > 0$, which, in this case, is always true.

<u>Drawing inferences from the values of $t_{\scriptscriptstyle L}$, $t_{\scriptscriptstyle R}$</u>: Additionally, from (OA.87), we have for $p \sim \mathcal{U}[l,h]$:

$$\begin{aligned}
&\frac{1}{(1-\gamma)n\overline{a}\overline{p}}\frac{1}{d}\frac{1}{t_{\scriptscriptstyle L}}p^* < \frac{c}{v} \iff \frac{1}{(1-\gamma)n\overline{a}\overline{p}}\frac{1}{d}\frac{1}{t_{\scriptscriptstyle L}}\left(1 - \frac{(2q-1)\gamma}{1-\gamma}\frac{1}{\overline{a}t_{\scriptscriptstyle L}}\right) < \frac{c}{v} \\
\iff &\sqrt{\frac{n(1-\overline{p})d\frac{c}{v}}{(2q-1)\gamma}}(1-\gamma)\overline{a} - \frac{(2q-1)\gamma}{(1-\gamma)\overline{a}}\frac{(1-\gamma)^2\overline{a}^2 n(1-\overline{p})d\frac{c}{v}}{(2q-1)\gamma} < d\frac{c}{v}(1-\gamma)n\overline{a}\overline{p} \\
\iff &\frac{v}{c} < d\frac{n(2q-1)\gamma}{1-\overline{p}},
\end{aligned} \tag{OA.90}$$

where, in the first equality, we used $f(p^*) = 1/d$, in the second inequality, we substituted for p^* from (OA.84), and, in the third inequality, we substituted for $t_{\scriptscriptstyle L}$ from (OA.36). Between (OA.89) and (OA.90), which is the relevant upper bound for v/c?

$$d\frac{n(2q-1)\gamma}{1-\overline{p}} < d\frac{(1-\gamma)^2\overline{a}^2 n(1-\overline{p})}{(2q-1)\gamma} \iff (2q-1)\gamma < (1-\gamma)\overline{a}(1-\overline{p}) \iff \gamma < \frac{\overline{a}(1-\overline{p})}{2q-1+\overline{a}(1-\overline{p})} \tag{OA.91}$$

Hence, if (OA.91) is true, then (OA.90) is relevant; otherwise (OA.89) is relevant. Note that (OA.91) is smaller than (OA.86), and hence in the feasible (up until now) region for γ.

Moreover, let us see how (OA.85) changes in terms of the computed $t_{\scriptscriptstyle L}$ in (OA.36).

We have:

$$\sqrt{\frac{(2q-1)\gamma}{n(1-\overline{p})d\frac{c}{v}}}\frac{1}{(1-\gamma)\overline{a}} > \frac{(2q-1)\gamma}{(1-\gamma)\overline{a}} \iff \sqrt{\frac{1}{n(1-\overline{p})d\frac{c}{v}}} > \sqrt{(2q-1)\gamma}$$
$$\iff \frac{v}{c} > dn(1-\overline{p})(2q-1)\gamma. \tag{OA.92}$$

For the existence of equilibrium $m0$, we need both possible upper bounds on v/c (OA.89) and (OA.90) to ex eed the lower bound in (OA.92). We have in turn:
i) Comparing (OA.89) with (OA.92):

$$d\frac{(1-\gamma)^2\overline{a}^2 n(1-\overline{p})}{(2q-1)\gamma} > dn(1-\overline{p})(2q-1)\gamma \iff (1-\gamma)^2\overline{a}^2 > (2q-1)^2\gamma^2 \iff \gamma < \frac{\overline{a}}{2q-1+\overline{a}},$$

which is identical to the current upper bound on γ in (OA.86) and hence true in the region we are considering.
ii) Comparing (OA.90) with (OA.92):

$$d\frac{n(2q-1)\gamma}{1-\overline{p}} > dn(1-\overline{p})(2q-1)\gamma \iff \overline{p} > 0,$$

which is also always true.
Checking assumptions A1 and A2: As mentioned, the upper bound on γ in (OA.86) supersedes the bound imposed by A1 (i.e., $\gamma < 1/(2q)$). This upper bound and the generic lower bound of 0 define are the current candidates for Γ_{m0}. Now we check the consistency of the upper bounds for v/c in (OA.89) and (OA.90) with respect to A2 (i.e., $v/c \geq 1$):
i) Comparing 1 with the bound in (OA.89):

$$n > \frac{(2q-1)\gamma}{d(1-\gamma)^2\overline{a}^2(1-\overline{p})}. \tag{OA.93}$$

ii) Comparing 1 with the bound in (OA.90):

$$n > \frac{1-\overline{p}}{d(2q-1)\gamma}. \tag{OA.94}$$

Expressions (OA.93) and (OA.94) impose lower bounds on n. Either can be relevant, depending on parameter values. Together they define interval N_{m0} in (OA.33).
Checking that $p^* \in (l,h)$: Given that $p \in [l,h]$, we need to also ensure that $l < p^* < h$. From the expression for p^* in (OA.84) and t_L given by (OA.36), we have: $1 - p^* =$

$\sqrt{(2q-1)\gamma\frac{dcn}{v}(1-\overline{p})}$ so

$$l < p^* < h \iff 1-h < 1-p^* < 1-l \iff (1-h)^2 < (1-p^*)^2 < (1-l)^2$$
$$\iff \frac{nd(2q-1)\gamma(1-\overline{p})}{(1-l)^2} \tag{OA.95}$$
$$< \frac{v}{c} <$$
$$\frac{nd(2q-1)\gamma(1-\overline{p})}{(1-h)^2}. \tag{OA.96}$$

How does the lower bound in (OA.95) compare with the existing one in (OA.92)?

$$\frac{nd(2q-1)\gamma(1-\overline{p})}{(1-l)^2} > dn(1-\overline{p})(2q-1)\gamma \iff (1-l)^2 < 1,$$

which is always true, and hence (OA.95) takes precedence over (OA.92).

Now how does the upper bound (OA.96) compare with the existing ones in (OA.89) and (OA.90)? We have in turn:
i) Comparing (OA.96) with the bound in (OA.89):

$$\frac{(1-\gamma)^2\overline{a}^2 n(1-\overline{p})}{(2q-1)\gamma} < \frac{nd(2q-1)\gamma(1-\overline{p})}{(1-h)^2} \iff \gamma > \frac{\overline{a}(1-h)}{2q-1+\overline{a}(1-h)}. \tag{OA.97}$$

Hence, we need to inquire further. Note that (OA.97) is smaller than (OA.86) and so in the feasible region of γ. Hence, either of (OA.89) and (OA.96) can be the relevant v/c upper bound.
i) Comparing (OA.96) with the bound in (OA.90):

$$\frac{d(2q-1)\gamma n}{1-\overline{p}} < \frac{nd(2q-1)\gamma(1-\overline{p})}{(1-h)^2} \iff \overline{p} < h,$$

which is always true, and hence (OA.96) is never the relevant upper bound on v/c. Combining the lower bound (OA.95) with the one implied by A2 (i.e., $v/c \geq 1$) and the upper bounds in (OA.89) and (OA.90) defines interval V_{m0} in (OA.35) (where we also divide all parameters by n).

Finally we need to check whether we need to update the bounds on γ to make sure that the lower bound on v/c is indeed lower than the upper. After some algebra we coclude that we need to tighten the upper bound on γ (lower bounds remains at zero) to $\bar{a}(1-l)/((2q-1)+\bar{a}(1-l))$, which results to Γ_{m0} in (OA.34). This concludes the proof of Proposition OA.7. ■

OA.3 Model Extensions: General Theory and Robustness

In the main text, we established the general existence of freeriding and non-monotonicity in corporate voting. While our structural estimation relied on specific functional forms (uniform uncertainty, symmetric valuations, homogeneous costs) to guarantee identification, the theoretical mechanisms are broader. In this section, we formally characterize the general environment in which these mechanisms operate and explore their limits.

Our analysis proceeds in three steps:

1. **General Uncertainty (Beta):** We formalize the conditions under which strategic substitution (freeriders and underdogs) dominates versus when it is overturned by bandwagon incentives (strategic complementarity), using a flexible beta distribution to model belief precision.

2. **Asymmetric Valuations:** We shift our focus from the descriptive measure of misrepresentation to analyze welfare (allocative efficiency). We show how the equilibrium adjusts to intensity of preference when $v_L \neq v_R$.

3. **Heterogeneous Costs:** We move beyond a homogeneous cost of voting. We show that the non-monotonic misrepresentation curve is not an artifact of corner solutions ($m0$) but a general result of differential elasticity under continuous cost distributions.

Throughout, we define the auxiliary constant $B \equiv \frac{(2q-1)\gamma}{(1-\gamma)\bar{a}}$ (the regular voter cushion), the pivotal cutoff $p^* \equiv \frac{t_L - B}{t_R + t_L}$, and the normalized incentive $u_{cn} \equiv v/(cn)$ (or $v_L/(cn)$ in the asymmetric case; or $v/(\bar{c}n)$ in the heterogeneous-cost case).

OA.3.1 Extension I: Underdog Stability under Beta Uncertainty on (l, h)

We now allow the latent discretionary support p to have a *scaled* Beta(α, β) distribution on $(l, h) \subset (0, 1)$ with width $d \equiv h - l > 0$:

$$f(p) \;=\; \frac{1}{d}\,\frac{\left(\frac{p-l}{d}\right)^{\alpha-1}\left(1-\frac{p-l}{d}\right)^{\beta-1}}{\mathcal{B}(\alpha,\beta)}, \qquad p \in (l, h).$$

As in the main text, under the large-n approximation the pivotal probability for L is proportional to $f(p^*)(1-p^*)$, so the underdog (strategic-substitution) condition for L is

$$\frac{\partial \Pr[\text{pivotal} \mid L]}{\partial p^*} < 0 \quad \Longleftrightarrow \quad \frac{f'(p^*)}{f(p^*)} - \frac{1}{1-p^*} < 0. \qquad \text{(OA.98)}$$

We characterize when (OA.98) holds on (l, h).

Proposition OA.8 (Underdog Stability on (l, h) with Scaled Beta Uncertainty)**.** *Let $p \sim \text{Beta}(\alpha, \beta)$ scaled to (l, h). Consider any equilibrium with cutoff $p^* \in (l, h)$. Then the strategic substitution condition* (OA.98) *holds whenever*

$$p^* \; > \; \underline{p}(l, h, \alpha, \beta),$$

where $\underline{p}$ is the smaller root of the quadratic

$$(\alpha + \beta - 1)\, p^2 \; - \; \big[\alpha(h + 1) + \beta(l + 1) - 2\big]\, p \; + \; \big[\alpha h + \beta l - (h + l) + hl\big] \; = \; 0. \quad \text{(OA.99)}$$

Equivalently, letting the coefficients be $K_2 = \alpha + \beta - 1$, $K_1 = \alpha(h+1) + \beta(l+1) - 2$, and $K_0 = \alpha h + \beta l - (h + l) + hl$, the threshold is:

$$\underline{p}(l, h, \alpha, \beta) \; = \; \frac{K_1 - \sqrt{K_1^2 - 4K_2K_0}}{2K_2}.$$

Corollary OA.1. *From the above we directly have:*

(i) ***Global stability for flat or decreasing beliefs.*** *If $\alpha \leq 1$, the inequality in* (OA.98) *holds globally near l; if in addition $\beta \geq 1$, it also holds near h, implying global stability over (l, h).*

(ii) ***Unit-interval benchmark.*** *When $(l, h) = (0, 1)$,* (OA.99) *reduces to the standard threshold*

$$\underline{p} \; = \; \frac{\alpha - 1}{\alpha + \beta - 1},$$

so the strategic substitution condition holds for all $p^* > \frac{\alpha - 1}{\alpha + \beta - 1}$.

Proof. For the scaled Beta density, the log-derivative is:

$$\frac{f'(p)}{f(p)} = \frac{\alpha - 1}{p - l} - \frac{\beta - 1}{h - p}.$$

Substituting into (OA.98) requires:

$$\frac{\alpha - 1}{p^* - l} - \frac{\beta - 1}{h - p^*} < \frac{1}{1 - p^*}.$$

All denominators are positive since $p^* \in (l, h) \subset (0, 1)$. Multiplying both sides by $(p^* - l)(h - p^*)(1 - p^*) > 0$ and rearranging terms yields a quadratic inequality $\Phi(p^*) < 0$, where the coefficients of $\Phi(p) = K_2 p^2 - K_1 p + K_0$ are obtained by expanding the expression:

$$\begin{aligned}
K_2 &= (\alpha - 1) + (\beta - 1) + 1 = \alpha + \beta - 1, \\
K_1 &= (\alpha - 1)(h + 1) + (\beta - 1)(l + 1) + (h + l) = \alpha(h + 1) + \beta(l + 1) - 2, \\
K_0 &= (\alpha - 1)h + (\beta - 1)l + hl = \alpha h + \beta l - (h + l) + hl.
\end{aligned}$$

Assuming $\alpha + \beta > 1$ (so $K_2 > 0$), Φ is convex, so $\Phi(p) < 0$ precisely between its two real roots. Denote the smaller root by $\underline{p}$. Then $\Phi(p^*) < 0$ whenever $p^* > \underline{p}$ (and p^* is below the upper root), as claimed.

For the *unit-interval case* $(l, h) = (0, 1)$, substituting $l = 0, h = 1$ yields $K_2 = \alpha+\beta-1$, $K_1 = 2\alpha + \beta - 2$, and $K_0 = \alpha - 1$. The quadratic factors into $((A + B + 1)p - A)(p - 1)$, recovering the root $\underline{p} = (\alpha - 1)/(\alpha + \beta - 1)$.

For the *global-stability corollary*, if $\alpha \leq 1$, the term $(\alpha - 1)/(p - l)$ is non-positive. If additionally $\beta \geq 1$, the term $-(\beta - 1)/(h - p)$ is non-positive. The RHS $1/(1 - p)$ is strictly positive. Thus the inequality holds globally. ■

Proposition OA.8 provides a sharp, closed-form sufficient condition on the equilibrium cutoff p^*. A primitive way to ensure it holds globally is to require $l \geq \underline{p}(l, h, \alpha, \beta)$. Higher α (greater mass near the left edge) tightens the condition by increasing the slope of f'/f near l, whereas higher β relaxes it. If $p^* < \underline{p}$, the likelihood-of-a-tie term dominates locally, leading to strategic complementarity (a "bandwagon" region) and potential multiplicity; the proposition therefore identifies the frontier between the stable underdog and unstable bandwagon regimes. Intuitively, when beliefs are more concentrated toward one side of the support, the density's slope amplifies the marginal effect of p^* on pivotality, making complementarity more likely unless the equilibrium lies sufficiently far from the lower bound.

As in the baseline model, we define the probability of misrepresentation as the likelihood that the election outcome differs from the full-participation benchmark p^{full}. Using the Beta CDF this is given by the probability mass between the equilibrium and the benchmark cutoffs:

$$P^{\text{misrep}} = \left|F(p^*) - F(p^{\text{full}})\right| = \left|\mathcal{I}_{x^*}(\alpha, \beta) - \mathcal{I}_{x^{\text{full}}}(\alpha, \beta)\right|, \tag{OA.100}$$

where $\mathcal{I}_x$ is the regularized incomplete Beta function and $x = (p - l)/d$ is the normalized position within the support. This formula captures how the shape of the uncertainty (skewness and tail thickness) directly distorts the mapping from voting incentives to democratic distortion.

