When two experts are better than one: The example of shareholder voting*

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Abstract

Introducing a single expert's advice before a vote can diminish its informational efficiency. We show that when two independent experts are involved, the opposite occurs: informational efficiency increases. We model expert advice, individual information acquisition, and voting in common-interest scenarios, using proxy advice and shareholder voting as the primary example. Adding a second expert enhances decision quality under two plausible assumptions: the first expert holds superior information compared to individual voters, and the second expert's advice is timely. When the second expert challenges the first's proposal, voters are prompted to conduct their own inquiries, resulting in better-informed decisions and reducing the likelihood of correlated errors. These findings hold implications for collective decision-making across various organizational settings.

Keywords: Collective decision-making, information acquisition, proxy advisors, strategic voting
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1 Introduction

In many contexts, members of a decision-making body have a common interest but no common information on how to pursue it. For instance, committee members at a university may all aim at integrating Artificial Intelligence into teaching, but are uncertain about the right AI policy; members of a parliament could be united in preventing a crisis but divided over the strategy that keeps it at bay; or institutional shareholders want to raise the share value but do not necessarily agree on the best measure. In such settings, a well-established method to come to a collective decision is simple majority voting. Theoretical support of this practice demonstrates that whenever no single expert is better informed than the entire collective body, simple majority voting outperforms delegation to an individual expert in terms of informational efficiency (De Caritat, 1785; Feddersen and Pesendorfer, 1996). Putting democratic values of participation aside, this seems to be the main rationale for the prevalence of simple majority voting in organizations and politics.

In a complex world where much is at stake, informed collective decisions are crucial. Yet, there is surprisingly little research on creating institutions that encourage members of a decision-making body to seek information before voting. Rather, the literature has concentrated on problems of efficient information aggregation through voting (e.g., Austen-Smith and Banks, 1996; Glaeser and Sunstein, 2009; Morton and Tyran, 2011; Levy and Razin, 2015; Buechel and Mechtenberg, 2019). Expert advice plays an important role: Kawamura and Vlaseros (2017) reveal both theoretically and in a laboratory experiment that expert information tends to reduce the incentive of committee members to use their own information, which results in more decisions unintentionally made against the common interest.

The rather small strand of literature on information acquisition before voting deals with group size (Bhattacharya, Duffy, and Kim, 2017), compulsory voting (Grosser and Seebauer, 2016), and behavioral norms (Mechtenberg and Tyran, 2019), but generally not with expert advice. In the context of shareholder voting Malenko and Malenko (2019) show that whenever a corporate board of directors does not provide informative proposals, the presence of a proxy advisor (i.e., an expert firm that advises institutional shareholders on how to vote) creates a disincentive for institutional shareholders to acquire own information, which leads to dependence on the quality of the proxy advice.

Hence, from both the literature on information aggregation and the literature on information acquisition, a common message emerges: Expert advice is detrimental, at least when it is not better than the aggregated information of the entire decision-making body would be if its members acquired own information.

This message of the extant literature is of great consequence in a complicated world that increasingly relies on expert advice in times of turmoil, e.g., during financial crises, pandemics, and geopolitical conflicts. Is listening to experts the wrong direction to go to inform democractic decisions? Are proxy advisors and publicly heard experts more harmful than helpful when it comes to voting?

This paper investigates the role of expert advice in common-interest voting with endogenous information acquisition. It ultimately arrives at a more optimistic conclusion. We argue that while listening to a single expert is indeed often detrimental, the solution is simple: add another expert, and listen to both. Intuitively, while listening to a single expert makes one follow their advice regardless of which own information one might have acquired, thus rendering the acquisition of own information obsolete, listening to two experts reveals the spots of controversy when experts disagree among themselves, thereby stimulating one's own research to form an opinion. Proving that this straightforward intuition holds generally, even when voters are strategic, is not trivial, necessitating a formal model.

We develop this argument in a simple theoretical framework of proxy advice, easily adaptable to committee voting in other applications. Consider institutional shareholders who vote on a variety of important issues, including director elections, executive compensation, and certain aspects of mergers and acquisitions. Proxy advisory firms (PAs in what follows) offer to recommend how to vote in shareholder meetings in exchange for a fee. In practice, these recommendations have significant influence on shareholder votes (see, for instance, Alexander et al., 2010; Choi, Fisch, and Kahan, 2010; Ertimur, Ferri, and Oesch, 2013; Iliev and Lowry, 2015; Larcker, McCall, and Ormazabal, 2013, 2015; Li, 2018; Malenko and Shen, 2016; McCahery, Sautner, and Starks, 2016; Matsusaka and Shu, 2021.) Hence, the regulation of PAs is highly contentious, as evidenced, for example, by frequent and substantial changes of rules applied by the U.S. Securities and Exchange Commission (SEC) within the last few years (most recently in July 2022, rescinding rules only adopted in 2020). A key point of contention is that PAs may crowd out shareholders' incentives to invest in own research, as pointed out by Malenko and Malenko (2019).

In this paper, we show that under two practical assumptions the presence of a PA actually leads to either more, or at least not fewer, shareholders investing in own research, thereby improving corporate decision quality. The basic intuition is that shareholders who otherwise, without a PA, "rubber-stamp" any board proposal, use the PA as a filter to identify controversial issues that deserve further investigation.

In our model, there are three types of agents: Shareholders, the firm's board of directors, and a PA. Shareholders and the board both care about firm value, whereas the PA cares for its profit. There is a proposal on an issue (e.g., a director election). The board and the PA receive a private imperfect and independently distributed signal about the correct decision, i.e., about which decision will increase firm value most. The board (which in this application is the first expert) recommends a decision based on its own signal. For brevity, we refer to this as the "board's proposal." Then, each shareholder individually decides whether to buy the PA's vote recommendation, i.e., the PA's signal, and whether to invest in own research, i.e., to obtain a private signal. Finally, shareholders vote, and the simple majority rule determines the outcome.

Two key assumptions set this model apart from the existing voting literature. First, we posit that the board is better-informed than any single shareholder alone. This assumption, "BIB" (for better-informed board), is in line with a long tradition of studies in corporate governance arguing that insiders (the board and management) have information about the company that may be superior to that of shareholders (Jensen and Meckling, 1976).

The second key assumption is "PAF" (proxy advice first): *after* receiving proxy advice, a shareholder can decide upon additional research about the issue at hand. This assumption is more likely to hold in regulatory settings that provide shareholders with sufficient time to conduct research. In other applications it is also plausible that single voters are informed worse than an expert (BIB) and that voters can decide upon investing in an own signal after listening to experts (PAF).

We solve our game-theoretic model for pure Perfect Bayesian Nash equilibria, mainly focusing on equilibria that are not Pareto-dominated by other equilibria.[1] We find that the

[1]Pareto-dominated equilibria are based on coordination failure.

presence of a PA increases the shareholders' incentives to invest in own research or leaves these incentives unchanged relative to the case without a PA.

The underlying intuition is as follows: Begin with the simplest firm, consisting only of one shareholder. Assume first there is no PA. Even if the shareholder has invested into own research and this signal is not in favor of the board's proposal, she is still better off to vote for the proposal since the board, by Assumption BIB, is better informed than the shareholder. Therefore, the shareholder would not invest into own research in the first place and prefers to always endorse the proposal.

This simple logic extends to equilibria involving many shareholders. Each shareholder only needs to consider the case in which her vote decides whether the proposal passes or not, i.e., where she is pivotal. If all shareholders vote based on their own information and a given shareholder is pivotal, this must mean that the positive and negative signals of other shareholders are equally frequent. In this situation, only her own information and the board's information are crucial, like in the single-shareholder scenario. Thus, shareholders lack the incentives to become informed.

This behavior is typically inefficient. Substituting the own research with the informativeness of the board's proposal is individually rational, but collectively harmful as it leads to correlated mistakes. This result holds as long as shareholders do not anticipate the board's proposal to be so conflicted as to be less informative than even a single shareholder's own research and, thus, close to uninformative, a model variation that we discuss in Section 5.

Compared to this benchmark, the presence of a PA -- i.e., a second expert -- leads to higher decision quality in our model. Intuitively, for a shareholder it pays off to invest in own research when there is sufficient controversy about whether the proposal should be accepted. When the PA's signal coincides with the board's signal, then there is not and hence a shareholder prefers to simply accept the uncontroversial issue. By contrast, when the PA's signal contradicts the board's, there is sufficient controversy about the issue. Hence, for a shareholder it pays off to invest in an own signal in that situation.

Thus, a PA not only contributes an additional signal into the decision-making process, but also triggers shareholders to conditionally generate their own signals. This effect is strongest when the board and the PA are similarly well informed such that their contradicting signals indicate strong controversy.

After showing our results for symmetric equilibria, we extend the analysis to asymmetric equilibria. Asymmetric equilibria permit shareholders to specialize on different strategies, even though they are ex ante identical.[2] It turns out that the crucial strategy of conditionally investing in research is also pervasive in asymmetric equilibria and is, in fact, used in a much larger area of the parameter space. In addition there are, depending on the parameters, shareholders who always invest in an own signal without subscribing to the PA, shareholders who rubber-stamp the board's proposals or shareholders who "robo-vote," i.e., always vote according to the PA's recommendations. With asymmetric equilibria, too, PAs improve collective decision-making. More generally framed, a second expert incentivizes some voters to obtain an own signal, which improves the collective decision.