We illustrate these implications in the accompanying figures. Figure OA.1 displays the probability densities for several pairs of (α, β), showing the transition from flat ($\alpha = \beta = 1$) to peaked ($\alpha = \beta = 1.5$) distributions. When the density is relatively flat (Corollary i), the stability condition holds globally. In contrast, when the density is spiked, there is a risk of bandwagon effects if the equilibrium p^* falls deep into the left tail.

In Figure OA.2, we test the robustness of the misrepresentation result using a moderate-precision specification ($\alpha = \beta = 1.5$). We simulate two support intervals: a *Narrow Support* case (Panel A, $l = 0.35$) and a *Wide Support* case (Panel B, $l = 0.25$); in both, the mode is fixed at $\bar{p} = 0.6$. The vertical lines in subplots (a) and (b) mark the sufficient threshold $\underline{p}$ derived in Proposition OA.8. In the Narrow Support case (Panel A), $\underline{p}$ lies close to the mode of the distribution, so the equilibrium cutoff p^* (shown in c) can fall slightly below $\underline{p}$ without violating stability in practice. In the Wide Support case (Panel B), the broader interval shifts $\underline{p}$ closer to the lower bound l, while the equilibrium

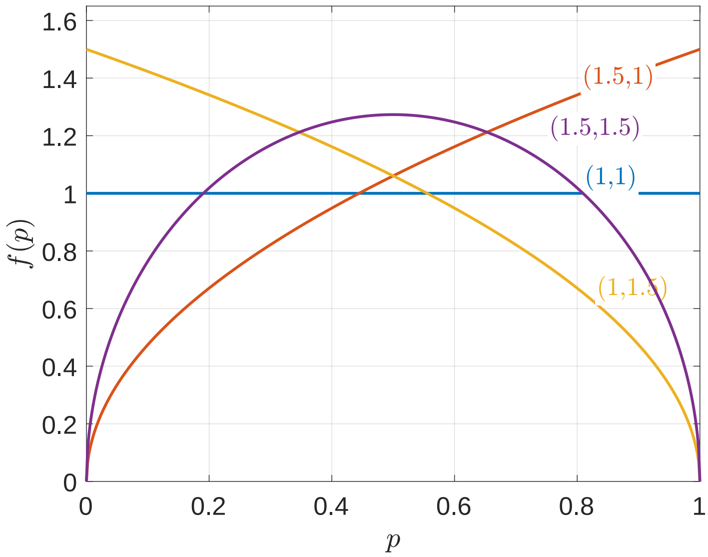


Figure OA.1: **Beta distributions of aggregate uncertainty.** The scaled Beta(α, β) nests the uniform ($\alpha = \beta = 1$), allows skewness ($\alpha \neq \beta$), and captures varying tail thickness. The figure depicts the density for $(\alpha, \beta) = \{(1, 1), (1.5, 1), (1, 1.5), (1.5, 1.5)\}$, and parameters $(l, h) = (0, 1)$.

p^* remains above it across the relevant range of incentives, satisfying the sufficient stability condition (see d). Crucially, subplots (e) and (f) demonstrate that despite this local departure from the sufficient condition, the non-monotonic hump shape of P^{misrep} persists in both cases. This indicates that while Proposition OA.8 provides a strict condition for uniqueness, the qualitative properties of the equilibrium identified in the main text are robust to broader parameterizations of the underlying uncertainty.

Finally, in Figure OA.3, we verify the structural stability of the hump across various shapes (α, β). Holding other primitives fixed, we observe two key effects. First, skewness: when $f(p)$ is skewed (e.g., $\alpha \neq \beta$), the hump shifts horizontally toward the side with more probability mass. Second, precision: when $f(p)$ is more peaked (larger $\alpha + \beta$), the curve flattens because pivotality is concentrated in a narrower range. Despite these shifts, the fundamental regime-transition mechanism persists, confirming that the uniform specification serves as a valid proxy for a broad class of informational environments.

OA.3.2 Extension II: Aggregate Welfare with Asymmetric Valuations

In the main text, we used P^{misrep} to measure deviations from the majority preference. However, if discretionary voters have heterogeneous intensities of preference, the majority preference need not maximize aggregate welfare. Here, we examine whether equilibrium deviations from this benchmark can be welfare-enhancing.

Let v_L and v_R denote the private benefits for discretionary voters of type L and R, respectively, and define $\kappa \equiv v_R/v_L$ as the relative valuation of the favorite.

We define welfare relative to the *discretionary* electorate, treating the fixed "regular" voters as a structural friction—such as partisan bias or uninformed noise—rather than welfare-relevant agents for this comparison. This welfare notion focuses on *allocative efficiency* and abstracts from participation costs (which are handled by equilibrium turnout). For a given state p (the share of discretionary voters favoring R), the expected aggregate benefit of electing R is proportional to pv_R, while that of electing L is proportional to $(1-p)v_L$. The planner prefers R iff

$$pv_R > (1-p)v_L \iff p\kappa > 1-p \iff p(1+\kappa) > 1,$$

which yields the *discretionary-efficiency benchmark* cutoff

$$p^{\text{opt}} = \frac{1}{1+\kappa}, \qquad \text{so higher } \kappa \text{ lowers the efficiency threshold.}$$

If $\kappa > 1$, efficiency requires R to win even when a numerical minority of discretionary voters support it (e.g., if $\kappa = 2$, then $p^{\text{opt}} = 1/3$).

The equilibrium satisfies first-order conditions equating marginal cost and benefit:

$$v_L \Pr[\text{Pivotal}|L] = c \quad \text{and} \quad v_R \Pr[\text{Pivotal}|R] = c, \tag{OA.101}$$

where pivotal probabilities are defined in (7)–(8). Dividing these equations eliminates c and, under the large-n symmetry approximation (Lemma 1), cancels the common scale term, yielding a condition that explicitly determines the equilibrium cutoff p^*:

(i) Asymmetric Cutoff Condition:

$$\kappa \frac{p^*}{1-p^*}\frac{1-\bar{p}}{\bar{p}} = 1. \tag{OA.102}$$

(ii) Asymmetric Scale Condition:

$$\frac{f(p^*)}{(1-\gamma)\bar{a}\, S}\left(\frac{p^*}{\bar{p}} + \frac{1-p^*}{1-\bar{p}}\right) = \frac{1}{u_{cn}}\left(1+\frac{1}{\kappa}\right), \tag{OA.103}$$

where $u_{cn} \equiv v_L/(cn)$. When $\kappa = 1$, this reduces to the baseline scale equation.

Proposition OA.9 (Market Correction for Intensity)**.** *In any interior (mm) or semi-interior (1m) equilibrium satisfying the stability (underdog) condition ((9)), an increase in the relative valuation of the freeriders ($\kappa \equiv v_R/v_L$) reduces the pivotal threshold p^* (i.e., $\frac{\partial p^*}{\partial \kappa} < 0$), making it easier for R to win.*

Proof. In the interior *mm* regime, the cutoff is determined entirely by (OA.102):

$$p^* = \frac{1}{1+\kappa(1-\bar{p})/\bar{p}},$$

so $\frac{\partial p^*}{\partial \kappa} < 0$. In the semi-interior $1m$ regime ($t_L = 1$), define $G(t_R, \kappa) = \kappa v_L \Pr[\text{Pivotal}|R](t_R) - c$. By the Implicit Function Theorem,

$$\frac{\partial t_R}{\partial \kappa} = -\frac{\partial G/\partial \kappa}{\partial G/\partial t_R}.$$

The numerator is strictly positive ($\partial G/\partial \kappa = v_L \Pr[\text{Pivotal}|R] > 0$), while the strategic substitution condition implies $\partial G/\partial t_R < 0$, hence $\partial t_R/\partial \kappa > 0$. Since $p^* = (1-B)/(1+t_R)$, it follows that $dp^*/d\kappa < 0$. ■

Proposition OA.9 confirms a *market correction for intensity*: the side with higher valuation votes more aggressively, shifting the pivotal cutoff toward p^{opt}. Consequently, what appears as "misrepresentation" relative to the majority preference may in fact improve aggregate welfare.

Misrepresentation vs. Welfare at $\kappa = 1$. Even when $\kappa = 1$, minimizing misrepresentation need not coincide with maximizing welfare. A utilitarian planner focused on discretionary voters sets $p^{\text{opt}} = 0.5$, whereas P^{misrep} measures deviation from the full-participation benchmark p^{full}. These coincide only if regular voters are balanced ($q = 1/2$, $B = 0$). If $B > 0$, then $p^{\text{full}} < 0.5$, so an outcome where R wins with $p \in (p^{\text{full}}, 0.5)$ is structurally representative but welfare-suboptimal for discretionary voters. Hence P^{misrep} captures aggregation failure, while welfare captures deviation from the median discretionary voter.

Finally, Figure OA.4 analyzes how asymmetry affects the observable misrepresentation probability. We simulate the baseline model for $\kappa \in \{0.5, 1, 2\}$, holding other parameters fixed. Two insights emerge. First, *persistence of non-monotonicity*: even with substantial valuation asymmetry, the inverted-U "hump" remains. Second, *leftward shift and flattening*: as κ increases (favoring R), the hump shifts left (lower u_{cn}) and flattens because, holding $u_{cn} = v_L/(cn)$ fixed, R's effective incentive scales with κ, inducing earlier R mobilization and higher total turnout.

OA.3.3 Extension III: Robustness to Idiosyncratic Costs

Our baseline model predicts full freeriding ($m0$) where $t_R = 0$. This is a corner solution driven by the assumption of a homogeneous positive cost c. A natural question is whether the resulting non-monotonicity of misrepresentation is merely an artifact of this corner. Here, we introduce a continuous distribution of voting costs to verify the structural stability of the hump shape.

Let the cost c_i be distributed across the population of discretionary voters according to the inverse CDF $C(t) = \bar{c}t^{\delta}$ ($\delta > 0$), where $t \in [0, 1]$ is the participation quantile. This formulation nests the baseline homogeneous cost as the limit $\delta \to 0$. The corresponding probability density function is:

$$f_c(c) = \frac{1}{\delta \bar{c}} \left(\frac{c}{\bar{c}}\right)^{\frac{1}{\delta}-1}, \qquad c \in [0, \bar{c}].$$

Figure OA.5 depicts this density for $\delta = \{0.5, 1, 2\}$. As δ increases, the distribution shifts mass toward zero. Notably, for $\delta > 1$, the density exhibits an asymptote at $c = 0$, creating a high concentration of low-cost voters who always participate ("always voters"). Conversely, $\delta < 1$ implies a vanishing density at zero, though no hard lower bound exists.

Under the same large-n approximation as in the main text, the marginal voter in each group is defined by v Pr[Pivotal] $= C(t_i)$. Substituting the power cost function into (7)–(8) yields the interior (mm) system.
First, the *Ratio Condition* (from equating the two groups' marginal conditions) is

$$r^\delta = \frac{t_L - B}{t_R + B} \cdot \frac{1-\bar{p}}{\bar{p}}, \qquad r \equiv \frac{t_R}{t_L}. \tag{OA.104}$$

Second, the *Scale Condition* ties the absolute level of incentives $u_{cn} \equiv v/(\bar{c}n)$ to total turnout:

$$\frac{t_L^\delta + t_R^\delta}{u_{cn}} = \frac{1}{(1-\gamma)\bar{a}\,d\,S^2}\left[\frac{t_L}{\bar{p}} + \frac{t_R}{1-\bar{p}} + B\left(\frac{1}{\bar{p}} - \frac{1}{1-\bar{p}}\right)\right], \qquad S \equiv t_R + t_L. \tag{OA.105}$$

Unlike the baseline, this system does not admit general closed-form solutions. However, we can characterize the solution at the symmetric benchmark ($q = 1/2 \Rightarrow B = 0, \bar{p} = 1/2$) and prove its local uniqueness.

Lemma OA.1 (Existence and local uniqueness at symmetry)**.** *At the symmetric benchmark ($q = \bar{p} = 1/2$), a unique interior equilibrium exists where $t_L = t_R = t$, satisfying*

$$t^{\delta+1} = \frac{u_{cn}}{2(1-\gamma)\bar{a}d}.$$

Furthermore, the Jacobian J of the system (OA.104)–(OA.105) *is nonsingular, hence the equilibrium is locally unique.*

Proof. See Section OA.3.4 for the explicit Jacobian calculation and the local stability argument. ■

Remark on asymmetry. While we verify the Jacobian explicitly at symmetry ($q = 1/2, \bar{p} = 1/2$), stability extends beyond this case. First, by continuity, nonsingularity holds on an open neighborhood of asymmetric parameters. Second, cost heterogeneity is stabilizing: by smoothing the aggregate best-response (dampening the sensitivity of total turnout to changes in the pivotal cutoff), heterogeneity enlarges the region of unique equilibria. Thus, stability persists for the relevant range of asymmetric parameters ($q > 1/2$, $\bar{p} \neq 1/2$) used in our analysis, provided beliefs over p are sufficiently diffuse.

Crucially, for any $\delta > 0$, the cost function implies $C(0) = 0$. Hence the lowest-cost quantiles face negligible costs, and any positive pivotal benefit induces a strictly positive measure of participants (since $t = (c/\bar{c})^{1/\delta} > 0$ for any $c > 0$); participation is therefore never exactly zero ($t_R > 0$ always), and the $m0$ corner formally disappears. The global dynamics are nonetheless preserved via the transition between interior (mm) and partial-freeriding ($1m$):

- *Rising phase (mm):* When R is strong (low p^*), $\Pr[\text{Pivotal}|R] \propto p^*$ is small while $\Pr[\text{Pivotal}|L] \propto (1-p^*)$ is large. With power costs this induces differential elasticities, $t_R \propto (p^*)^{1/\delta}$ vs. $t_L \propto (1-p^*)^{1/\delta}$. Because p^* is small, t_R grows much more slowly than t_L, so misrepresentation initially *rises* with incentives.

- *Falling phase (1m):* Once the underdog is fully mobilized ($t_L = 1$), the system enters $1m$. Further increases in incentives (u_{cn}) strictly increase t_R, narrowing the gap and causing misrepresentation to *fall*.

Figure OA.6 confirms this intuition. We simulate $\delta \in \{0, 0.5, 1, 2\}$. The inverted-U persists for all δ. Larger δ (a flatter supply of voters with more mass near low costs) raises baseline turnout, smooths the curve, and lowers peak misrepresentation; but the single interior hump remains, driven by the same $mm \to 1m$ transition as in the baseline.

We highlight $\delta = 1$ (Panel c), corresponding to a *uniform cost* distribution ($C(t) = \bar{c}t$). This benchmark smooths the participation discontinuity of the homogeneous-cost model, though it requires numerical solutions. In our estimation (Section 4 and OA.9), the baseline homogeneous-cost specification outperforms this continuous benchmark in fit, reinforcing the value of the closed-form baseline.