As another application, consider the example mentioned in the introductory paragraph, a university committee tasked deciding on new policies related to teaching (for example, a policy on how to deal with new developments in Artificial Intelligence). Given a first proposal

[2]Of course, another reason for shareholders to behave heterogeneously in practice is that they differ ex ante. Studies featuring shareholder heterogeneity include Levit, Malenko, and Maug (2021) and Levit, Malenko, and Maug (2022).

that is based on some information, the committee members may be inclined to simply agree. (We leave aside a perhaps also typical feature of life at universities, namely, strong opinions that are unrelated to efficiency considerations.) However, if a report is introduced that contradicts the first proposal, committee members are more likely to engage in this issue, leading to better decisions.

Our paper contributes to the literature on strategic voting in a common interest setting, which started with Austen-Smith and Banks (1996) and Feddersen and Pesendorfer (1996, 1997, 1998).[3] Informational inefficiencies of voting occur when symmetry assumptions of the standard Condorcet model are violated, either with regard to the signal technology (Austen-Smith and Banks, 1996) or with regard to the information-transmission process (Gerardi and Yariv, 2007; Iaryczower, Shi, and Shum, 2018; Buechel and Mechtenberg, 2019). Inefficiencies are also generated when private information becomes costly (Persico, 2004; Gershkov and Szentes, 2009), or when public information is provided that is not of sufficiently high quality (Kawamura and Vlaseros, 2017; Jeong, 2019; Liu, 2019; Malenko and Malenko, 2019). Generally speaking, inefficiencies can be generated by correlation of private beliefs across voters, either through public information or through information-transmission processes between voters that are not optimally tailored to the signal (quality) distribution.[4]

A related strand is the literature on voting in corporations. Seminal works in this literature, elucidating specifically the role of strategic voting, include Maug (1999), Maug and Yilmaz (2002), and Maug and Rydqvist (2009). Other work on (strategic) voting in the corporate finance context includes Matvos and Ostrovsky (2006), Brav and Mathews (2011), Levit and

[3]For studies of informational efficiency in games with strategic complements and strategic substitutes, see Angeletos and Pavan (2007) and Hellwig and Veldkamp (2009).

[4]Accordingly, Levy and Razin (2015) show that correlation neglect can enhance informational efficiency.

Malenko (2011), Van Wesep (2014), Bar-Isaac and Shapiro (2020), Ma and Xiong (2021), Meirowitz and Pi (2022), and Parlasca and Voss (2023), among others.

We contribute to the literature by theoretically showing that it makes a fundamental difference whether only one or two independent experts offer advice to voters: In the first case, expert advice is often detrimental since it leads to correlated mistakes; in the second case, expert advice can be helpful since it leads to targeted private information acquisition -- and aggregation -- when facing contentious issues.

The paper proceeds as follows. Section 2 sets up the model. Section 3 provides the main results, which are then illustrated in Section 4. Section 5 shows robustness of the results, in particular with respect to asymmetric equilibria. Section 6 briefly discusses potential other applications of our model.[5]

2 Model Setup

2.1 Basic Ingredients

To fix ideas, we develop the model in the context of voting on corporate decisions. Thus, we follow frameworks such as Malenko and Malenko (2019), Bar-Isaac and Shapiro (2020), and Ma and Xiong (2021).

A firm is owned by $N > 1$ shareholders, where N is odd. The firm faces uncertainty with respect to a binary decision. Examples vary by jurisdiction and include but are not restricted to director elections, dividends, shareholder proposals, compensation-related matters, etc.

[5] All propositions of the main text are proven in Appendix A in this document. Some further arguments used in the discussion in the main text are formally shown in the Supplementary Online Material (SOM), which is available here: https://bit.ly/twoexperts-SOM.

Making the ex post correct decision will increase firm value by an amount normalized to 1, while the wrong decision leaves it unchanged.

More formally, there are two states of the world $\theta \in \{A, B\}$ with equal prior probability. Slightly abusing notation, we assume that the firm has to decide on a binary issue $\{A, B\}$ that yields value 1 if and only if the decision matches the true state.

The board of directors receives a binary signal s_B regarding the issue to be voted on. The signal takes on values a or b. The signal quality is $q_B \in (\frac{1}{2}, 1)$, i.e., $Pr[s_B = a|\theta = A] = Pr[s_B = b|\theta = B] = q_B$. Again slightly abusing notation, we assume that the board then recommends either action A or B.[6] We call this the "board's proposal."

A profit-maximizing proxy advisor (PA) offers advice to shareholders at fee $f > 0$. The PA receives a signal about the true state as well. The quality of that signal is $q_P \in (\frac{1}{2}, 1)$. The PA provides a vote recommendation *for* or *against* the board's proposal to subscribing shareholders.

Shareholders decide whether to subscribe to the PA's offer. If a shareholder subscribes, she receives the PA's recommendation.[7] A shareholder *then* decides whether to invest $c > 0$ in own research about the issue at hand. If a shareholder expends own research costs, this leads to a private signal of quality $q_S \in (\frac{1}{2}, 1)$. When the shareholder meeting is held, each shareholder votes *yes* or *no*. Abstentions are excluded.[8] For simplicity, each shareholder holds one share of the firm and each share provides one vote. The decision that receives a majority of votes is implemented. Conditional on state θ, all signals are independent, and

[6] This choice of notation choice becomes lucid when we will focus on the case that the board has received signal b and recommends action B.

[7] Hence, the PA sells information directly in the sense of Admati and Pfleiderer (1990).

[8] In practice, shareholders may also abstain. However, according to most institutional settings abstentions are counted (either as *yes* or *no*) and hence shareholders' voting action is essentially binary.

precision levels q_B, q_P, and q_S are common knowledge.

Our first leading assumption is that the board knows better than any single shareholder what is good for the company.

Assumption 1 (BIB)**.** *The board is at least as well informed as a single shareholder, i.e.,*

$$q_S \leq q_B.$$

"BIB" stands for better-informed board. For the quality of the PA q_P we do not make an assumption that restricts it to be above or below the other agents' qualities.

In the course of the analysis it will come in handy to transform signal qualities $q \in (0.5, 1)$ into log-odds $\log(\frac{q}{1-q}) \in (0, \infty)$. We denote the log-odds of the board being correct as $\ell_B := \log(\frac{q_B}{1-q_B})$ and likewise $\ell_S := \log(\frac{q_S}{1-q_S})$ for the shareholders and $\ell_P := \log(\frac{q_P}{1-q_P})$ for the PA. Then Assumption BIB reads $\ell_S \leq \ell_B$.[9] This notation is convenient since it allows us to aggregate signal qualities by summation. To see this, consider the board's signal b and assume, for instance, that both the PA and one shareholder have received signals a and that there is no further information. Then, the board's signal is rather correct than not if and only if $q_B(1-q_P)(1-q_S) \geq (1-q_B)q_P q_S$, which is equivalent to $\ell_B \geq \ell_P + \ell_S$.

Our second leading assumption is that shareholders can condition their research investment on the PA's recommendation.

Assumption 2 (PAF)**.** *Subscribing shareholders decide upon own research investment* after *they have received the PA's recommendation.*

[9]Nitzan and Paroush (1982) show that among voters with idiosyncratic signal precision the optimal voting weights would be according to these log-odds.

"PAF" stands for "proxy advice first". Shareholders may conduct a bulk of their general research about a company independent of the proxy advice and also before receiving the PA's recommendation. Our assumption PAF is that the information relevant for deciding on a specific issue can be conditioned on the PA's recommendation.[10]

2.2 Simplification and Timeline

It turns out that we can substantially simplify the exposition without losing substance of the analysis by fixing the signal and behavior of the board and the behavior of the PA. The board receives a signal and then makes a recommendation. We let the board's signal be always b (for board).[11] We fix the board's behavior by assuming it makes the proposal according to its signal, i.e., it has received signal b and now proposes action B.[12] Likewise, we fix the PA's behavior to set fee $f > 0$ and recommend according to its signal, i.e., it recommends *for* if it has received signal b (for board) and it recommends *against* if it has received signal a (against board).

These simplifications do not affect the substance of our analysis and results. Since the board, like the shareholders, aims at maximizing firm value, revealing its signal to help shareholders decide for the optimal policy is in its own interest. The proxy advisor, in turn, can generate profits only from helping individual shareholders to make a decision that is even more informed than it would be without the PA. The reason is that the shareholders'

[10]Relaxing this assumption would change the timing of our model such that shareholders have to decide simultaneously about subscribing to the PA and about investing in own research. That is the assumption in Malenko and Malenko (2019). We discuss the consequences of making this assumption in our model in Section 5.3 and provide the corresponding results in Supplementary Online Material (SOM) Section 1.3.

[11]This will exclude strategies that depend on the label of the alternative, such as always voting *yes* for alternative A and *no* for alternative B independent of which alternative the board has proposed.

[12]In Section 5.4, we discuss to which extent, and with which implications, a re-interpretation of our model covers conflicts of interest between board and shareholders.

willingness to pay for proxy advice depends only on the PA's contribution to the informedness of the vote.[13] Hence, the optimal strategy of the PA is to reveal its true signal whenever asked to do so, and to set the fee f equal to the shareholder's willingness to pay for this revelation. If the willingness to pay is negative, the PA will be driven out of the market. In our setting, the PA stimulates rather than crowds out own research for any given fee that allows the PA to be in the market. Thus, the PA's profit maximization does not conflict with efficiency. Hence, explicitly including a strategic PA and an endogenous fee does not add any interesting results in our setting. These insights are captured by our simplifying assumptions, to focus the analysis on the main implications of the model.

The timeline, which is illustrated by Figure 1, summarizes the simplified setup. At $t = 0$ nature draws a state of the world and signals for all potential recipients of signals. At $t = 1$ each shareholder decides whether to pay the fee for the PA's report. Those who pay the fee receive the truthful vote recommendation which is equivalent to learning the PA's signal. At $t = 2$ each shareholder decides whether to invest costs c to receive an own independently and identically distributed signal of quality q_S. At $t = 3$ shareholders vote. At $t = 4$ the proposal passes if a majority approves it and payoffs are realized.