OA.3.4 Jacobian Calculation at Symmetry

This note verifies that, at the symmetric benchmark ($q = 1/2 \Rightarrow B = 0$, $\bar{p} = \frac{1}{2}$), the interior equilibrium system in Extension III (heterogeneous costs) is locally nonsingular and stable.

Let $r \equiv t_R/t_L$ denote the turnout ratio and $S \equiv t_L + t_R$ denote total turnout. Define G_1 and G_2 as the residuals of the *Ratio Condition* (OA.104) and the *Scale Condition* (OA.105). Using $t_L = S/(1+r)$ and $t_R = rS/(1+r)$:

$$G_1(r,S) \equiv \underbrace{r^\delta}_{\text{LHS of (OA.104)}} - \underbrace{\frac{\frac{S}{1+r} - B}{\frac{rS}{1+r} + B} \cdot \frac{1-\bar{p}}{\bar{p}}}_{\text{RHS of (OA.104)}} = 0,$$

$$G_2(r,S,u_{cn}) \equiv \underbrace{\frac{1}{(1-\gamma)\bar{a}\,d} \cdot \frac{\frac{t_L}{\bar{p}} + \frac{t_R}{1-\bar{p}} + B\left(\frac{1}{\bar{p}} - \frac{1}{1-\bar{p}}\right)}{S^2}}_{\text{RHS of (OA.105)}} - \underbrace{\frac{t_L^\delta + t_R^\delta}{u_{cn}}}_{\text{LHS of (OA.105)}} = 0.$$

At $q = 1/2$ ($B = 0$) and $\bar{p} = \frac{1}{2}$, seek a symmetric solution with $r = 1$ and $t_L = t_R = S/2$. Then

$$G_1(r,S) = r^\delta - \frac{1}{r},$$

so $r = 1$ solves $G_1 = 0$. The scale function simplifies to

$$G_2(r, S, u_{cn}) = \frac{2}{(1-\gamma)\bar{a}d} \cdot \frac{1}{S} - \frac{2(S/2)^\delta}{u_{cn}} = \frac{2}{(1-\gamma)\bar{a}d} \cdot \frac{1}{S} - \frac{2^{1-\delta}S^\delta}{u_{cn}}.$$

Let S^* be the unique positive solution to $G_2(1, S, u_{cn}) = 0$.

Evaluate the Jacobian at $(r, S) = (1, S^*)$:

$$J \equiv \begin{pmatrix} \partial G_1/\partial r & \partial G_1/\partial S \\ \partial G_2/\partial r & \partial G_2/\partial S \end{pmatrix}.$$

We obtain:

1. $\partial G_1/\partial r = \delta r^{\delta-1} + r^{-2}$. At $r = 1$, this is $\delta + 1 > 0$.
2. $\partial G_1/\partial S = 0$ at $B = 0$ (the S terms cancel).
3. $\partial G_2/\partial r = 0$ at $r = 1$ (by symmetry of $t_L^\delta + t_R^\delta$ around $r = 1$).
4. $\partial G_2/\partial S = -\dfrac{2}{(1-\gamma)\bar{a}d} \dfrac{1}{S^2} - \dfrac{2^{1-\delta}\delta}{u_{cn}} S^{\delta-1} < 0$ for any $S > 0$.

Thus J is diagonal. The nonzero determinant $\det(J) = (\delta + 1)(\partial G_2/\partial S) \neq 0$ confirms local uniqueness. Since the diagonal entries have opposite signs with $\partial G_2/\partial S < 0$, the fixed point is locally stable under standard best-response or tatonnement dynamics.

OA.4 Micro-foundation: Trading and the Timing of Ownership

In the preceding sections, we analyzed how the distribution of preferences $f(p)$ drives voting participation. We treated this aggregate uncertainty as a primitive. In this section, we provide a micro-foundation for that uncertainty, clarifying how trading and share lending around the record date generate the randomness in p.

We show that *ex-ante trading* (before the record date) provides a natural source for the aggregate uncertainty $f(p)$ used in our equilibrium derivations. Conversely, we discuss how *ex-post trading* (after the record date but before the vote) is, under our timing assumptions, neutral for equilibrium outcomes.

OA.4.1 Ex-Ante Trading as a Micro-Foundation

Let n denote total shares and $\gamma \in [0, 1)$ the fraction held by regular (non-discretionary) voters. Between an observation date t_0 and the record date T, discretionary shares may be traded or lent. Following Kyle (1985), aggregate order flow is

$$y = x_I + u,$$

where x_I represents informed trading and $u \sim \mathcal{N}(0, \sigma_u^2)$ is noise trading. Let $\phi = \Phi(|y|) \in [0, 1]$ denote the (random) fraction of discretionary shares whose ownership changes before T, where Φ is an increasing turnover function ($\Phi' > 0$) mapping trading volume into share turnover.

If a share turns over, its new owner's vote is drawn i.i.d. from the stationary pool of types, where $\bar{p}$ represents the long-run population mean. Thus, if K is the number of new votes supporting R, we have $K \sim \text{Binomial}((1-\gamma)n, \bar{p})$. The realized support $\tilde{p} = K/((1-\gamma)n)$ enters the law of motion:

$$p_T \;=\; (1-\phi)p_0 + \phi\,\tilde{p}. \tag{OA.106}$$

We now formalize how random turnover generates randomness in the record-date composition p_T.

Lemma OA.2 (Distribution of the record-date composition under turnover)**.** *Let ϕ have a continuous density g_ϕ on $[0, 1]$ induced by the noise u. Then:*

(i) ***Conditional moments.***

$$\mathbb{E}[p_T \mid p_0, \phi] = (1-\phi)p_0 + \phi\bar{p}, \quad \text{Var}(p_T \mid p_0, \phi) = \phi^2 \frac{\bar{p}(1-\bar{p})}{(1-\gamma)n}.$$

(ii) ***Mixture density.*** *The unconditional density is a continuous mixture:*

$$f_{p_T}(p) = \int_0^1 f_{p_T|\phi}(p \mid \varphi)\, g_\phi(\varphi)\, d\varphi.$$

If g_ϕ assigns strictly positive mass on an interval of $[0, 1]$ and $(1-\gamma)n < \infty$, then $f_{p_T}(p)$ is continuous and strictly positive on a bounded interval $[l, h] \subset (0, 1)$.

Proof. (i) follows from (OA.106) and the Binomial moments. (ii) Conditioning on $\phi = \varphi$, p_T lies on the grid $\{(1-\varphi)p_0 + \varphi\, k/M : k = 0, \ldots, M\}$ with $M = (1-\gamma)n$. Integrating over a continuous g_ϕ transforms this discrete grid into a continuous law on $[l, h]$ with a strictly positive density on its interior. ■

This yields a direct identification result.

Proposition OA.10 (Micro-foundation of aggregate uncertainty)**.** *Under Lemma OA.2, the model's random variable p can be interpreted as the realization of p_T in (OA.106). Hence, the density $f(p)$ used in all equilibrium expressions is the record-date distribution generated by ex-ante trading and lending.*

Proof. Direct from Lemma OA.2: p_T has a continuous density on $[l, h]$ with mean between p_0 and $\bar{p}$ and non-zero variance whenever $\phi > 0$ with positive probability. Substituting $f(p_T)$ for $f(p)$ in the pivotal-probability expressions leaves all equilibrium relations unchanged. ■

Interpretation and empirical link. Equation (OA.106) makes explicit how order-flow volatility σ_u and turnover ϕ map into dispersion of p_T. Higher σ_u or lending intensity increases $\text{Var}(p_T)$, i.e. a wider $[l, h]$ and lower local density $f(p^*)$. Record-date turnover or loan-fee spikes can therefore serve as empirical proxies for the degree of aggregate uncertainty.

OA.4.2 Ex-Post Trading and Neutrality

After the record date but before the announcement of results, shares may be re-traded. In our static framework, such transactions are neutral. Agents choose participation strategies based on the benefit v—which captures the total expected value of the preferred outcome, including any anticipated capital gains—at the moment of the decision. Because secondary-market trading occurs *after* the vote is cast, the realization of these trades cannot retroactively affect the participation condition ($v \cdot \Pr[\text{Pivotal}] \gtrless c$). Hence, such trading may redistribute payoffs ex post but not voting influence ex ante. Dynamic feedback effects where voting intent affects equilibrium prices (e.g., Meirowitz and Pi, 2022; Levit et al., 2024) are beyond the scope of this analysis.

OA.5 Proposal Classification

The ISS's functional classification of proposals into 257 types is fine enough to risk obscuring the economic meaning of each proposal type. For example, ISS assigns a different proposal type for Amend Articles/Bylaws/Charter to Remove Antitakeover Provisions (S0326), Approve/Amend Terms of Existing Poison Pill(S0322),' and Submit Shareholder Rights Plan (Poison Pill) to Shareholder Vote (S0302), even though these proposals address the same economic issue—takeover defense. For this reason, it is useful to work with a coarser and more economically meaningful classification. Our classification groups corporate governance proposals into four economically relevant types. We list these types along with their frequency in our sample in Table 2. The set of types is chosen to reflect the main issues that arise in the literature on voting and corporate governance (for example, Knoeber (1986); LaPorta et al. (1998); Grullon and Michaely (2002); Gompers et al. (2003); Bebchuk et al. (2009); Becht et al. (2009); Bebchuk and Fried (2009); Ferri and Maber (2012)). Once the set of types is chosen, the proposals are classified in a straightforward way, based on their description, as illustrated in the above example. In Table OA.2, we list the top three proposals per type.

OA.6 Estimation sample

In Table OA.3 Panel A, we describe our U.S. estimation sample–excluding observations that do not satisfy A1, that is, proposals in meetings where regular (mandatory) voters' ownership is too large for discretionary voting to be consequential. In total, we exclude 55,363 proposals in 19,770 meetings. The excluded companies are significantly smaller ($9 versus \$11 billion in the sample firms). They have more N-PX ownership (57% versus 24% in sample firms) and more insider ownership (15% versus 9% in sample firms). The total participation is 78% in the excluded firms (versus 67% in sample firms), but voluntary participation only 17%, compared to 30% in sample firms. Among the excluded proposals, 88% are management proposals, compared to 86% among our sample proposals. In Table OA.3 Panel B, we report univariate statistics for the input parameters for our estimation.

For the non-U.S. sample, we describe our estimation sample in Table OA.4. The excluded firms have more N-PX ownership, with 14% compared to 5% in sample firms, and much higher insider ownership, with an average of 59%, compared to 23% in our sample (see Table OA.4). The average participation rate in excluded proposals is 47%, versus 36% in-sample, and discretionary participation 2% versus 9% in-sample.

OA.7 Model fit

We compare the precision of out-of-sample predictions of our model with that of a reduced form model with a parsimonious set of fixed effects (firm, year, and proposal type) and explanatory variables based on the literature (Table 3 of Malenko and Shen (2016)). With both the reduced form model and our model, we calculate model parameters with all years up to 2015. For proposals from 2016–2020, we then use these parameters (ie, $v/(cn)$ and the distribution parameters of p) to predict total participation, $dSuL$, $dSuR$, and the outcome index $O_{\text{disc}}(p)$ in (3), where we drop for brevity the dependence on the participation rates. We provide the estimates in Table OA.5. Our model produces smaller mean squared errors (MSE) than the reduced-form model (Panel C in Table OA.3). The difference is significant, according to a Diebold and Mariano (1995) test; for this test, we treat the predictions as a time series with the meeting order as a time stamp.

OA.8 The magnitude of the benefits of voting

The algorithm estimates the benefit-to-cost ratio per share $v/(cn)$. In this section, we set these estimates into the context of the literature.

Since we are the first to estimate the benefit-to-cost ratio, we transform it to a more comparable measure, the return on investment, conditional on a win for one's preferred side. This transformation requires assumptions about two unknowns: the number of shares n and the cost of voting c. For this section, we will vary n and assume $c = 1$; please see Section 4.6 for an in-depth discussion of the cost of voting. Assuming a higher cost would linearly translate into lower returns. Under this assumption, one can interpret the ratio between the benefit-to-cost ratio per share $v/(cn)$ and the average ownership stake in dollars (\$) as the average return to winning.

Figure OA.7 depicts the "return on winning" as a function of the ratio of market capitalization and n, that is, the average value of shares held prior to the vote. We exclude estimations in which the benefit-to-cost ratio falls below 1 (i.e., irrelevant proposals).

The graph shows that an average ownership stake over \$200,000 can yield realistic estimates of the benefit-to-cost ratios (below 20%). For an average ownership stake of \$1.5 million —that is, the average holding size of insiders convicted by the SEC (Ahern (2017))— and a cost of \$1, the return is 0.6%. This result compares to an average return of 1.6% for the passing of governance shareholder proposals by Cuñat et al. (2012). For the comparable subsample - governance shareholder proposals - our estimate is 2.7%. Hence, as in Ahern (2017), using the average ownership stake yields estimates that are roughly comparable to estimates in the literature.

OA.9 Robustness

Now we report several robustness tests, which are reported in Table OA.6.

OA.9.1 Alternative model with uniform idiosyncratic costs

Our baseline estimates imply a predominance of the $m0$ equilibrium, with high turnout by the underdog side (t_L) despite an expected win by R. To test the robustness of this finding, we estimate a variant of the model that introduces idiosyncratic costs of voting—what we refer to as the *uniform-cost* case—derived from Extension I in Section OA.4 (OA.4.1). In the notation of that section, this corresponds to parameters $\delta = 1$, $\kappa = 1$, $p \sim \mathcal{U}[l, h]$, and $v_R = v_L = v$. This specification allows for heterogeneous participation costs across discretionary shareholders, while preserving symmetry in valuations and aggregate uncertainty.

Because closed-form solutions for turnout rates are unavailable in this case, numerical estimation is required and introduces additional computational noise. To evaluate the model's fit, we compare its estimation errors to those from our baseline constant-cost specification.

As reported in Table OA.6, the uniform-cost variant exhibits estimation errors approximately 30% higher than in the baseline. In this setting, almost all proposals are estimated to lie in the mm equilibrium with partial participation on both sides, implying a lower overall probability of misrepresentation (11%) relative to the baseline model.

OA.9.2 Alternative Estimation Methods

In this section, we show how robust our estimations are to alternative estimation choices. For all of the following variations, MSEs are significantly smaller than the comparison model.

Availability. Our baseline estimations assume that all shareholders are available to vote ($\overline{a} = 1$). However, Holderness and Pontiff (2016) document that not all shareholders participate in valuable rights offerings, suggesting that some miss even high-impact corporate events. Assuming an $\overline{a}$ of 0.9 or 0.8 instead increases the estimation errors by 37 (38)%. With a 10% (20%) of shareholders not participating, participation rates are higher on the right by 9 p.p. (2 p.p.), and participation rates for L are lower by 1 p.p. for a 0.9 $\overline{a}$ and higher by 9 p.p. for 0.8. The probability of a misrepresentative outcome is lower, with 13% (11%), and the benefit-cost ratio much higher at 0.63 for 0.9 $\overline{a}$ and 1.37 for 0.8 $\overline{a}$.