2.3 Strategies

The most important strategic aspects concern the shareholders. They have several strategies both on the information acquisition stages ($t = 1$ and $t = 2$, respectively) and on the voting stage ($t = 3$). On the information acquisition stages, there are six strategies: A

[13] In Malenko, Malenko, and Spatt (2021), the PA biases a costless public recommendation to enhance shareholders' perceived pivotality since their willingness to pay for the PA's costly signal increases in pivotality. Heterogeneity in voters, which allows these manipulations to be effective, is created by subjective values.

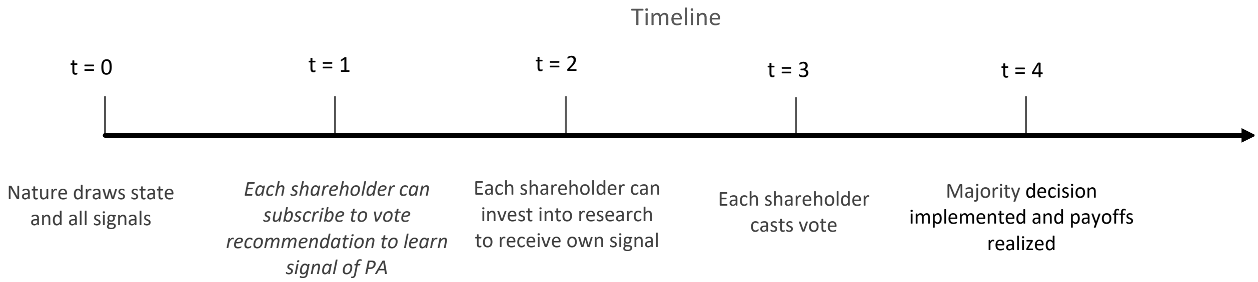

Figure 1: Timeline. For simplicity, the board's and PA's behavior is fixed. In particular, the PA's recommendation strategy is fixed to be truthful such that subscribing shareholders learn the PA's signal. (Actions in italics only apply if there is a PA.)

shareholder who does not subscribe may invest in own research (NotSubscribe-Invest) or not (NotSubscribe-NotInvest); a shareholder who does subscribe may unconditionally invest in research (Subscribe-Invest) or not (Subscribe-NotInvest) or, else, may invest in research only if the recommendation is *for* (Subscribe-InvestIFFfor) or only if the recommendation is *against* (Subscribe-InvestIFF$against$).

In the voting stage, any shareholder chooses *yes* or *no*. The set of voting strategies depends on the acquired information which may include the PA's signal and the own signal. For instance, for a shareholder who acquired both kinds of information (e.g., with Subscribe-Invest), a voting strategy is a mapping $v_i : \{for, against\} \times \{a, b\} \to \{yes, no\}$. Slightly abusing notation, we write σ_i for the information acquisition *and* voting strategy of a shareholder i, and we use $\sigma = (\sigma_1, ..., \sigma_N)$ to denote a strategy profile of shareholders.

We study Perfect Bayesian Nash equilibria, i.e., players best respond to their beliefs and update their beliefs according to Bayes' rule wherever possible. We focus on pure strategies, but analyze both symmetric and asymmetric strategy profiles. Mixed equilibria are often interpreted as pure-strategy equilibria of different players, that is, players do not literally randomize between the strategies, but the probability weight on each pure strategy rather represents the fraction of the population that plays it. Hence, they are similar to asymmetric equilibria in pure strategies, which capture heterogeneous behavior of shareholders more directly. Therefore, we do not additionally treat mixed equilibria. When there are multiple equilibria in some area, we exclude those that are Pareto-dominated by other equilibria. This eliminates equilibria that are due to miscoordination.

To analyze the model we take the perspective of a regulator who compares a market with a PA, as in the game defined above, with a market in which no PA is admitted. The regulator maximizes welfare which coincides with maximizing decision quality in our setup. We will assume that costs of information acquisition, be it fee f or costs c, are relatively small compared to benefits on decision quality. Hence, when shareholders have to trade off costs of information acquisition with benefits of higher firm value, we will assume that the latter dominates. When there are two strategies with the same decision quality, then shareholders strictly prefer the one with lower costs, as we assume that costs are strictly positive. The quality of corporate decisions is measured by $\Pi(\sigma)$, the ex ante probability that the decision will match the true state.[14] In what follows, all proofs are relegated to Appendix A.

3 Main Results

Benchmark: One Expert. Consider first the benchmark situation where there is only one expert, in this case, the board. That is, no PA is admitted. Thus, posit that in the timeline of Figure 1 actions at $t = 1$ are suppressed. Then a shareholder's information

[14] This is also called *informational efficiency*, which can be distinguished from *economic efficiency* (see, e.g., Buechel and Mechtenberg, 2019). Economic efficiency means welfare, which here can be defined as $\Pi(\sigma)$ net of the investment costs in own research since the prices paid to the PA are transfers. When investment costs c become arbitrarily small, the two concepts coincide.

acquisition decision reduces to whether to acquire an own signal or not in $t = 2$. Suppose for a moment that all shareholders do acquire such a signal and vote according to it. We call this strategy profile *UNIS*, for "UNconditional Investment in own Signal," where the term "unconditional" will be justified later, when shareholders could potentially condition their investment in own research on the PA's vote recommendation.[15] In this strategy profile the decision quality amounts to $\Pi(\sigma^{UNIS}) = \pi(N)$, where $\pi(N) := \sum_{i=\frac{N+1}{2}}^{N} \binom{N}{i} q_S^i (1-q_S)^{N-i}$ is the probability that a majority decision of N shareholders is correct.

While the decision quality of such voting behavior is usually very high (De Caritat, 1785), it is unfortunately not an equilibrium under Assumption BIB. The intuition is straightforward once spelled out. A single shareholder i can improve by deviating to not acquire a signal and vote *yes*. When this shareholder i is pivotal, the signals of all $N-1$ other shareholders are split: there are as many a-signals as there are b-signals among them. Now, even if i's signal points against the board's proposal, Assumption BIB, i.e., the assumption that the board is at least as well informed as i, makes it beneficial to vote *yes*, i.e., for the board's proposal, and not to acquire own information in the first place. We call this latter strategy and its corresponding strategy profile "*Rubber-stamping*".[16]

Proposition 1 (SYM without PA)**.** *Suppose no PA is admitted. If Assumption BIB holds, then there does not exist a symmetric equilibrium in which shareholders invest in own research. Hence, decision quality in symmetric equilibria is bounded by:* $\Pi(\sigma) \leq q_B$. *The*

[15]For simplicity, we use the same labels for strategies as for the symmetric strategy profiles composed of these strategies, e.g., we speak of UNIS both to denote the strategy to invest in an own signal and to vote according to it and to denote the strategy profile in which all shareholders do so. The precise meaning of these labels will be obvious from the context.

[16]Assumption BIB, $q_S \leq q_B$, is in fact necessary and sufficient for Proposition 1. Since we have Assumption BIB as a leading assumption, we only show sufficiency in the proof of Proposition 1.

Pareto-efficient[17] *symmetric equilibrium is Rubber-stamping and leads to decision quality* $\Pi(\sigma^{Rubber}) = q_B$.

Proposition 1 shows that without a PA the quality of decision making is bounded by the quality of the board whose proposal is rubber-stamped by the shareholders. This result is similar to the substitution effect of Malenko and Malenko (2019), but occurs on a different level: For the scenario that the board's proposals are uninformative, Malenko and Malenko (2019) obtain over-reliance of shareholders on the PA's recommendations; for the scenario that the board's proposals are informative, we obtain over-reliance on this proposal without any PA, as a new benchmark.[18]

Admitting a Second Expert. The presence of a second expert, which in this application is a proxy advisor, substantially increases a shareholder's set of information-acquisition strategies. One of them, Subscribe-InvestIFF*against*, gives rise to the following symmetric strategy profile, which we denote by $\hat{\sigma}$ and call "*CAIS* (Conditional on Advice Invest in Signal):" All shareholders subscribe to proxy advice; if the recommendation is *for*, they vote *yes*; if the recommendation is *against*, they invest in own research and vote according to their own signal, i.e., vote *yes* if the signal is b and *no* if it is a.

In this strategy profile shareholders use the PA's recommendation as a filter: *for* recommendations are followed without being challenged; *against* recommendations trigger further

[17] Recall that the criterion of Pareto-efficiency is applied within the set of symmetric equilibria. Within the set of all strategy profiles, there might well be strategies that Pareto-dominate the Pareto-efficient symmetric equilibrium.

[18] The result that no shareholder invests in own research is stylized. When studying asymmetric equilibria without PA, we find the same message in a less stylized form: Without PA, there always exist shareholders who do not invest in own research, while the number of shareholders who do is bounded. For symmetric mixed-strategy equilibria, similar results to our analysis of asymmetric pure-strategy equilibria, as discussed in Section 5.1, are expected.

investigation of the issue. CAIS is illustrated in Table 1.

		Own Signal	
		b (for board)	a (against board)
PA's recommendation	for	yes	
	$against$	yes	no

Table 1: Strategy CAIS: Invest in research if and only if vote recommendation is *against*; and after for recommendation vote *yes*, after *against* recommendation vote *yes* if and only if signal is for board.

It turns out that based on this strategy profile the negative result of Proposition 1 can be mitigated by the presence of a PA, as Proposition 2 shows.

Proposition 2 (SYM with PA)**.** *Let Assumptions BIB and PAF hold. Let costs c be arbitrarily small and let fee f be sufficiently smaller. Suppose there is a PA with $\ell_P \in (\ell_B - \ell_S, \ell_B + \ell_S)$. Then there exists a symmetric equilibrium in which shareholders conditionally invest in own research. The Pareto-efficient equilibrium is CAIS and leads to decision quality $\Pi(\hat{\sigma}) > q_B$. Otherwise (i.e., if $\ell_P \notin (\ell_B - \ell_S, \ell_B + \ell_S)$), the Pareto-efficient equilibrium is Rubber-stamping with $\Pi(\sigma^{Rubber}) = q_B$.*

In the proof of Proposition 2 (Appendix A.1) we proceed as in the proof of Proposition 1 (Appendix A.2), by providing first the full characterization of all equilibria as a lemma and then selecting those that are not Pareto-dominated. Comparing Proposition 2 with Proposition 1, we conclude that the presence of a PA either strictly improves decision quality or leaves it unchanged, compared to the setting without a PA. The condition for the strict improvement can be rewritten as $|\ell_B - \ell_P| < \ell_S$, which has the following interpretation: the difference in quality of board and PA is smaller than the information quality of one shareholder. If this conditions is satisfied, there is no equilibrium with information acquisition without a PA, while we have a new equilibrium (CAIS) with a PA in which all shareholders conditionally invest in own research.

The first intuition for the conditions of the PA being beneficial as stated in Proposition 2 can be seen from their violations. Consider the symmetric strategy profile CAIS. If $\ell_P \leq \ell_B - \ell_S$, we have $\ell_S + \ell_P \leq \ell_B$, i.e., the board is better informed than the PA and one shareholder together. Then there is a deviation from CAIS to Rubber-stamping. Intuitively, the board is sufficiently well informed that it does not individually pay off to acquire any information, even if it were costless. If $\ell_P \geq \ell_B + \ell_S$, i.e., the PA is better informed than the board and one shareholder together, then there is a deviation from CAIS to not investing and to voting against the board's proposal. Indeed, the deviating shareholder's vote is only pivotal if board and PA disagree and voting *no* improves decision quality, given that the PA is so well informed. If costs c or f are not small enough, there is again a beneficial deviation, e.g., to Rubber-stamping, which saves costs. Finally, if the PA's fee f is not sufficiently smaller than the costs c, then deviating to UNIS saves costs without affecting the outcome.[19]

In Section 1 of the Supplementary Online Material (SOM), we extend the analysis to the complete characterization of all symmetric equilibria in pure strategies, with and without Assumptions BIB and PAF. Most importantly, that analysis shows that the two key assumptions Assumption BIB and PAF are not only sufficient but also necessary for the conclusion, as we will discuss below.

[19]The assumption c small enough assures that shareholders who can improve decision quality by investing in own research would not shy away due to the high costs. The assumption that the costs are larger than zero matters when deviations that do not affect decision quality are considered. The assumption that fees f are sufficiently smaller than c means that the results answer the question whether there is a fee f such that a PA can profitably be active in the market.

4 Illustration and Discussion

Numerical Example. To get a better understanding of Propositions 1 and 2, consider Example 1.

Example 1 (Symmetric Equilibria)**.** *Let* $q_B = 0.75$*,* $q_P = 0.7$*, and* $q_S = 0.6$*. Then* $\ell_B = 0.477$*,* $\ell_P = 0.368$*, and* $\ell_S = 0.176$ *such that the condition* $\ell_P \in (\ell_B - \ell_S, \ell_B + \ell_S)$ *of Proposition 2 is satisfied, as* $0.368 \in (0.477 - 0.176, 0.477 + 0.176)$*. Table 2 illustrates the implications of Propositions 1 and 2 for decision quality. First, not admitting a PA leads to Rubber-stamping and hence to a decision quality of* $q_B = 0.75$*, independent of the number of shareholders* N *(Proposition 1). Second, when a PA is admitted, CAIS is the Pareto-efficient symmetric equilibrium, which delivers a strictly higher decision quality (by Proposition 2). Its decision quality is further increasing in the number of shareholders* N *and approaching* $0.925 < 1$ *for large* N*. Finally, Table 2 shows the hypothetical case in which all shareholders play UNIS, i.e., invest in own research. This is not an equilibrium but a classic benchmark capturing the quality of majority decisions by* N *sincere voters, as already pointed out by the Marquis de Condorcet (De Caritat, 1785). In this benchmark case, decision quality may start low, but becomes larger than in equilibrium for a sufficiently large number of voters.*

Setting	Decision quality	$N = 3$	$N = 5$	$N = 21$	$N = 101$	$N = 1,001$
No PA	$\Pi(\sigma^{Rubber}) = q_B$	0.75	0.75	0.75	0.75	0.75
With PA	$\Pi(\hat{\sigma}) = q_B q_P + p^{dis}\pi(N)$	0.784	0.798	0.855	0.917	0.925
Hypothetical	$\Pi(\sigma^{UNIS}) = \pi(N)$	0.648	0.683	0.826	0.979	1.0

Table 2: Decision quality in Example 1. The table considers the two Pareto-efficient symmetric equilibria, Rubber-stamping and CAIS, and strategy profile UNIS, which is not an equilibrium. Illustration of Propositions 1 and 2 for $q_B = 0.75$, $q_P = 0.7$, and $q_S = 0.6$. $p^{dis} := (1 - q_B)q_P + q_B(1 - q_P)$ is the probability that the board's and the PA's signal differ.

We now turn to illustrating Propositions 1 and 2 graphically, while at the same time extending our analysis to the entire parameter space.

Graphical Illustration. Figure 2 illustrates the full parameter space, including the areas where Assumption BIB is violated. An entry (x, y) in this coordinate system has the simple interpretation that the board is equally well informed as x shareholders, while the PA is equally well informed as y shareholders.[20]

In the upper panel of Figure 2, no PA is admitted. By Proposition 1, Rubber-stamping is the Pareto-efficient equilibrium under Assumption BIB, i.e., $q_S \leq q_B$. This is illustrated in the area $\frac{\ell_B}{\ell_S} \geq 1$. Assumption BIB is necessary and sufficient for this conclusion as UNIS is the Pareto-efficient equilibrium for $\frac{\ell_B}{\ell_S} < 1$. Hence, when there is no PA, information acquisition occurs if and only if the board is less well informed than a single shareholder, i.e., when Assumption BIB is violated.[21]

In the lower panel of Figure 2, there is a PA and Assumption PAF is satisfied. Proposition 2 has shown that under Assumption BIB, i.e., for $\frac{\ell_B}{\ell_S} \geq 1$, we have either CAIS or Rubber-stamping as Pareto-efficient symmetric equilibrium. Moreover, by Proposition 2 the parameter space in which CAIS is an equilibrium is given by the condition $\ell_P \in (\ell_B - \ell_S, \ell_B + \ell_S)$, which defines a corridor around the 45-degree line.[22] On the 45-degree line the board and the PA are exactly equally well informed, i.e., $\frac{\ell_P}{\ell_S} = \frac{\ell_B}{\ell_S}$ (or $q_B = q_P$). Note that this corridor is not bounded from the upper right. Hence, for arbitrarily well-informed board and PA, there is still an equilibrium with conditional information acquisition of all shareholders, as

[20] "Equally well informed" means here that if x shareholders have received a signal a (against the board) then both states A and B are equally likely. Hence, if more than x shareholders have received a signal a and there is no other information, then the board should be overruled.

[21] The additional results, due to the violation of Assumption BIB, are provided in the Supplementary Online Material (SOM) Section 1.

[22] When studying asymmetric equilibria, we show that CAIS can be played by a majority of shareholders far beyond this corridor. The corridor only restricts the area in which *all* shareholders play CAIS.

long as the board and the PA are roughly equally-well informed. The intuition is that whenever their signals contradict each other, there is sufficient controversy to invest in own research. Below this corridor, the board's signal is more informative than the PA's and a single shareholder's signal together such that any shareholder can deviate to Rubber-stamping. Similarly, above the corridor the PAs' signal is more informative than the board's and a single shareholder's signal together such that any shareholder has an incentive to deviate to subscribe to the PA and follow its advice. A strategy profile consisting of only this strategy, call it *Follow* (or "robo-voting"), is however not an equilibrium, as any agent can save costs by not subscribing to the PA without affecting the outcome.[23] That is why Rubber-stamping is also the Pareto-efficient symmetric equilibrium in this area of the parameter space.

Importantly, our results show that PAs need not be better informed than the board to improve corporate decision quality. To further understand the workings of the model, consider the comparative statics of changing information quality. Assume $\frac{\ell_B}{\ell_S} > 1$ and start with an uninformed PA: $q_P \approx 0.5$ i.e., $\frac{\ell_P}{\ell_S} \approx 0$. Decision quality remains unaffected by the PA's information quality q_P (or $\frac{\ell_P}{\ell_S}$) at first, then discontinuously increases from q_B to $\Pi(\hat{\sigma})$. Within the region where CAIS is an equilibrium, decision quality further improves as $\Pi(\hat{\sigma})$ is continuously increasing in q_P. Finally, it returns to the level q_B when Rubber-stamping is played again. Hence, there is a non-monotonic effect of a PA's information quality on the corporate decision quality with the latter being highest for a PA that is slightly better informed than the board.[24] Comparative-static effects of the board's information quality

[23] We will revisit this question when studying asymmetric equilibria. It turns out that Follow can be part of an equilibrium strategy profile.