Alternative bins. Our baseline estimations use bins per proposal type$\times\gamma$ tercile$\times n$ tercile$\times q$ tercile. In Table OA.6 Panel A, we report the performance and equilibrium incidence for bins using quartiles of γ, q, and n instead. The estimates are similar to the baseline ones, with 16% higher errors.

Size instead of the number of distinct investors. Our baseline estimations use the number of distinct institutional investors that do not submit N-PX forms as the measure for n. However, this number does not take non-institutional investors into account. Another proxy for n, which we use here, is the size of the firm: Brav et al. (2022) shows it correlates highly with the number of actual shareholder accounts. In Table OA.6 Panel A, we report the performance and equilibrium incidence using market capitalization for n. Using capitalization results in higher errors and reallocates the equilibrium distribution from $m1$ to mm and $1m$, reducing the participation estimates on the right. It does not, however, change the estimate for the probability of an unrepresentative result much.

Insiders vote like N-PX voters. We assume that insiders vote with management. In reality, not all insiders may agree with management; one may argue that they should behave similar to other N-PX voters instead. In this robustness test, we assume that they vote exactly as N-PX voters do. In Table OA.6 Panel A, we report the performance and equilibrium incidence. Assuming that insiders vote the same fractions as N-PX results in a 16% higher estimation error and reduces the number of observations for which Assumption 1 is fulfilled. Although the equilibrium distribution is similar to our baseline estimations, the estimate for the benefit-cost ratio as well as the probability of an unrepresentative result are much lower, with 0.3 and 7%.

OA.9.3 Sample Splits

In this section, we examine our model's performance and the robustness of the estimates for subsamples in which our assumptions are less likely to hold. All results are reported in Table OA.6 Panel B.

Equity lending. In the presence of an equity lending market, discretionary voters may decide to lend their shares instead of voting, effectively increasing the opportunity costs of voting. Currently, the U.S. equity lending market operates over-the-counter, and data are available from Markit for the period 2001-2016.[1] The Markit database covers over 90% of that market and contains firm-quarter-level information on the supply of lendable

[1] We are most grateful to Pedro Saffi for providing us with part of this dataset.

shares for most stocks listed on public exchanges. Following Campello et al. (2019), we define equity lending supply as the difference between the value of a firm's lendable shares and the number of lendable shares currently on loan, divided by the firm's market capitalization. This calculation precisely measures the net lendable supply. We define equity lending demand as the value of shares actually borrowed divided by the firm's market capitalization. We then compare the firms above and below the median in terms of the demand and supply of equity lending and investigate the effect on our estimation results. Consistent with equity lending affecting the cost of voting, we estimate a higher benefit-to-cost ratio (a lower cost of voting) when price of lending is low (when demand is low or when supply is high). Estimates for the probability of unrepresentative outcomes are lower than in our baseline version, especially for the subsample with high equity lending demand and high equity lending supply. Estimation errors are similar to our baseline estimations in the subsample of low supply, but larger than in our baseline estimations in the subsamples of high demand and low supply, and smaller in the subsample of high supply.

Number of proposals. Since our model focuses on one proposal, results for meetings with only one nonroutine proposal should be more representative. However, estimation errors are actually higher for single-proposal meetings than for multi-proposal ones. Our estimates for the benefit-to-cost ratio is higher for meetings with multiple proposals. The probability of an unrepresentative outcome is higher for meetings with single proposals.

Importance of information. An important ingredient of the voting process missing from our model is information aggregation of dispersed private information. Hence, the algorithm should be more suitable when information aggregation matters less. This should be the case for meetings with only one proposal (see the previous paragraph), common proposal types, or for proposals later in the proxy season, after shareholders have already observed the voting preferences in many firms and guidance on the respective proposal types. We divide the sample by the frequency of a proposal type within a year, and alternatively by the date of the meeting within each year. The estimation errors are higher for more common proposals and later meetings although there information should matter less. Our estimate for the benefit-to-cost ratio is higher for rare proposal types and early meetings; so is the probability of an unrepresentative outcome. Equilibrium incidences are similar across the subsamples and similar to the base algorithm.

Table OA.1: **Number of observations per year.** This table shows the number of proposals and meetings per year in our sample of U.S. firms from 2003–2020.

Panel A: Number of observations per year

Year	Proposals	Meetings
2003	548	298
2004	2160	1257
2005	2202	1322
2006	2183	1321
2007	2052	1245
2008	2115	1296
2009	2541	1477
2010	2287	1339
2011	4928	2919
2012	4652	2697
2013	5467	3076
2014	5373	3126
2015	5149	2896
2016	5224	2930
2017	5251	2960
2018	4641	2802
2019	4443	2777
2020	3806	2292

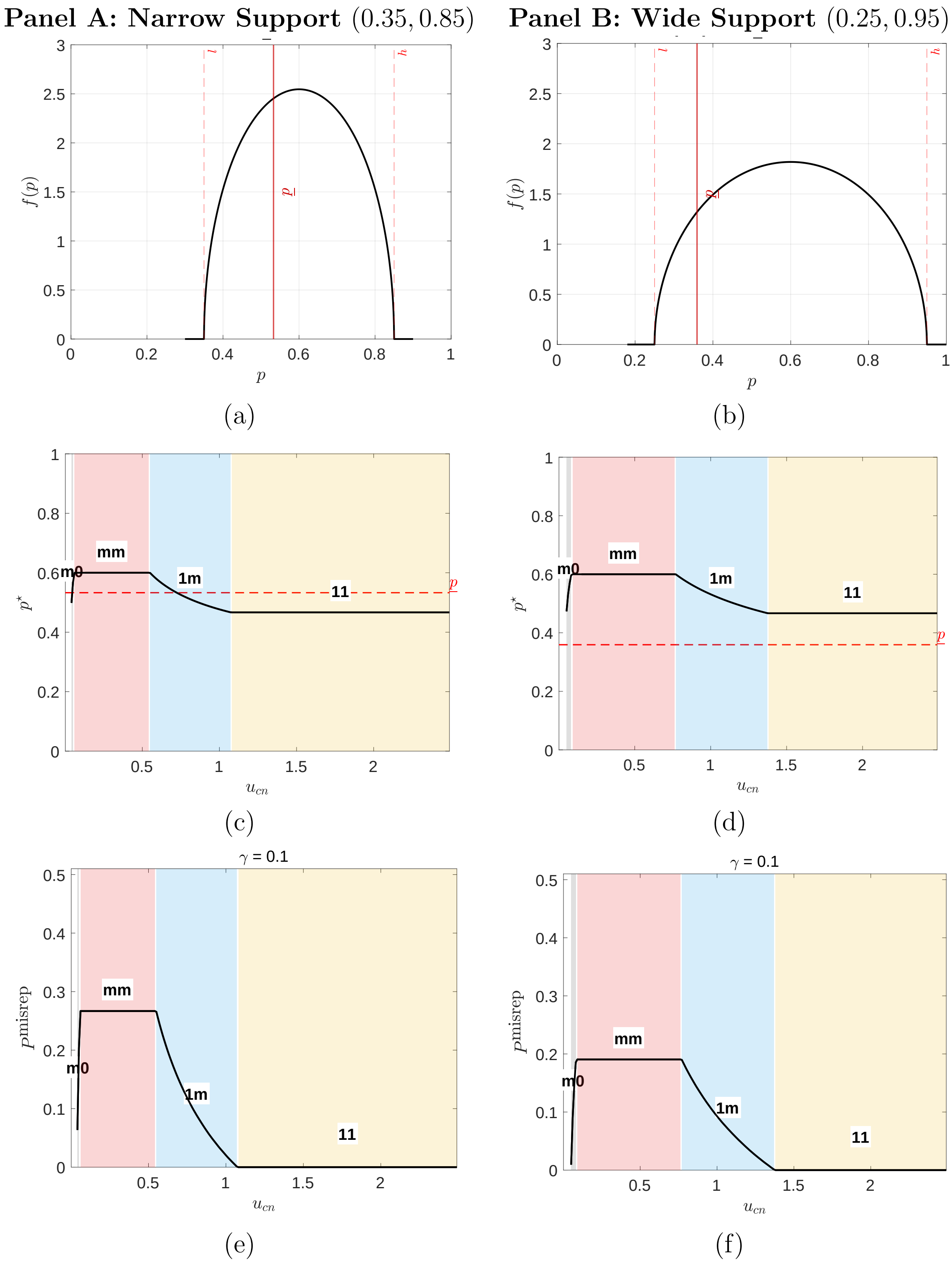
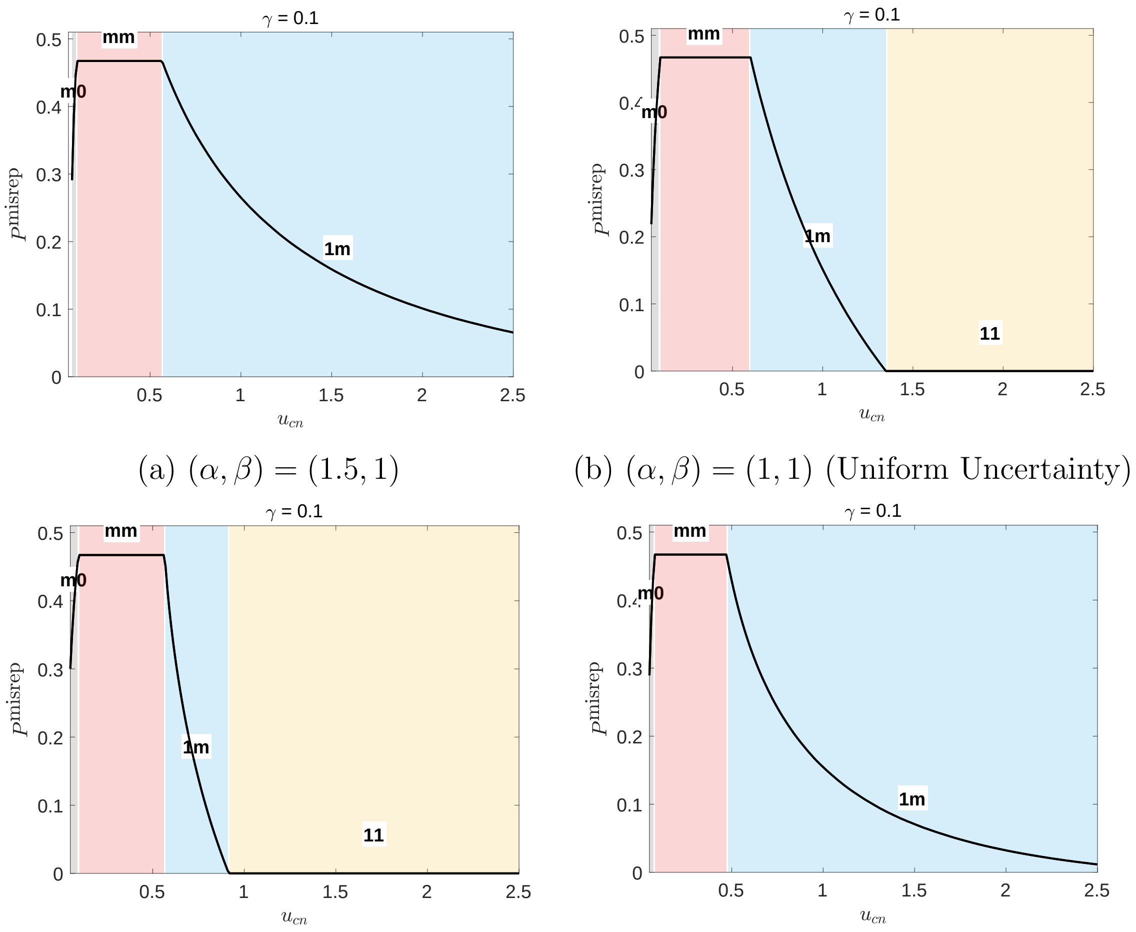


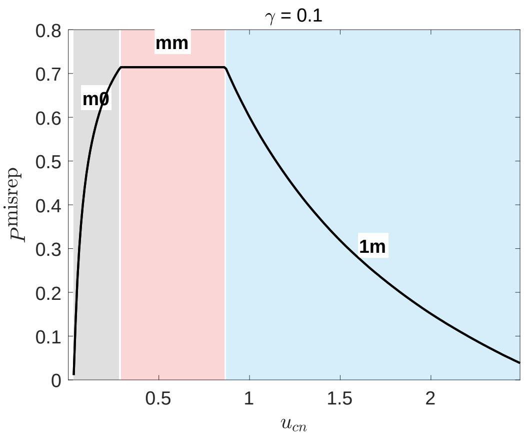
Figure OA.2: **Robustness of Non-Monotonicity.** Simulations with $\alpha = \beta = 1.5$. Panel A considers a narrower support $(l, h) = (0.35, 0.85)$, while Panel B considers a wider support $(0.25, 0.95)$. (a) and (b) show the corresponding PDFs and the sufficient stability threshold $\underline{p}$. (c) and (d) plot the equilibrium cutoff p^* against the incentive u_{cn}, illustrating where the condition $p^* > \underline{p}$ holds. (e) and (f) depict the misrepresentation probability P^{misrep} against u_{cn}. Parameters: $\gamma = 0.1$, $\bar{a} = 1$, $q = 0.8$; here $u_{cn} = v/(cn)$.



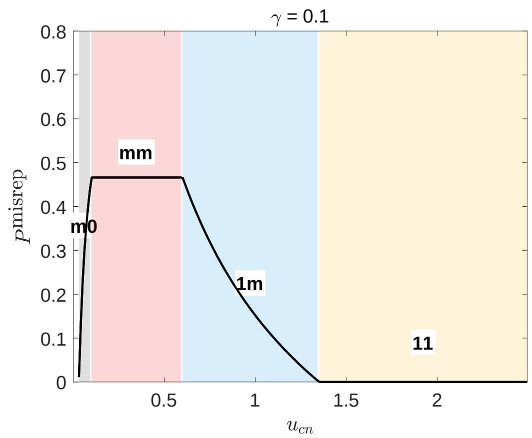
(a) $(\alpha, \beta) = (1.5, 1)$ (b) $(\alpha, \beta) = (1, 1)$ (Uniform Uncertainty)

(c) $(\alpha, \beta) = (1, 1.5)$ (d) $(\alpha, \beta) = (1.5, 1.5)$

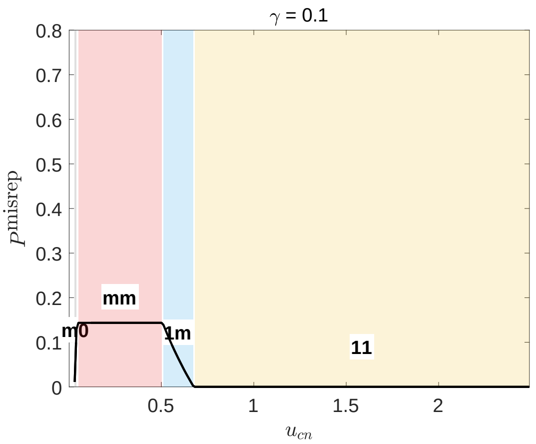
Figure OA.3: **Misrepresentation under Beta Uncertainty.** $P^{\mathrm{misrep}}(u_{cn})$ for selected Beta(α, β) parameters $\{(1.5, 1), (1, 1), (1, 1.5), (1.5, 1.5)\}$. Skewness shifts the hump horizontally; the regime-transition mechanism persists. Parameters: $\gamma = 0.1$, $\bar{a} = 1$, $q = 0.8$, $l = 0.45$, and $h = 0.95$; here $u_{cn} = v/(cn)$.



(a) $\kappa = 0.5$



(b) $\kappa = 1$



(c) $\kappa = 2$

Figure OA.4: **Misrepresentation under valuation asymmetry.** $P^{\text{misrep}}(u_{cn})$ for valuation ratios $\kappa = \{0.5, 1, 2\}$. As κ increases (R's valuation rises), R mobilizes at lower incentive levels, shifting the hump leftward and flattening it. Parameters: $\gamma = 0.1$, $\bar{a} = 1$, $(\alpha, \beta) = (1, 1)$ (uniform uncertainty), $l = 0.45$, $h = 0.95$, $q = 0.8$; here $u_{cn} = v_L/(cn)$.

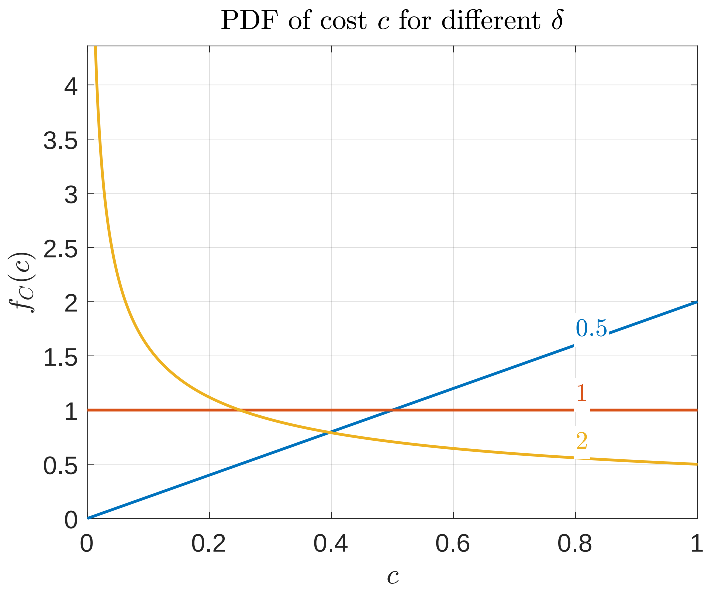
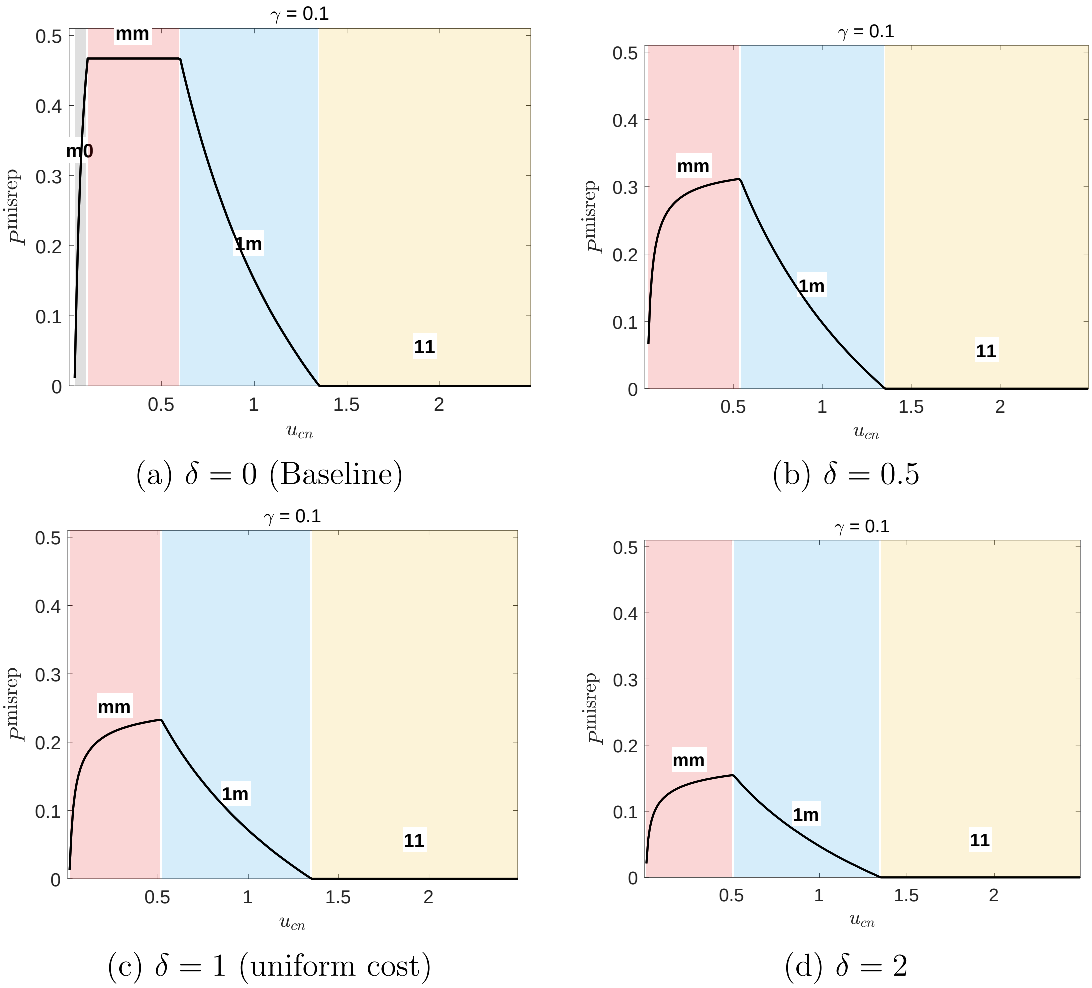


Figure OA.5: Cost density $f_c(c)$ for curvature parameters $\delta = \{0.5, 1, 2\}$ and $\bar{c} = 1$.

Table OA.2: **Proposal type classification.** This table lists the most frequent ISS proposal descriptions by proposal type, for the sample of U.S. proposals 2003-2020.

Proposal type	Most frequent ISS proposal descriptions
Board	Require Independent Board Chairman, Board Diversity, Establish Committee
Executive compensation	Advisory Vote to Ratify Named Executive Officers' Compensation, Stock Retention/Holding Period, Performance-Based and/or Time-Based Equity Awards
Takeover defense	Submit or Remove Shareholder Rights Plan (Poison Pill) Requirement
Voting	Declassify the Board of Directors, Require a Majority Vote for the Election of Directors, Proxy Access
Other governance	Amend Articles/Bylaws/Charter, Reincorporate in Another State



(a) $\delta = 0$ (Baseline)

(b) $\delta = 0.5$

(c) $\delta = 1$ (uniform cost)

(d) $\delta = 2$

Figure OA.6: **Misrepresentation and cost curvature.** P^{misrep} vs. $u_{cn} = v/(\bar{c}n)$ for $\delta = \{0, 0.5, 1, 2\}$. Each curve splices interior mm and $1m$ equilibria. Parameters: $\gamma = 0.1$, $\bar{a} = 1$, $(\alpha, \beta) = (1, 1)$ (uniform uncertainty), $l = 0.45$, $h = 0.95$, $q = 0.8$. Larger δ concentrates low costs, raising baseline turnout even at low u_{cn} and smoothing the hump; even with $\delta > 0$ (no corners), a single interior hump arises from the $mm \to 1m$ transition.

Table OA.3: **Estimation.** This table shows statistics on input data for the estimation and model fit for a sample of proposals voted upon in U.S. firms from 2003–2020. Panel A compares the estimation sample to excluded observations. Panel B provides the univariate statistics for the input data. Panel C reports mean squared error (MSE) of our baseline estimations and the ones in Table OA.5, their difference, the test statistic and the p-value of the Diebold-Mariano test for equality of predictive accuracy.

Panel A: Estimation sample

Variable	Sample Mean	Excluded Mean	t	p
Meeting level				
Market capitalization	10594.65	8520.21	5.04	0
%N-PX ownership	0.24	0.57	-164.12	0
Closely held	0.09	0.15	-33.89	0
Proposal level				
Participation (all)	0.67	0.78	-74.21	0
Participation (voluntary)	0.3	0.17	53.97	0
Management	0.86	0.88	-10.09	0

Panel B: Input parameters of the algorithm

Variable	Name	N	Mean	Std. Dev.	Min	Max
Firm-time specific						
Institutional and insider ownership (%)	γ	22520	0.35	0.12	0	0.98
Number of voting shares approximated by the number of accounts	n	14481	755	947	1	14061
Proposal-type specific						
Average support for the most populous choice among institutional and insider ownership (%)	q	22520	0.97	0.06	0.62	1
Discretionary (non-institutional, non–insider) support for the minority preference (%)	$dSuL$	22520	0.12	0.08	0.01	0.98
... for the majority preference	$dSuR$	22520	0.1	0.06	0	0.46
...for the minority preference, squared (%)	$dSuL^2$	22520	0.05	0.05	0	0.95
...for the majority preference, squared (%)	$dSuR^2$	22520	0.06	0.03	0	0.27

Panel C: Comparison between reduced-form and estimation forecasts

	Participation	$dSuL$	$dSuR$	$O_{\text{disc}}(\overline{p})$
In-sample - 2003–2015				
MSE algorithm	0.08	0.07	0.04	0.05
MSE reduced form	0.1	0.06	0.05	0.08
Difference	-0.02	0.01	-0.01	-0.03
S (1)	-5.63	4.87	-3.31	-9.53
p-value	$<$0.0000	$<$0.0000	$<$0.0000	$<$0.0000
Out-of-sample - 2016–2020				
MSE baseline estimation	0.1	0.08	0.04	0.06
MSE reduced form	0.14	0.09	0.08	0.11
Difference	-0.04	-0.01	-0.04	-0.05
S (1)	-4.8	-1.34	-3.31	-8.97
p-value	$<$0.0000	$<$0.0000	$<$0.0000	$<$0.0000

Table OA.4: **International estimation sample.** This table shows a comparison between sample proposals and those excluded from the sample because they violate assumption 1 for a sample of non-U.S. proposals from 2013–2020.

Variable	Sample Mean	Excluded Mean	t	p
Meeting level				
Market capitalization	1407.22	1389.17	0.98	0.33
closely held	0.23	0.59	-197.16	0
Proposal level				
Participation (all)	0.36	0.47	-48.44	0
Participation (voluntary)	0.09	0.02	69.68	0
Management	0.99	0.99	-6.15	0

Table OA.5: **Comparison of Estimation Methods.** This table compares the prediction accuracy of the algorithm to reduced-form models for each proposal. For the dependent variable and the relevant sample see the table caption. Independent variables are those from Table 3 of Malenko and Shen (2016), excluding the ISS recommendation. Standard errors are in parentheses. *, **, and *** represent significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent variable	Total participation	$dSuL$	$dSuR$	$O_{\text{disc}}(p)$	Total participation	$dSuL$	$dSuR$	$O_{\text{disc}}(p)$	Total participation
Sample	All	All	All	All	Until 2015	Until 2015	Until 2015	Until 2015	All
Regression	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	Tobit
MaxTSR	0	0	0	0	0	0	0	0	0
	(-0.180727)	(-1.15935)	(-0.395957)	(-0.746027)	(-0.949033)	(-0.213804)	(-0.561144)	(0.0739457)	(0.0739457)
BelowCutoffMaxTSR	-0.001	0	0.001	-0.001**	0	0.001	-0.001**	-0.002**	-0.002**
	(-1.07153)	(-0.312041)	(0.785249)	(-2.36344)	(-0.426521)	(1.24929)	(-2.34219)	(-2.07104)	(-2.07104)
Total Compensation	0	0	0	-0.000**	0	0	-0.000*	0	0
	(-0.2923)	(-1.40556)	(0.185489)	(-2.29327)	(-1.28222)	(-0.122351)	(-1.72919)	(0.0316934)	(0.0316934)
TDC1 Change	0	0	0	0	0	0	0	0	0
	(-0.678945)	(0.614249)	(0.591185)	(-0.0658558)	(0.608049)	(0.934467)	(-0.270131)	(-0.598448)	(-0.598448)
Stock Compensation	-0.083***	0.037	0.087***	-0.048***	0.034	0.097***	-0.057***	-0.102***	-0.102***
	(-3.77596)	(1.38186)	(3.49848)	(-2.70632)	(1.08322)	(3.35333)	(-2.68036)	(-3.94355)	(-3.94355)
Director holdings	0.049	-0.092	0.024	-0.093**	-0.069	0.028	-0.094*	0.045	0.045
	(0.914358)	(-1.5053)	(0.395151)	(-2.09986)	(-0.975271)	(0.395365)	(-1.81985)	(0.723276)	(0.723276)
Log Equity	0.028***	0.029***	-0.010**	0.038***	0.030***	-0.015***	0.044***	0.035***	0.035***
	(6.32465)	(5.42282)	(-2.03187)	(10.4722)	(4.84866)	(-2.64375)	(10.1887)	(6.84478)	(6.84478)
ROA	-0.057	-0.027	0.056	-0.092**	-0.173**	0.006	-0.181***	0.011	0.011
	(-1.28231)	(-0.490972)	(1.10375)	(-2.54709)	(-2.0815)	(0.0787503)	(-3.13925)	(0.163843)	(0.163843)
Market/book	0	0.001***	0	0.000**	0.001**	0.001*	0	0	0
	(-0.339894)	(2.70742)	(1.44033)	(2.29271)	(2.31134)	(1.88213)	(1.05254)	(-1.17107)	(-1.17107)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Proposal type FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.381	0.309	0.287	0.353	0.304	0.281	0.346	0.388	0
$\#N$	2200	2283	2200	2200	1906	1841	1841	1841	0

Table OA.6: **Robustness.** This table reports alternative estimations. In Panel A we maintain the whole sample and change some attribute of our algorithm. The first column describes whether the algorithm assumes the same cost of voting across voters (base) or cost is idiosyncratic (uniform-cost model); whether availability is 1 (base) or rather 0.9, or 0.8; whether the algorithm matches the moments of terciles (base) or the moments of quartiles, and whether it uses size terciles instead of terciles of n (base). In Panel B we maintain the baseline algorithm and look into different (sub)samples. The first column reports whether the entire sample or a subsample was used, where "High/Low forecast standard deviation" refers to the highest/lowest tercile of analyst forecast standard deviation); "Early/Late meetings" refer to meetings held before/after the median proxy meeting date; "Early/Late meetings–ISS" refer to meetings held before/after ISS has issued recommendations for the respective proposal type in both directions; and "High/low equity lending supply/demand" refers to the quarterly highest/lowest quintile in equity lending supply/demand. In both panels we report: the number of observations; the MSE; the estimates for the benefit-cost ratio, participation on L and R, and the probability of an outcome non-representative of the population preference or the preference of regular voters; and the incidence of each equilibrium type for these estimations (columns (7)–(9)).