[24] A non-monotonic effect of the PA's recommendation quality on the corporate decision quality is also predicted by the analysis of Malenko and Malenko (2019). In their model, higher PA quality always weakly reduces the shareholders' investment in private signals such that maximal research incentives are obtained for the lowest PA quality. In our model, maximal research incentives are obtained for intermediate PA quality,

are analogous if $\frac{\ell_P}{\ell_S} > 1$, i.e., the PA is better informed than a single shareholder. Finally, increasing signal quality of the shareholders, q_S, reduces $\frac{\ell_B}{\ell_S}$ and $\frac{\ell_P}{\ell_S}$, which means graphically moving towards the origin. This improves decision quality of CAIS as shareholders base their decision on their own information when the PA's recommendation is *against*.

Assumption BIB, i.e., $\frac{\ell_B}{\ell_S} \geq 1$, rules out UNIS, the strategy profile in which all shareholders acquire information. Violating BIB while satisfying PAF, UNIS is the Pareto-efficient symmetric equilibrium in the lower left corner of the parameter space (in the lower panel of Figure 2), which is defined by the condition $\ell_S > \ell_B + \ell_P$. Hence, in the presence of a PA, UNIS requires that one single shareholder must be better informed than board and PA together. Interestingly, this is an even stronger condition than the condition for UNIS when no PA is admitted ($\ell_S > \ell_B$).

Let us now compare the upper panel with the lower panel. Under Assumption BIB, i.e., for $\frac{\ell_B}{\ell_S} \geq 1$, the presence of a PA weakly improves decision quality, as it replaces Rubber-stamping with CAIS if anything. When Assumption BIB is violated, there can be a different effect. Suppose that the quality of the board is not much better than a coin flip, i.e., $q_B \approx 0.5$. Then $\frac{\ell_B}{\ell_S} \approx 0$ and there is the equilibrium with full information acquisition (UNIS) and high decision quality, as long as no PA is admitted. The presence of a PA who is better informed than a single shareholder ($\frac{\ell_P}{\ell_S} > 1$) destroys this equilibrium and reduces decision quality from $\pi(N)$ to $q_B \approx 0.5$. The reason is that conditional on pivotality a shareholder prefers to follow the PA's recommendation over acquiring and using the own signal. Hence, Assumption BIB dramatically changes how admission of a PA affects decision quality when

namely when it equals the board's quality. If proxy advice does not arrive sufficiently early or if the PA is already better informed than the board, a competence-increasing regulation of the PA may undermine shareholders' research incentives and affect decision quality negatively.

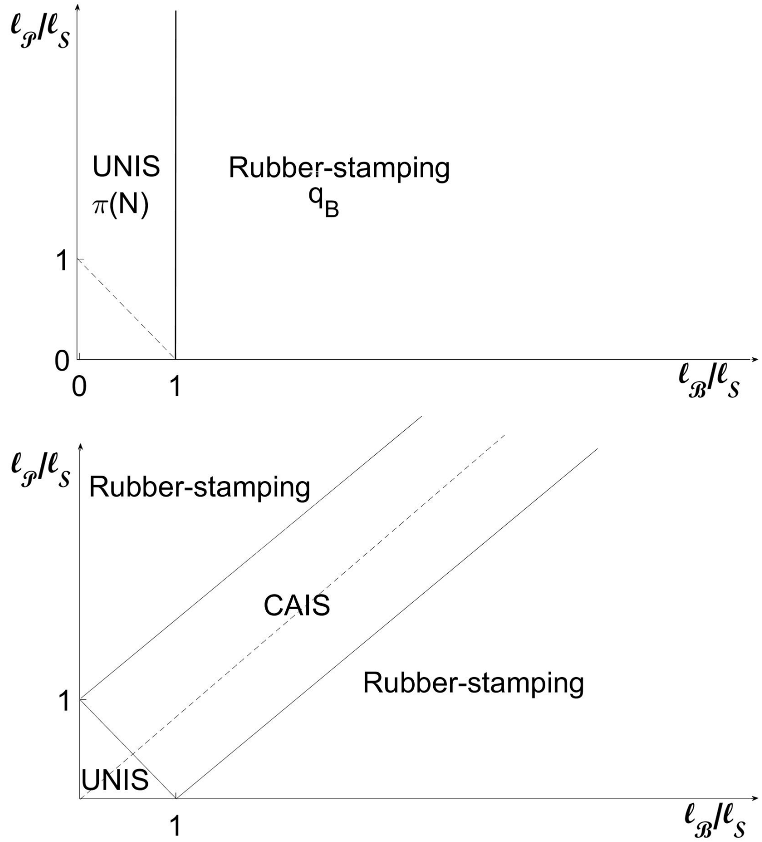

Figure 2: Parameter space with Pareto-efficient symmetric equilibria. Upper panel: without a PA; lower panel: with a PA. Both panels: The areas to the left of $\frac{\ell_B}{\ell_S} = 1$ are precluded by Assumption BIB; they are still depicted here to show the effect of the assumption.

studying symmetric equilibria.

5 Extensions and Robustness

5.1 Asymmetric Equilibria

The main text characterizes the (Pareto-efficient) symmetric equilibria. We can drop the symmetry assumption. Since the characterization of all (Pareto-efficient) asymmetric equilibria is quite cumbersome and involves many case distinctions, we relegate it to the Supplementary Online Material (SOM) Section 2 and provide only the main result and the essence of the other findings here. Interestingly, although we model shareholders as ex ante homogeneous, there is specialization on different strategies in the Pareto-efficient equilibria, e.g., in one typical equilibrium, some shareholders play CAIS, some shareholders play UNIS, while others play either Rubber-stamping or always follow the PA's recommendation, depending on whether the board or the PA is better informed.

An overview of the Pareto-efficient asymmetric equilibria is presented in Figure 3 which is proven in SOM Lemma 2.3. *Protest* is defined as the strategy profile in which no shareholder invests in research and all shareholders vote *no*. *Follow* refers to the strategy profile where all players buy the PA's recommendation and follow it when voting (without investing in own research).

Our basic results remain similar. In particular, we can first show that without PA, the number of shareholders who invest in own research is bounded from above. That is, in the equilibrium without a PA there are always some shareholders not investing in research, given that Assumption BIB is satisfied. Second, when admitting a PA whose signal quality is not too far from the board's, the number of shareholders who invest or conditionally invest weakly increases. Again, the basic idea is that the PA's recommendation is used as a condition to invest in own research like in information-acquisition strategy Subscribe-InvestIFF*against*, which constitutes CAIS. While this was true for all shareholders in Proposition 2 in a certain parameter range, we now find this in much larger areas of the parameter space, while no longer all shareholders use this strategy (see again Figure 3). More precisely, if we have $\frac{|\ell_B - \ell_P|}{\ell_S} < \frac{N+1}{2}$, then $N - \frac{|\ell_B - \ell_P|}{\ell_S}$, i.e., more than half of all shareholders, invest into own information, either conditionally as in CAIS or even unconditionally as in UNIS. The above condition means that the difference between the information quality of the PA and the

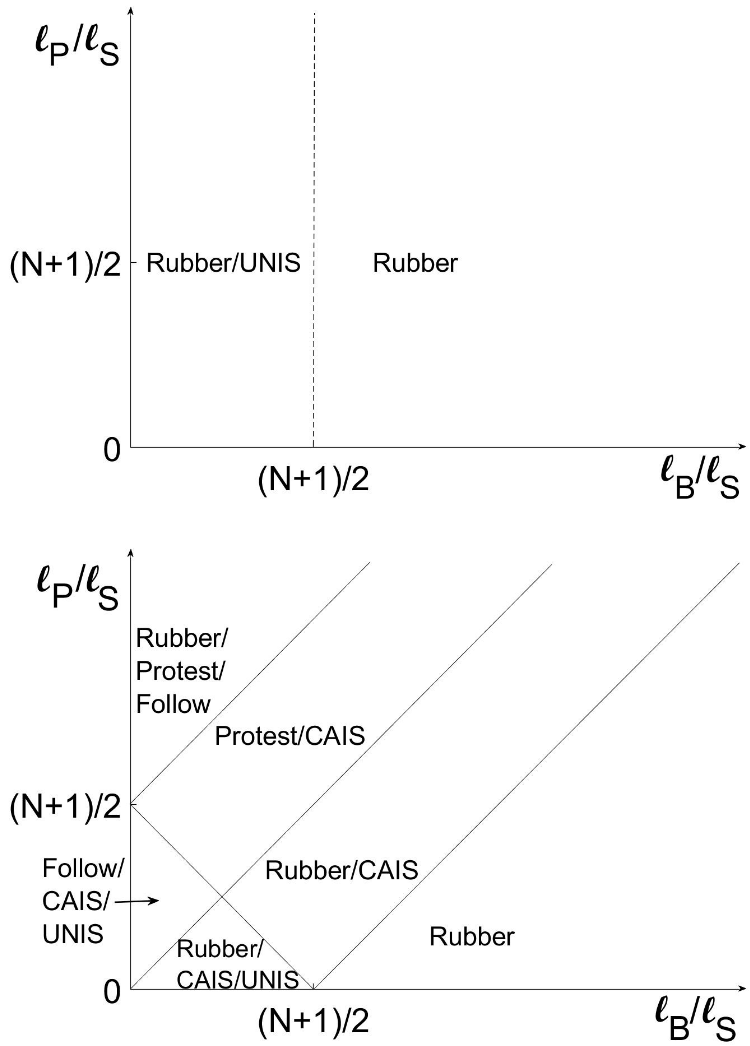

Figure 3: Parameter space with Pareto-efficient (potentially asymmetric) equilibria. Upper panel without a PA based on SOM Proposition 2.1, lower panel with a PA based on SOM Lemma 2.3. CAIS is part of the equilibrium strategy profile in large areas of the parameter space.

information quality of the board must not exceed the aggregated information quality of about half of all shareholders together, which graphically widens the corridor in the lower panel of Figure 2 from starting at 1 to starting at $\frac{N+1}{2}$ in the lower panel of Figure 3 on both axes.[25] Moreover, the number of investing shareholders, $N - \frac{|\ell_B - \ell_P|}{\ell_S}$, is decreasing in this difference of information quality. Hence, we find the strongest research incentives for shareholders when the PA is as well informed as the board.[26]

Finally, the question remains how the effects of a PA on equilibrium behavior translates into decision quality. Proposition 3 provides the answer.