Panel A: Whole sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All	Estimates					Equilibrium (as a fraction of N)		
Algorithm	N	MSE	$v/(cn)$	t_L	t_R	P^{misrep}	Full Freeriding	Partial Freeriding	No Freeriding
Base	22,520	0.05	0.36	0.65	0.02	0.14	0.83	0.17	0
Idiosyncratic cost	22,582	0.06	0.17	0.63	0.1	0.11	0	1	0
$\overline{a} = 0.9$	22,446	0.07	0.63	0.71	0.04	0.13	0.64	0.36	0
$\overline{a} = 0.8$	22,027	0.07	1.37	0.77	0.09	0.11	0.53	0.47	0
Quartiles	21352	0.06	0.44	0.69	0.02	0.11	0.75	0.25	0
Size instead of N	22,630	0.06	0.32	0.45	0.11	0.14	0.74	0.26	0
Insiders vote like NPX	19,719	0.06	0.3	0.57	0.03	0.07	0.88	0.12	0

Panel B: Baseline algorithm

Sample	(1) N	(2) MSE	(3) $v/(cn)$	(4) t_L	(5) t_R	(6) P^{misrep}	(7) Full Freeriding	(8) Partial Freeriding	(9) No Freeriding
Low equity lending demand	5336	0.05	0.4	0.68	0.05	0.12	0.74	0.26	0
High equity lending demand	4193	0.05	0.32	0.7	0.01	0.09	0.79	0.21	0
Low equity lending supply	4088	0.06	0.26	0.59	0.02	0.11	0.84	0.16	0
High equity lending supply	5266	0.04	0.48	0.77	0.04	0.08	0.67	0.33	0
Single proposal	8275	0.06	0.18	0.62	0	0.13	0.97	0.03	0
Bundle	7642	0.05	0.44	0.7	0.05	0.12	0.68	0.32	0
Rare proposal type	8210	0.04	0.41	0.68	0.04	0.14	0.71	0.29	0
Common proposal type	14427	0.06	0.18	0.62	0	0.12	0.98	0.02	0
Early meeting	8748	0.05	0.44	0.7	0.03	0.12	0.7	0.3	0
Late meeting	4972	0.05	0.24	0.63	0.02	0.1	0.85	0.15	0
Fewer analysts	4280	0.05	0.34	0.63	0.02	0.13	0.8	0.2	0
More analysts	4173	0.05	0.54	0.78	0.05	0.09	0.58	0.42	0

Figure OA.7: **Benefit-to-cost ratio vs. average ownership stake.** This figure depicts $v/(cn)$ divided by the holding size, that is, the ratio of market capitalization and n, as a function of holding size, for a sample of U.S. proposals between 2003–2020. We exclude estimations in which the benefit-to-cost ratio is lower than 1 (i.e., irrelevant proposals).

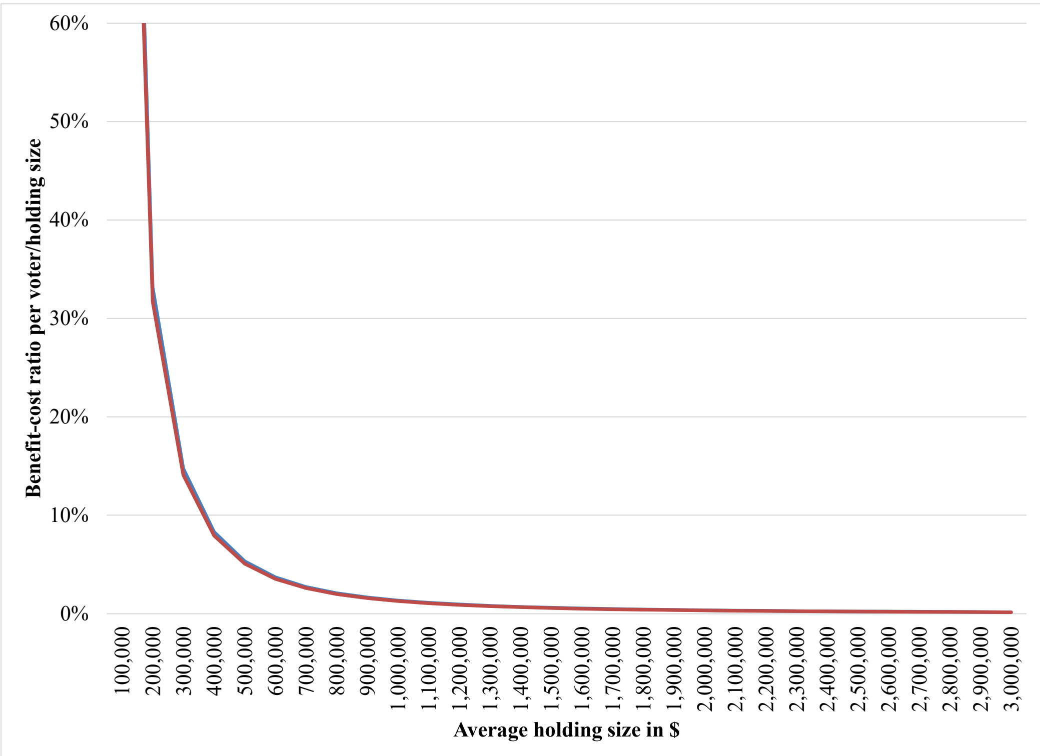
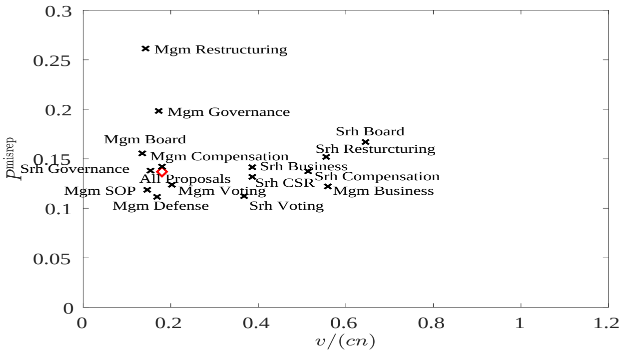
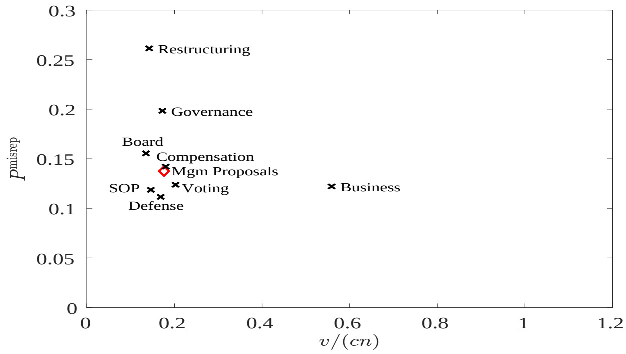


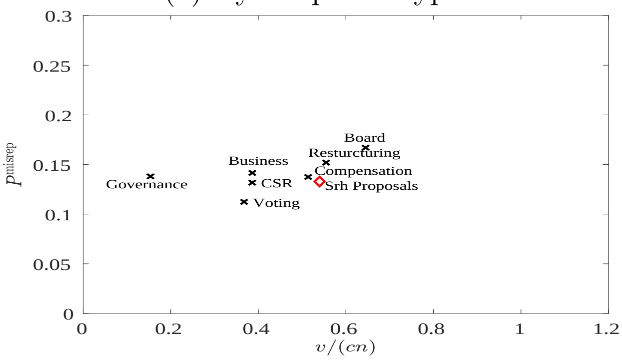
Figure OA.8: **Probability of misrepresentation $\mathbf{P^{misrep}}$ and benefit-cost ratios $\mathbf{v/(cn)}$.** These figures shows P^{misrep} as a function of $v/(cn)$, for a sample of U.S. proposals between 2003–2020 in Panels (a)-(f). In Panel (a)-(c), we report estimates by proposal type. In Panel (d)((e).(f),(g)), we sort the proposals in bins of q, γ, n, and year (industry. controversial industry, non-annual meeting) instead of proposal type for the estimation, and report the estimates by year (industry, controversial industry, non-annual meeting).



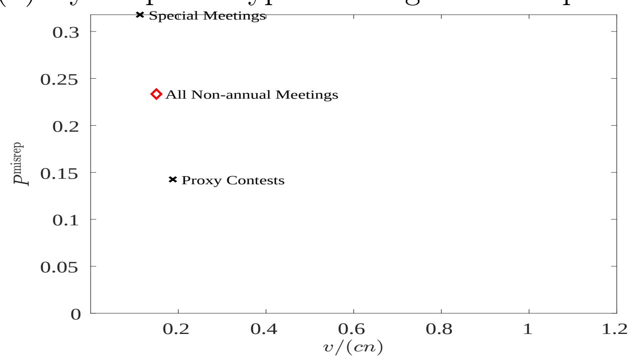
(a) By Proposal Type



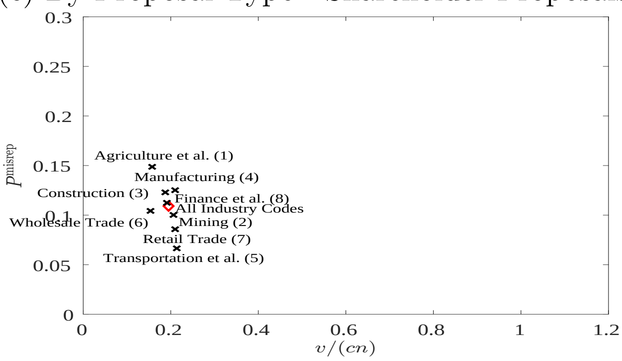
(b) By Proposal Type - Management Proposals



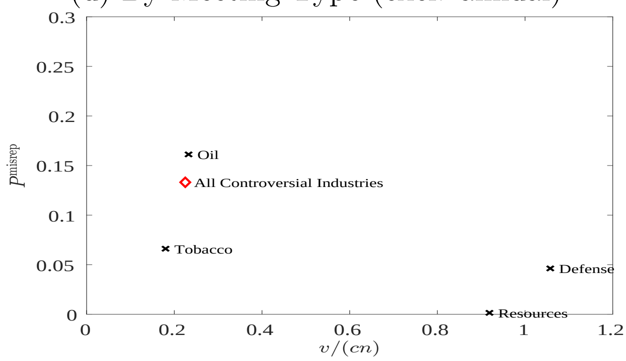
(c) By Proposal Type - Shareholder Proposals



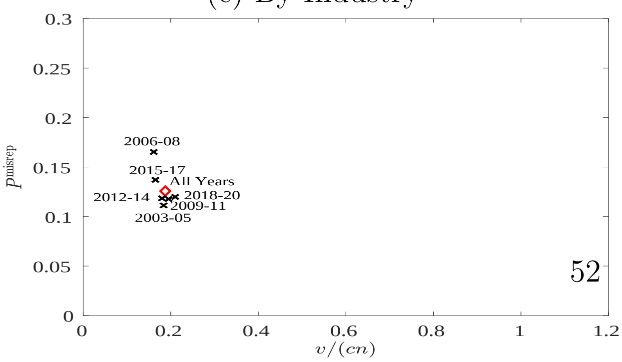
(d) By Meeting Type (excl. annual)



(e) By Industry

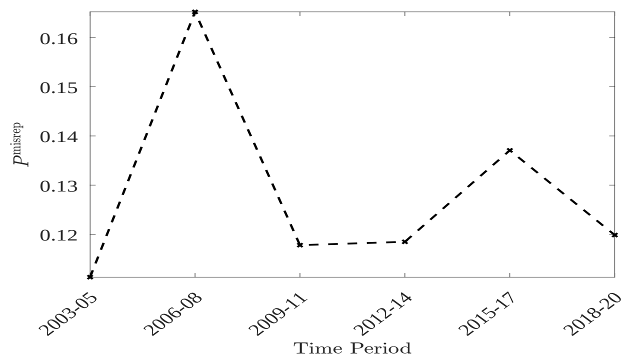


(f) By Controversial Industry

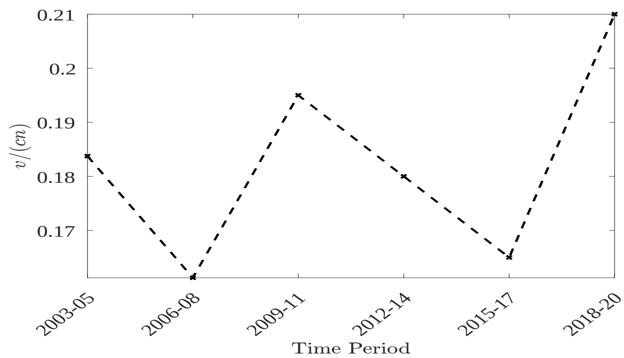


(g) By Period

Figure OA.9: **Trends in v/(cn) and $\mathbf{P^{misrep}}$.** These figures shows P^{misrep} (Panel (a)) and $v/(cn)$ (Panel (b)), for a sample of U.S. proposals between 2003–2020. We sort the proposals in bins of q, γ, n, and year instead of proposal type for the estimation, and report the estimates by year.

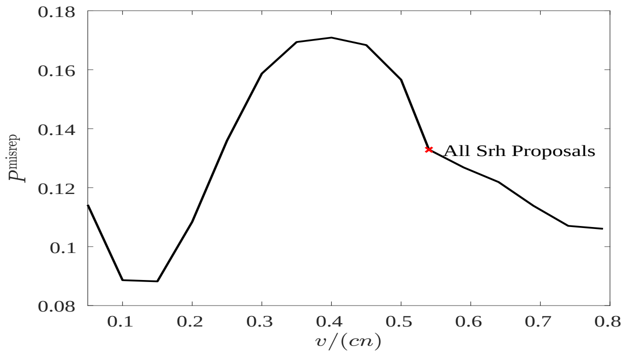


(a) Misrepresentation Probability

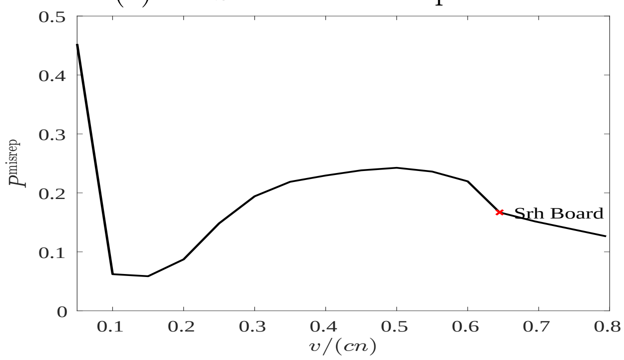


(b) Benefit-to-cost ratio per share

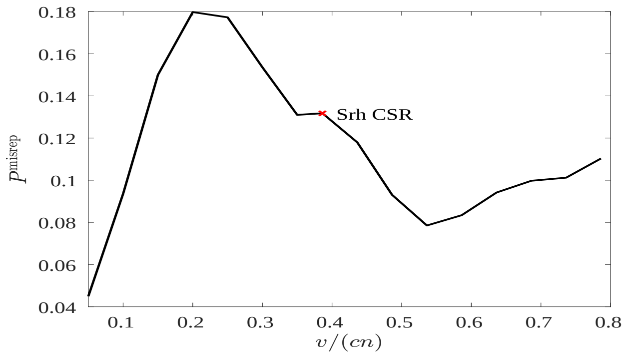
Figure OA.10: **Counterfactual probability of misrepresentation $\mathbf{P^{misrep}}$ and benefit-cost ratios $\mathbf{v/(cn)}$ by proposal type (shareholder proposals).** This figure shows the counterfactual P^{misrep} for the subsample given in the caption when we change $v/(cn)$ but hold all other parameters constant at the weighted sample median, for a sample of U.S. shareholder proposals 2003–2020.



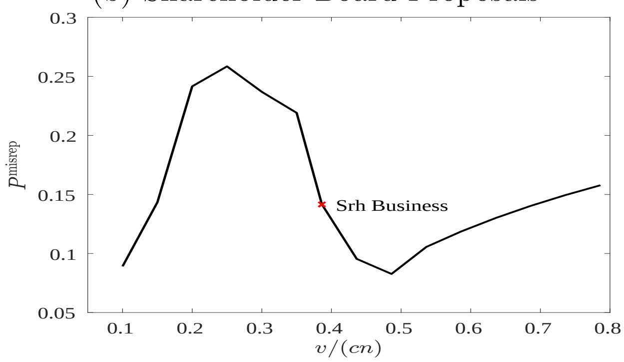
(a) All Shareholder Proposals



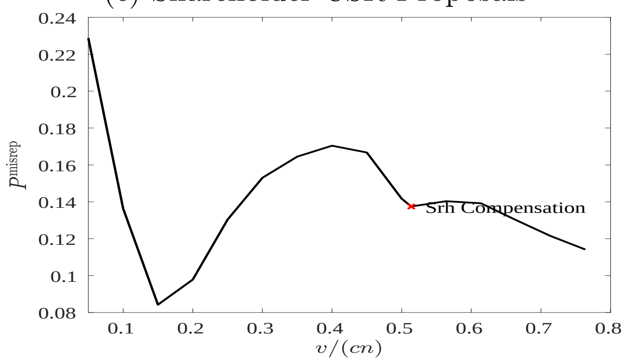
(b) Shareholder Board Proposals



(c) Shareholder CSR Proposals

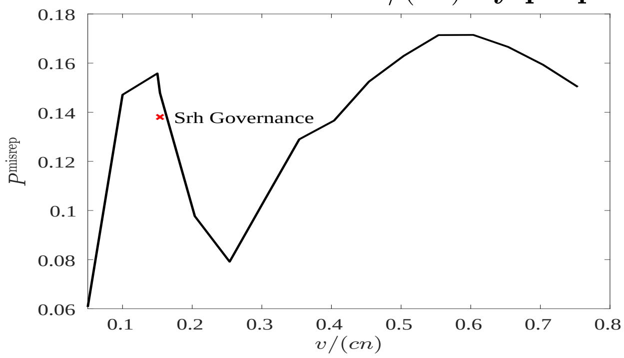


(d) Shareholder Business Proposals

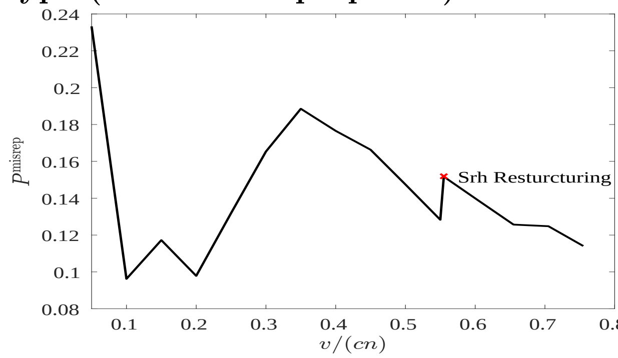


(e) Shareholder Compensation Proposals

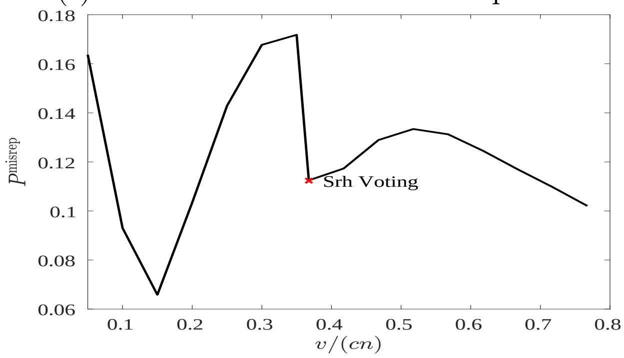
Counterfactual probability of misrepresentation P^{misrep} and benefit-cost ratios v/(cn) by proposal type (shareholder proposals) - continued



(f) Shareholder Governance Proposals

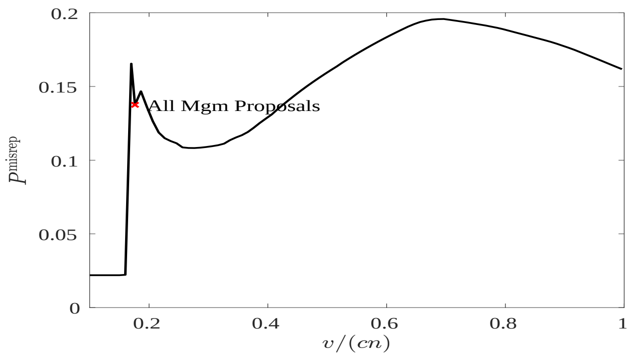


(g) Shareholder Restructuring Proposals

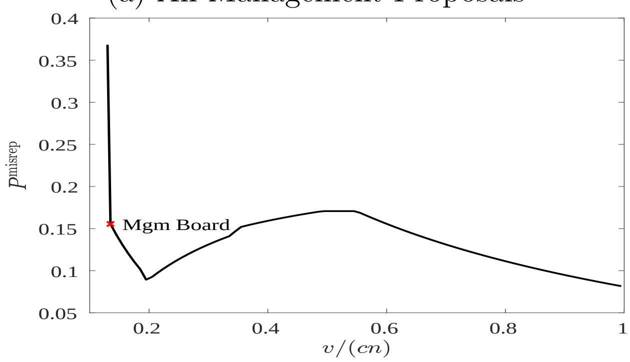


(h) Shareholder Voting Proposals

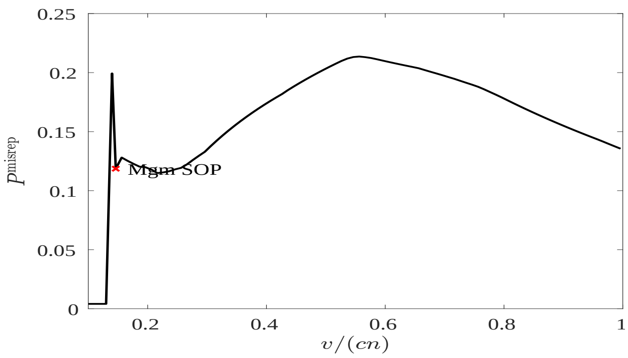
Figure OA.11: **Counterfactual probability of misrepresentation $\mathbf{P^{misrep}}$ and benefit-cost ratios $\mathbf{v/(cn)}$ by proposal type (management proposals).** This figure shows the counterfactual P^{misrep} for the subsample given in the caption when we change $v/(cn)$ but hold all other parameters constant at the weighted sample median, for a sample of U.S. management proposals 2003–2020.



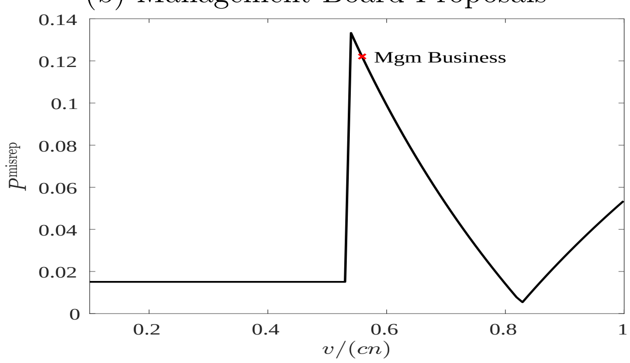
(a) All Management Proposals



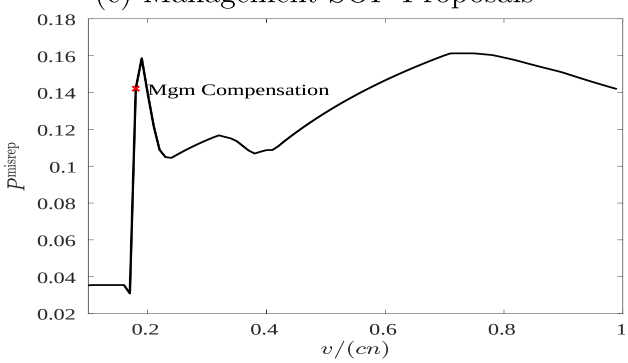
(b) Management Board Proposals



(c) Management SOP Proposals

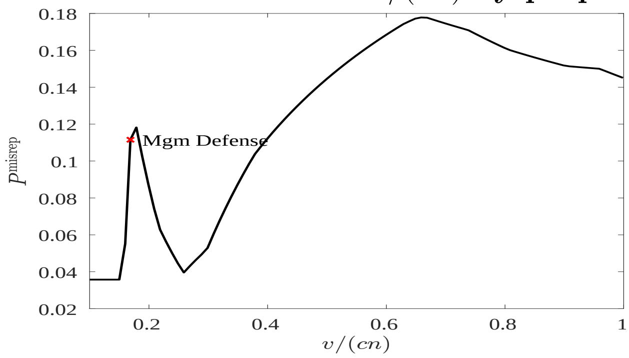


(d) Management Business Proposals

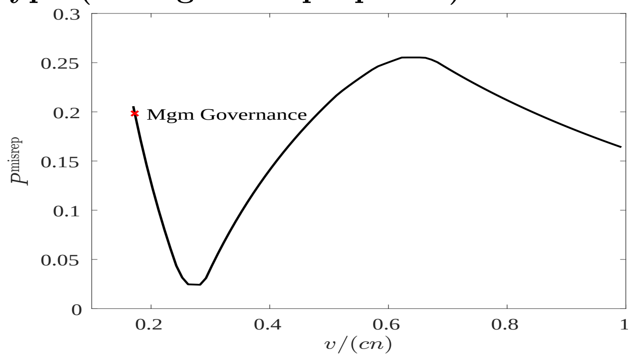


(e) Management Compensation Proposals

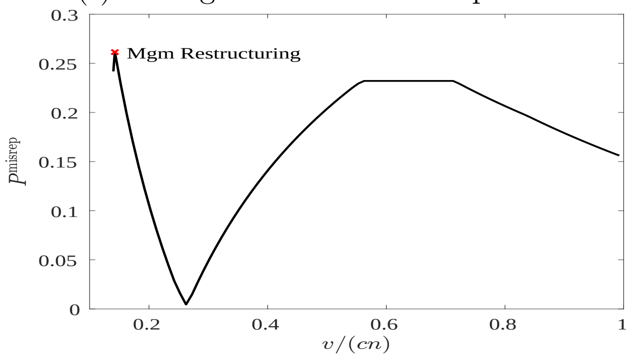
Counterfactual probability of misrepresentation P^{misrep}
and benefit-cost ratios v/(cn) by proposal type (management proposals) - continued



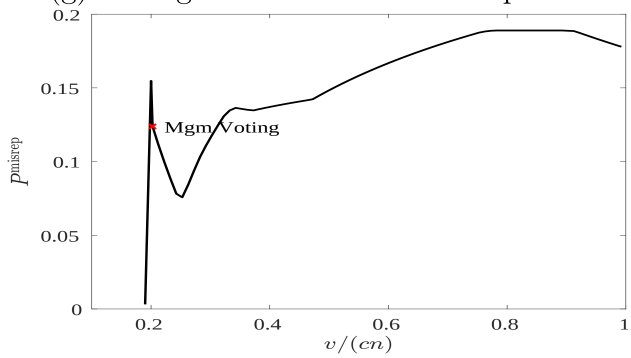
(f) Management Defense Proposals



(g) Management Governance Proposals

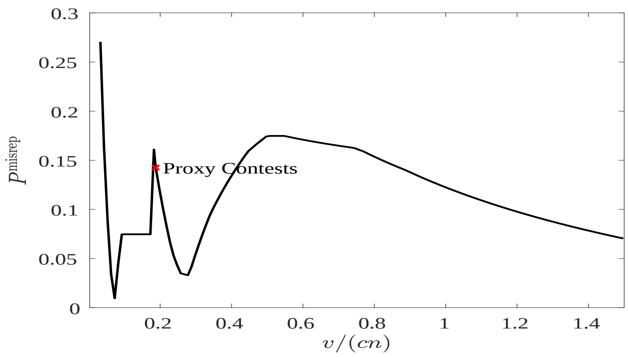


(h) Management Restructuring Proposals

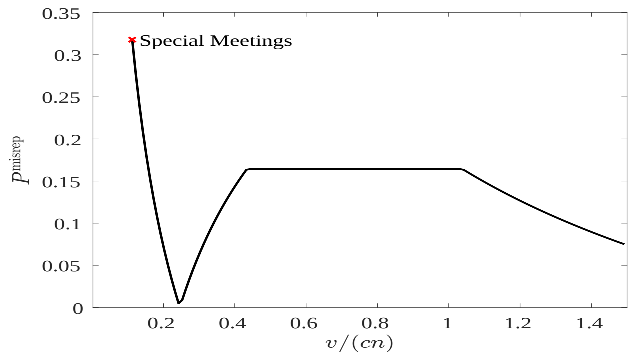


(i) Management Voting Proposals

Figure OA.12: **Counterfactual probability of misrepresentation $\mathbf{P^{misrep}}$ and benefit-cost ratios v/(cn) by non-annual meetings.** This figure shows the counterfactual P^{misrep} for the non-annual meeting given in the caption when we change $v/(cn)$ but hold all other parameters constant at the weighted sample median, for a sample of U.S. shareholder proposals 2003–2020. We sort the proposals in bins of q, γ, n, and non-annual meeting type instead of proposal type for the estimation.