Proposition 3 (ASYM)**.** *Let costs c and f be sufficiently small. For any setting of signal qualities $q_B, q_P, q_S \in (\frac{1}{2}, 1)$, decision quality in any Pareto-efficient equilibrium with a PA under Assumption PAF, $\Pi(\sigma^*)$, is weakly higher than decision quality in any strategy profile without a PA (including their Pareto-efficient equilibria), i.e., $\Pi(\sigma^*) \geq \bar{\Pi}^{no-PA}$, where $\bar{\Pi}^{no-PA}$ is the maximal decision quality for any strategy profile in the game without a PA.*

The proof of Proposition 3 considers all Pareto-efficient strategy profiles and shows that each of them is an equilibrium with maximal decision quality.[27] It then uses the insight that any decision quality without a PA can be replicated with a PA who is ignored. As a consequence, decision quality cannot be reduced.[28] In sum, the novel type of equilibrium behavior that we find in this paper exists in a broad range of the parameter space. The main insight, that PAs weakly improve decision quality, holds even for the whole parameter space when considering asymmetric strategy profiles.

[25] Observe that the larger the number of shareholders N, the less demanding this assumption is.

[26] Other comparative-static effects might be different for asymmetric equilibria than for symmetric, see Supplementary Online Material (SOM) Section 2.

[27] Indeed, for asymmetric equilibria there is no issue of inefficiency.

[28] This simple line of argumentation does not apply to symmetric equilibria.

5.2 One Dominant Shareholder

We have thus far assumed that $N > 1$ and odd which means that we have at least three shareholders. Let us now consider the case of only one shareholder $N = 1$, which applies to any company with a shareholder who holds a decisive majority of shares. We can show that both main results carry over to this case. First, without a PA, there is no incentive to invest in research under Assumption BIB, i.e., for $q_S \leq q_B$. Second, the presence of a PA with appropriate information quality improves decision quality, as it leads to a Pareto-efficient equilibrium in which the shareholder conditionally invests in research.

Interestingly, since one single shareholder is always pivotal, the Assumption PAF is not necessary for research investment in that special case. That is, even when the subscription decision and the information acquisition decision are made simultaneously, there is an equilibrium with investment in own research for $N = 1$. In this equilibrium strategy the shareholder subscribes to the vote recommendation and invests in own research (Subscribe-Invest) and votes *yes* if and only if at least one of the two supports the board's proposal. Hence, for the case of only one shareholder, there is a complementarity between proxy advice and own research, independently of the timing of the two decisions.

5.3 Different Timelines

How would a different timeline affect the results? Consider the situation when proxy advice arrives *after* the shareholders' decision to invest in own research, i.e., when Assumption PAF is violated. All actions occur as illustrated in the timeline (Figure 1), but proxy advice arrives at the end of period $t = 2$. We consider the cases where Assumption BIB holds and where it does not hold.

If Assumption BIB holds, the Pareto-efficient symmetric equilibrium is Rubber-stamping and hence decision quality is bounded by q_B. Hence, there is no positive effect of having a PA, as decision quality with or without a PA is bounded by the quality of the board.

If Assumption BIB does not hold, that is, if the board does not have the best information regarding what is good for the company, we find that UNIS is an equilibrium and Pareto-efficient if and only if $\ell_S \geq \ell_B + \ell_P$; otherwise, Rubber-stamping is the Pareto-efficient equilibrium. This condition is the same as in our model with early proxy advice (see bottom right corner of the lower panel of Figure 2). It is more demanding than the condition in the setting without a PA, which was $\ell_S > \ell_B$. Specifically, the condition $\ell_S \geq \ell_B + \ell_P$ means that a single shareholder has to be better informed, not only than the board, but than both the board and the PA together. Hence, the introduction of a PA whose information arrives late, if anything, weakens the shareholders' research incentives.[29]

In sum, introducing a PA whose advice does not arrive sufficiently early does not induce equilibria with higher decision quality, but may even reduce decision quality. The positive effects of proxy advice in our model are hence indeed restricted to having both Assumption BIB and Assumption PAF satisfied.[30]

[29] This is recognized also by policy makers. For example, one of the recent SEC rules holds that, contrary to prior proposals, PAs are not required to engage with the companies that are the subjects of their advice (see `https://www.sec.gov/rules/final/2022/34-95266.pdf`). While somewhat controversial in light of possible errors in proxy advisors' recommendations, SEC Chairman Gary Gensler motivated this rule by saying that proxy advisor clients "deserve to receive independent proxy voting advice in a timely manner." (`https://www.sec.gov/news/press-release/2021-236`)

[30] The exemption is $N = 1$ when a PA can improve decision quality even if PAF is violated; see Section 5.2.

5.4 Conflicts of Interest

In a re-interpretation of our model the board has a partial conflict of interest with the shareholders. Suppose the effect of conflicted interests is that this reduces the likelihood that the board's proposal is correct from $q_B > 0.5$ to some $\tilde{q}_B > 0.5$. More technically, suppose the board's bias is a random variable that is drawn and private information. Shareholders know the distribution of the bias, but not its realization. The distribution of the bias is such that either the board's proposal is determined by the bias or that it is determined by the signal. Moreover, suppose that the board's bias is symmetrically distributed around zero.[31] This introduces noise into the informativeness of the board's proposal as shareholders put positive probability on the case that the proposal is independent of the signal. Then the assumption of a high quality board $\tilde{q}_B \geq q_S$ thus means that the board is not only better informed, but also that the board's agency problem is limited. Conversely, a low $\tilde{q}_B$ means either that the board has a low signal quality or that it has a high agency problem such that its proposal is not very informative.

Reconsidering the comparative-statics on q_B (cf., e.g., Figure 2), we can thus also address how the agency problem affects the decision quality. Start with a very well informed board and a small agency problem: $q_B > \tilde{q}_B > q_P > q_S$. Reducing $\tilde{q}_B$ first fosters the shareholders' research incentives up to the point $\tilde{q}_B \approx q_P$, then reduces them. This non-monotonicity makes it possible that agency problems may even increase the quality of corporate decision making, as boards whose proposals are less informative may incentivize shareholders to (conditionally) invest in own research.

If we further increase the agency problem up to a point where the board's proposal

[31] Asymmetry of the bias distribution would make one type of proposal more informative than the other.

becomes close to uninformative (i.e., $\tilde{q}_B \approx \frac{1}{2}$), a proxy advisor is indeed detrimental for the reasons elaborated in the literature. However, a second PA might now play the role of the second expert and challenge the first PA's recommendation. This could induce the controversy needed to make shareholders invest in own research.

6 Conclusion

In this paper we develop a model analyzing information acquisition before voting, focusing on shareholder voting and proxy advisory firms (PAs) as an example. As a benchmark, there is a single expert, the board. When the board's proposals are sufficiently informative, shareholders do not have incentives to conduct their own research and simply rubber-stamp the board's proposals. Hence in the absence of a second expert, decision quality is bounded by the quality of the board (Proposition 1). Introducing a second expert, a PA whose information level is not too far from the board's, alters this result and leads to a higher decision quality (Proposition 2). This only holds if the vote recommendation of the PA arrives sufficiently early such that shareholders can respond to *against* recommendations with an own investigation of the issue. Extending the analysis from symmetric equilibria to asymmetric equilibria, we find that many but not all shareholders play this conditional information acquisition strategy. Consequently, we arrive at the same overall conclusion: PAs improve corporate decision quality (Proposition 3).

Importantly, this does not imply that adding experts will *simpliciter* always be beneficial. Instead, the generalization depends on how much controversy the experts generate among themselves. While two (at best equally well informed) experts create more controversy than one, adding another as well informed expert reverts the effect: any controversy among three equal experts involves two signals offsetting each other, and one signal being provided as if there was only a single expert. Hence, multiple experts are better than one if and only if they create more controversy, e.g., if there is an even number of equal experts, or if signal qualities differ among experts in a way that increases controversy. Having two similarly informed experts is a cheap and simple way of doing so, and creates more controversy than a larger number of experts.[32]

While our model is applied to the world of shareholder meetings, other practically relevant situations in principle have similar features. For example, Sangiorgi and Spatt (2017) argue that credit rating agencies can "crowd out" independent information production by investors. Future work might analyze under which conditions credit rating agencies positively contribute to information production.

Even more broadly, in many situations, committee members or other team members making majority decisions are faced with the question of whether to acquire information in addition to what the chairman or group leader proposes, or whether to rubber-stamp proposals put in front of them. For instance, a parliament voting on a proposed measure to keep a crisis at bay, or a faculty committee voting on a specific usage of AI in teaching, may have to decide between rubber-stamping the proposed measure or individually acquiring additional information before voting. Our model provides insights into when having a separate advisor's signal available to all committee and team members would stimulate individual information acquisition and improve decision-making.

[32]The larger the (even) number of experts with conditionally independent informative signals of equal quality, the smaller is the probability of a tie in the signal realizations.

A Appendix: Proofs

A.1 Proof of Proposition 1

To prove Proposition 1 Lemma A.1 is helpful.

Lemma A.1 (SYM without PA: All Equilibria)**.** *Let Assumption BIB hold. Suppose no PA is admitted.*

i. Define Protest as the strategy profile in which no shareholder invests in research and all shareholders vote no. Protest is a symmetric equilibrium for any $q_B, q_S \in (0.5, 1)$*. Its decision quality is* $1 - q_B$*.*

ii. Rubber-stamping (i.e., no shareholder invests in research and all shareholders vote yes) is a symmetric equilibrium for any $q_B, q_S \in (0.5, 1)$*. Its decision quality is* q_B*.*

iii. There are no other symmetric equilibria.

Proof. We address each part separately.

i. We have $N \geq 3$ shareholders (because $N > 1$ and odd). When all shareholders vote *no*, a single shareholder is never pivotal. Hence, there is no way to increase decision quality. Deviations can thus only affect costs. Since no information is acquired in this information-acquisition strategy (NotSubscribe-NotInvest), costs are minimal. Hence, there is no unilateral improvement.

   Decisions always implement the opposite of the board's proposal. By assumption of the simplified model, the board's proposal corresponds to its signal (B). Hence, the ex ante probability that the true state matches the decision equals the probability that the board's signal does not match the true state, which is $1 - q_B$.

ii. The proof that Rubber-stamping is an equilibrium is fully analogous to part i. of Lemma A.1. With Rubber-stamping, the decision quality equals the ex ante probability that the board's signal matches the true state, which is q_B.

iii. There are only two information-acquisition strategies. For not investing in an own signal both strategies are symmetric equilibria (see part i. and ii.). Consider now investment in an own signal: Since shareholders pay c they must condition on their own signal. Otherwise, they could improve their utility by voting the same and not investing c. Conditioning on their signal leaves two pure strategies: vote *yes* if b and *no* if a (i.e., UNIS) or the opposite (vote *yes* if a and *no* if b). If voting *yes* after a (against) was optimal, then voting *no* after a would also be so. Hence, shareholders could profitably deviate to unconditionally voting A.

   We finally show that UNIS is not an equilibrium under Assumption BIB, i.e., $q_S \leq q_B$.[33] Consider shareholder i deviates to Rubber-stamping. The deviation changes the outcome

[33] In fact, UNIS is a symmetric equilibrium if and only if $q_S > q_B$.

only if i is pivotal and the own signal is a: Under UNIS i would vote *no*, under Rubber-stamping i would vote *yes*. Pivotality implies that among the $N-1$ other shareholders the signals are split in $\frac{N-1}{2}$ a-signals and $\frac{N-1}{2}$ b-signals. Conditional on that case, B is more likely to be true than A (such that Rubber-stamping weakly improves decision quality) if and only if

$$\begin{aligned}
q_B(1-q_S)\binom{N-1}{\frac{N-1}{2}}q_S^{\frac{N-1}{2}}(1-q_S)^{\frac{N-1}{2}} &\geq (1-q_B)q_S\binom{N-1}{\frac{N-1}{2}}(1-q_S)^{\frac{N-1}{2}}q_S^{\frac{N-1}{2}} \\
q_B(1-q_S) &\geq (1-q_B)q_S \\
\frac{q_B}{1-q_B} &\geq \frac{q_S}{1-q_S} \\
\ell_B &\geq \ell_S.
\end{aligned}$$

Hence, Rubber-stamping weakly improves decision quality for $q_S \leq q_B$, which is Assumption BIB. Moreover, Rubber-stamping saves costs c. Therefore, it strictly improves utility of the deviating shareholder i.

$\square$

Now, we use Lemma A.1 to prove Proposition 1. Under Assumption BIB there are only two equilibria. Equilibrium Rubber-stamping leads to the same costs as the Protest equilibrium. Rubber-stamping Pareto-dominates Protest because it leads to higher decision quality $\Pi(\sigma^{Rubber}) = q_B > 0.5 > 1 - q_B = \Pi(\sigma^{Protest})$.

A.2 Proof of Proposition 2

To prove Proposition 2 Lemma A.2 is helpful.

Lemma A.2 (SYM with PA: All Equilibria)**.** *Let Assumptions BIB and PAF hold. Let costs c be arbitrarily small and let fee f be sufficiently smaller.*

i. Protest (i.e., no shareholder invests in research and all shareholders vote no) is a symmetric equilibrium for any $\ell_B, \ell_S \in (0,\infty)$. Its decision quality is $1-q_B$.

ii. Rubber-stamping (i.e., no shareholder invests in research and all shareholders vote yes) is a symmetric equilibrium for any $\ell_B, \ell_S \in (0,\infty)$. Its decision quality is q_B.

iii. CAIS is a symmetric equilibrium if and only if $\ell_P \in (\ell_B - \ell_S, \ell_B + \ell_S)$. Its decision quality is: $\Pi(\hat{\sigma}) = q_B q_P + [(1-q_B)q_P + q_B(1-q_P)]\pi(N)$, with $\pi(N) := \sum_{i=\frac{N+1}{2}}^{N}\binom{N}{i}q_S^i(1-q_S)^{N-i}$.

iv. CAIS-2 is a symmetric equilibrium if and only if $\ell_P \in (\ell_B - \ell_S, \ell_B + \ell_S)$. Its decision quality is: $\Pi(\sigma^{CAIS-2}) = (1-q_B)(1-q_P) + [(1-q_B)q_P + q_B(1-q_P)]\pi(N)$.

v. There are no other symmetric equilibria. In particular, there is no equilibrium in which all shareholders subscribe to proxy advice and unconditionally invest in own signal (Subscribe-Invest).

Proof. We address each part of Lemma A.2 separately.

i. The proof is identical to the proof of Lemma A.1, part i.

ii. The proof is identical to the proof of Lemma A.1, part ii.

iii. CAIS is illustrated in Table 1. We show that CAIS is an equilibrium if and only if $\ell_P \in (\ell_B - \ell_S, \ell_B + \ell_S)$.

Suppose first that $\ell_P \notin (\ell_B - \ell_S, \ell_B + \ell_S)$, i.e., either $\ell_P \leq \ell_B - \ell_S$ or $\ell_P \geq \ell_B + \ell_S$. We show that CAIS cannot be an equilibrium. In CAIS pivotality implies that the vote recommendation is *against* and that among the $N-1$ other shareholders the signals are split in $\frac{N-1}{2}$ a-signals and $\frac{N-1}{2}$ b-signals. (Indeed, after recommendation *for* no shareholder is pivotal.)

Let $\ell_P \leq \ell_B - \ell_S$. Consider a shareholder i who deviates to Rubber-stamping. This deviation alters the decision in comparison to CAIS if the vote recommendation is *against*, all other shareholder's signals are split, and i's signal is a: In CAIS, i would vote *no*, in the deviation i would vote *yes*. This deviation weakly improves decision quality if $\ell_B \geq \ell_P + \ell_S$, which holds by assumption. Since, the deviation saves costs c, it increases i's expected utility.

Let $\ell_P \geq \ell_B + \ell_S$. Consider a shareholder i who deviates to voting *no* without information acquisition (as in Protest). This deviation alters the decision in comparison to CAIS if the vote recommendation is *against*, all other shareholders' signals are split, and i's signal is b: In CAIS, i would vote *yes*, in the deviation i would vote *no*. This deviation weakly improves decision quality if $\ell_P \geq \ell_B + \ell_S$, which holds by assumption. Since the deviation saves costs c, it increases i's expected utility.

Hence, if $\ell_P \notin (\ell_B - \ell_S, \ell_B + \ell_S)$, CAIS is not an equilibrium.

Now suppose that $\ell_P \in (\ell_B - \ell_S, \ell_B + \ell_S)$. In order to show that CAIS is an equilibrium, we demonstrate that there is no individual deviation that improves utility. We use the following principle: if a deviation is more attractive than an other deviation in terms of utility, then excluding the former is sufficient to exclude the latter. We organize the potential deviations by information-acquisition strategy. There are six information-acquisition strategies to consider. Pivotality always implies that the vote recommendation is *against* and that among the $N-1$ other shareholders the signals are split in $\frac{N-1}{2}$ a-signals and $\frac{N-1}{2}$ b-signals.

(1) NotSubscribe-NotInvest. Deviating to NotSubscribe-NotInvest and voting *yes* as in Rubber-stamping is not an improvement for low enough costs given $\ell_S + \ell_P > \ell_B$. This deviation only changes the outcome if the PA has recommended *against*, i has received signal a (against), and all other shareholders' signals are split. It would

weakly improve decision quality iff

$$
\begin{aligned}
q_B(1-q_P)(1-q_S)\binom{N-1}{\frac{N-1}{2}} q_S^{\frac{N-1}{2}}(1-q_S)^{\frac{N-1}{2}} &\geq (1-q_B)q_Pq_S\binom{N-1}{\frac{N-1}{2}}(1-q_S)^{\frac{N-1}{2}} q_S^{\frac{N-1}{2}} \\
q_B(1-q_P)(1-q_S) &\geq (1-q_B)q_Pq_S \\
\frac{q_B}{1-q_B} &\geq \frac{q_P}{1-q_P} + \frac{q_S}{1-q_S} \\
\ell_B &\geq \ell_P + \ell_S.
\end{aligned}
$$

By assumption $\ell_P > \ell_B - \ell_S$, this deviation strictly decreases decision quality. It does save costs f always and c with probability $q_B(1-q_P) + (1-q_B)q_P$. For low enough costs f and c, Rubber-stamping does not increase utility because of its lower decision quality.

Deviation to vote *no* without information acquisition (as in Protest) is not an improvement for low enough costs given $\ell_P < \ell_B + \ell_S$.

(2) NotSubscribe-Invest. Deviation NotSubscribe-Invest and voting according to the own signal as in UNIS does not change the outcome. Indeed, after a for recommendation i is not pivotal, after an *against* recommendation i votes under her deviation as she does under CAIS. Hence, this deviation is an improvement only if it saves costs. It is not an improvement if $f \leq c[q_Bq_P + (1-q_B)(1-q_P)]$, which is satisfied if f is sufficiently lower than c.