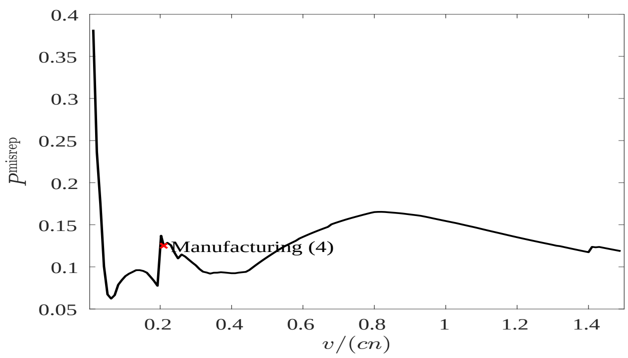


(a) Proxy Contests

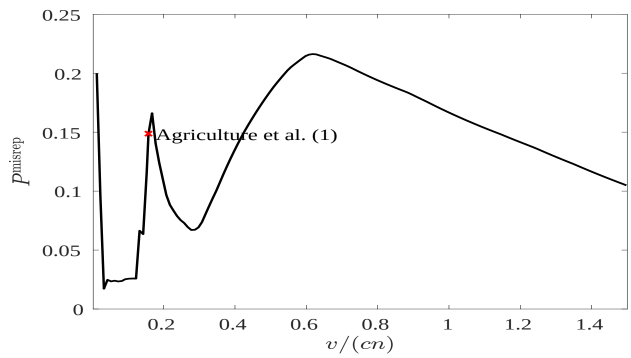


(b) Special Meetings

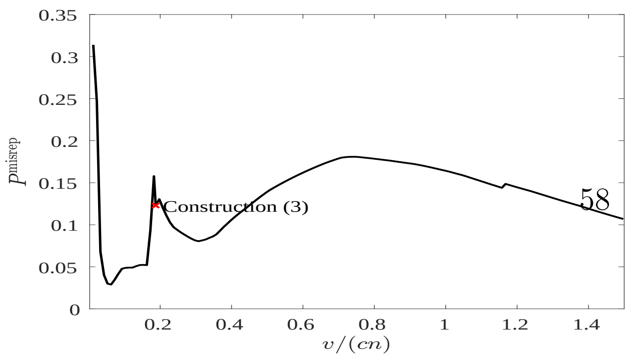
Figure OA.13: **Counterfactual probability of misrepresentation $\mathbf{P^{misrep}}$ and benefit-cost ratios v/(cn) by industry.** This figure shows the counterfactual P^{misrep} for the industry given in the caption when we change $v/(cn)$ but hold all other parameters constant at the weighted sample median, for a sample of U.S. shareholder proposals 2003–2020. We sort the proposals in bins of q, γ, n, and industry instead of proposal type for the estimation.



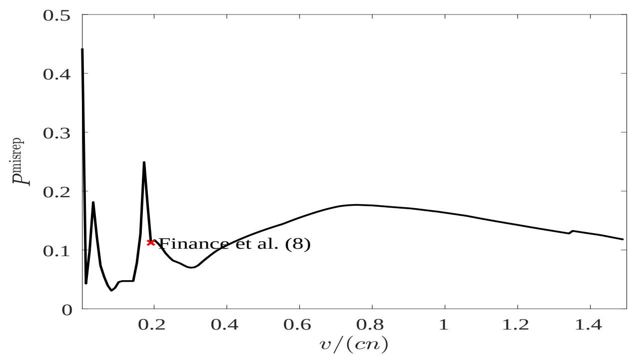
(a) Manufacturing



(b) Agriculture

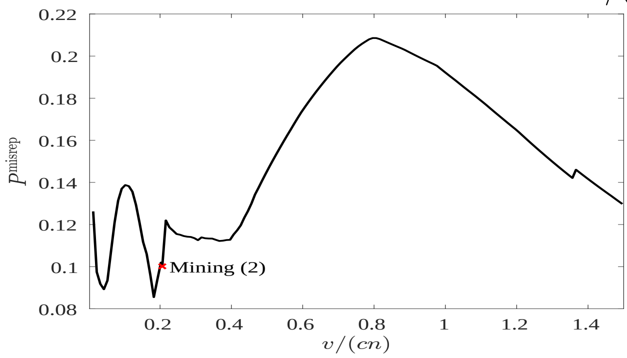


(c) Construction

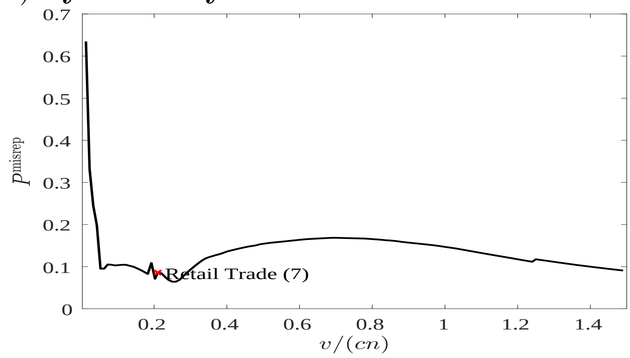


(d) Finance

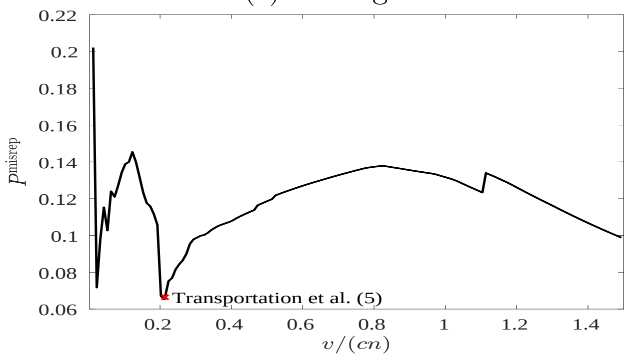
Counterfactual probability of misrepresentation $\mathbf{P^{misrep}}$ and benefit-cost ratios v/(cn) by industry - continued



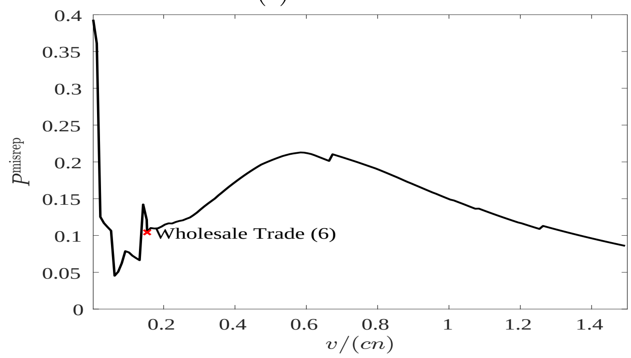
(e) Mining



(f) Retail

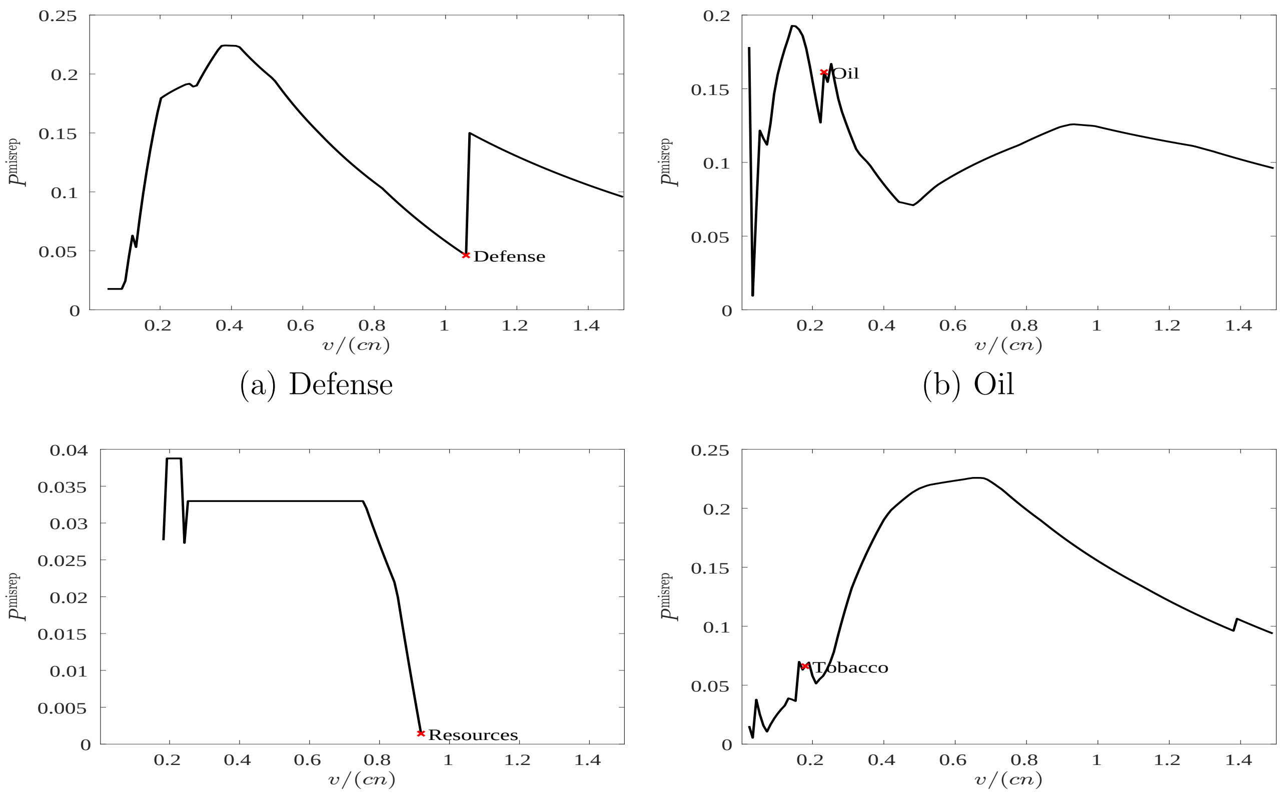


(g) Transportation



(h) Wholesale

Figure OA.14: **Counterfactual probability of misrepresentation $\mathbf{P^{misrep}}$ and benefit-cost ratios $\mathbf{v/(cn)}$ by controversial industry.** This figure shows the counterfactual P^{misrep} for the industry given in the caption when we change $v/(cn)$ but hold all other parameters constant at the weighted sample median, for a sample of U.S. shareholder proposals 2003–2020. We sort the proposals in bins of q, γ, n, and industry instead of proposal type for the estimation.



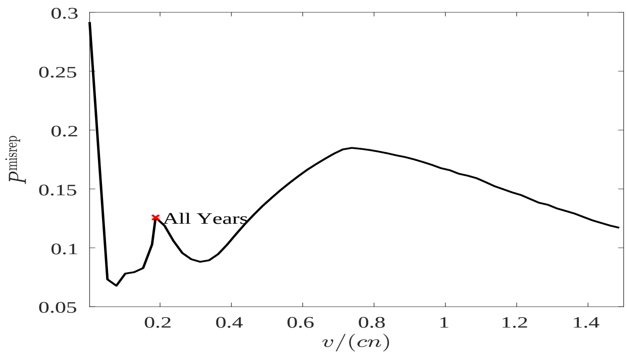
(a) Defense

(b) Oil

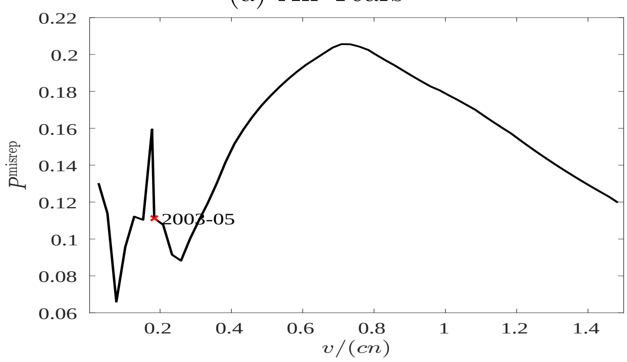
(c) Resources

(d) Tobacco

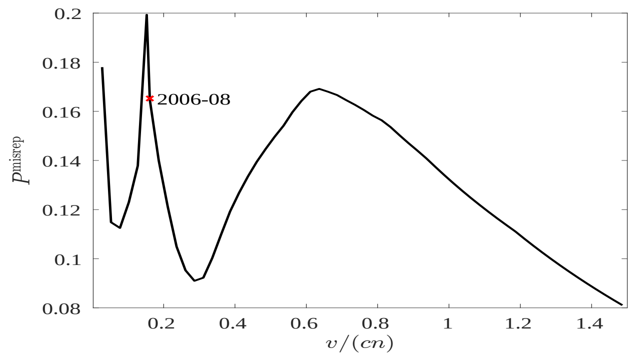
Figure OA.15: **Counterfactual probability of misrepresentation $\mathbf{P^{misrep}}$ and benefit-cost ratios $\mathbf{v/(cn)}$ by time period.** This figure shows the counterfactual P^{misrep} for the period given in the caption when we change $v/(cn)$ but hold all other parameters constant at the weighted sample median, for a sample of U.S. shareholder proposals 2003–2020. We sort the proposals in bins of q, γ, n, and time period instead of proposal type for the estimation.



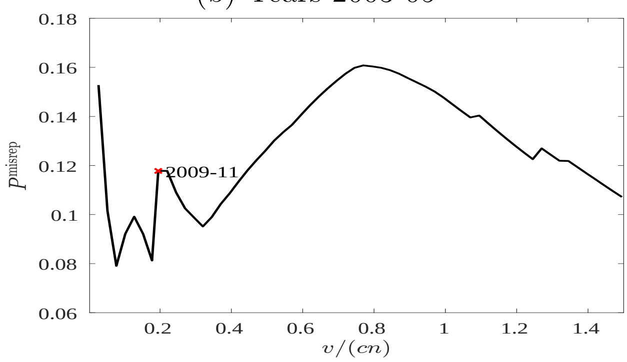
(a) All Years



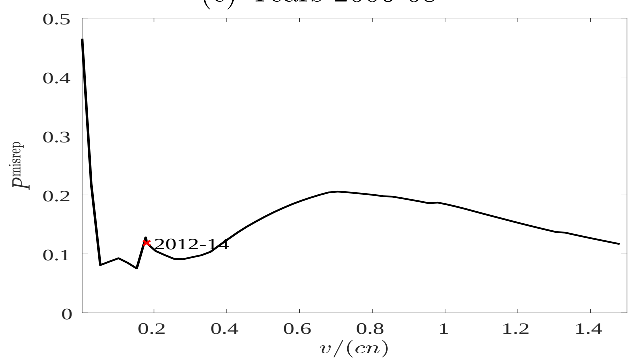
(b) Years 2003-05



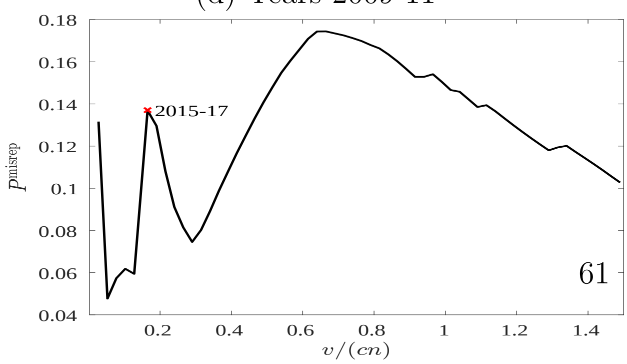
(c) Years 2006-08



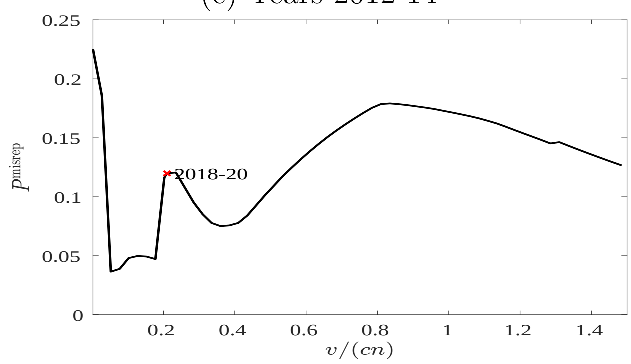
(d) Years 2009-11



(e) Years 2012-14



(f) Years 2015-17



(g) Years 2018-20

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