(3) Subscribe-NotInvest. The deviation to buying the PA's recommendation and following it is not an improvement given $\ell_P < \ell_B + \ell_S$ and low enough c.

(4) Subscribe-Invest. Deviation to buy both recommendation and signal. Case 1, illustrated in Table A.2, is outcome equivalent, but more costly. Case 2, illustrated in Table A.3, is not an improvement given $\ell_P < \ell_B + \ell_S$.

(5) Subscribe-InvestIFFfor. Consider the deviation to buying the PA's recommendation and investing in an own signal iff the recommendation is for. The case illustrated in Table A.4 is not an improvement given $\ell_P < \ell_B + \ell_S$. The alternative case, which differs by voting *yes* after the *against* recommendation, is not an improvement given $\ell_S + \ell_P > \ell_B$.

(6) Subscribe-InvestIFF*against*. Consider the deviation to applying the same information-acquisition strategy as in CAIS, but a different voting strategy. The most attractive deviation is to vote *no* after the for recommendation. This is outcome equivalent and equally costly and, hence, not an improvement.

Hence, under the conditions assumed in part iii. of the Lemma CAIS is an equilibrium.

Finally, concerning decision quality, notice that if board and PA receive the same signal, this signal determines the decision, and if they receive a different signal, the signal that is received by a majority of shareholders determines the decision. Therefore, decision quality in CAIS is $(q_Bq_P) * 1 + (1-q_B)(1-q_P) * 0 + [(1-q_B)q_P + q_B(1-q_P)]\pi(N) * 1$, as q_Bq_P is the probability that the board and the PA both receive the same and correct signal, and $[(1-q_B)q_P + q_B(1-q_P)]$ is the probability that the two receive signals that are different from each other.

iv. CAIS-2 is illustrated in Table A.1.

		Own Signal	
		b (for board)	a (against)
PA	for	no	
	$against$	yes	no

Table A.1: CAIS-2: Invest in research iff vote recommendation is *against*; after for recommendation vote *no*, after *against* recommendation vote *yes* iff the own signal is b.

The proof that CAIS-2 is an equilibrium if and only if $\ell_P \in (\ell_B - \ell_S, \ell_B + \ell_S)$ is identical to the proof that CAIS is an equilibrium under these conditions (cf. Proof of Lemma A.2, part iii.).[34]

Concerning decision quality, notice that if board and proxy advisor receive the same signal, the decision is contrary to this signal, and if they receive different signals, the signal that is received by a majority of shareholders determines the decision. Therefore, decision quality in CAIS-2 is $(q_B q_P) * 0 + (1-q_B)(1-q_P) * 1 + [(1-q_B)q_P + q_B(1-q_P)]\pi(N) * 1$.

v. To show that there are no additional equilibria, we exhaustively discuss all pure strategies. Again, we organize the discussion by information-acquisition strategy.

(1) NotSubscribe-NotInvest. There are only voting strategies *yes* or *no*. Both lead to equilibria as shown in parts i and ii.

(2) NotSubscribe-Invest. Since shareholders pay c they must condition on their own signal. Otherwise, they could improve their utility by voting the same and not investing c. Conditioning on the own signal leaves two pure strategies: vote *yes* if the signal is b and *no* if the signal is a (i.e., as in UNIS) or the opposite (vote *yes* if the signal is a and *no* if the signal is b). If voting *yes* after a (*against*) was optimal, then voting *no* after a would also be optimal. Hence, shareholders could improve their utility by unconditionally voting A. Only UNIS remains. Under Assumption BIB, NotSubscribe-NotInvest and voting *yes* as in Rubber-stamping is a profitable deviation from UNIS.

(3) Subscribe-NotInvest. Since shareholders pay f they must condition on the PA's recommendation. For instance, they vote *yes* after for and *no* after *against*; or they do the opposite. In either case, no shareholder is pivotal since all vote for the same, given a particular recommendation.

A shareholder can improve her utility by not paying f and voting, e.g., *yes*. Hence, there is no symmetric equilibrium with this information-acquisition strategy.

[34] This is not surprising, as both strategies have the same information-acquisition strategy, Subscribe-InvestIFF*against*, and they only differ in a voting action, where no player is pivotal.

(4) Subscribe-Invest. Since shareholders pay both f and c they must condition their voting strategy on both the PA's vote recommendation and the own signal. Otherwise, they could improve their utility with the same voting behavior, but saving costs. This means that in fact only two voting strategies remain.

Case 1: vote *yes* except if the PA's recommendation is *against* and the own signal is a, as in Table A.2. In this case no shareholder is pivotal if the PA recommends for. Hence, shareholder i can only be pivotal if the recommendation is *against*. If so, i would vote according to her signal. Hence, deviating to unconditionally investing in an own signal and voting accordingly, as in UNIS, would not change the outcome because either i is not pivotal or i would also vote according to the signal. However, acting as in UNIS saves fee f. Thus, this is a profitable deviation, and the strategy profile of case 1, illustrated in Table A.2, cannot be an equilibrium.

		Own Signal	
		b (for board)	a (against)
PA	for	yes	yes
	against	yes	no

Table A.2: A strategy profile based on acquiring both proxy advice and own signal, case 1: Subscribe-Invest and vote *yes*, except if PA's recommendation is *against* and the own signal is a.

Case 2: vote *no* except if both the PA's recommendation is for and the own signal is b, as in Table A.3. The analogous argument as above for case 1 applies, as follows: In this case no shareholder is pivotal if the PA recommends *against*. Hence, shareholder i can only be pivotal if the recommendation is for. If so, i would vote according to signal. Hence, deviating to unconditionally investing in an own signal as in UNIS would not change the outcome because either i is not pivotal or i would also vote according to the signal. Acting as in UNIS, however, saves fee f. Thus, strategy profile of case 2 cannot be an equilibrium.

		Own Signal	
		b (for board)	a (against)
PA	for	yes	no
	against	no	no

Table A.3: A strategy profile based on acquiring both proxy advice and own signal, case 2: Subscribe-Invest and vote *no*, except if PA's recommendation is for and the own signal is b.

Therefore, there cannot be a symmetric equilibrium with this information-acquisition strategy (Subscribe-Invest), in which shareholders unconditionally buy both the PA's recommendation and an own signal.

(5) Subscribe-InvestIFFfor. Since shareholders pay f and sometimes c they must condition their voting strategy on the recommendation and the own signal when

they acquire them. In particular, after having bought the own signal on top of the recommendation for, shareholders must vote according to their signal in equilibrium. Voting the opposite is dominated, and not conditioning as well. This leaves two cases, which we address as Cand. 5a and Cand. 5b. We show that none of them is an equilibrium under Assumption 1.[35] Consider first Cand. 5a: shareholders vote *yes* except if the PA's vote recommendation is for and the own signal is a (against) as in Table A.4.

		Own Signal	
		b (for board)	a (against)
PA	for	yes	no
	$against$	yes	

Table A.4: Cand. 5a. A strategy profile based on acquiring an own signal iff the recommendation is for: Subscribe-InvestIFFfor and vote *yes*, except if PA's recommendation is for and the own signal is b.

Consider shareholder i who deviates to NotSubscribe-NotInvest and voting *yes*, as in Rubber-stamping. This deviation only alters the outcome when the vote recommendation is for, all other shareholders' signals are split, and i's signal is a (*against*): Under Cand. 5a, i would vote *no*, but under her deviation she votes *yes*. Decision quality improves by this deviation if $\ell_B + \ell_P > \ell_S$. This condition is satisfied by Assumption 1. Moreover, the costs are lower under this deviation than under Cand. 5a. Hence, Cand. 5a cannot be an equilibrium.

Now consider Cand. 5b. Shareholders vote *no* except if the PA's vote recommendation is for and the own signal is b. Again, no shareholder is pivotal after recommendation *against*. Hence, deviating to NotSubscribe-NotInvest and voting *yes* as in Rubber-stamping is an improvement, identical to the case of Cand. 5a above.

(6) Subscribe-InvestIFF*against*. Since shareholders pay f and sometimes c they must condition their voting strategy on the recommendation and the own signal when they acquire them. In particular, after having bought the own signal on top of the recommendation *against*, shareholders must vote according to their signal in equilibrium. Voting the opposite is dominated, and not conditioning as well. This leaves two cases: CAIS and CAIS-2, which we have addressed. Hence, there are no further equilibria.

□

Now we can turn to the proof of Proposition 2. Suppose there is a PA with $\ell_P \in (\ell_B - \ell_S, \ell_B + \ell_S)$. To show that CAIS is an equilibrium and Pareto-efficient, we use Lemma A.2, which shows that besides CAIS there are three further equilibria in this paremeter space: Rubber-stamping, Protest, and CAIS-2. It remains to show that CAIS Pareto-dominates in this area.

[35]In fact, each of these strategy profiles is a symmetric equilibrium if and only if $\ell_S > \ell_B + \ell_P$.

First, CAIS has the same costs as CAIS-2 and decision qualities are: $\Pi(\hat{\sigma}) = q_B q_P + [(1-q_B)q_P + q_B(1-q_P)]\pi(N)$. $\Pi(\sigma^{CAIS-2}) = (1-q_B)(1-q_P) + [(1-q_B)q_P + q_B(1-q_P)]\pi(N)$. CAIS has higher decision quality iff $q_B q_P > (1-q_B)(1-q_P)$, which always holds as $q_B, q_P > 0.5$. Hence, CAIS Pareto-dominates CAIS-2.

Second, decision quality of Rubber-stamping is q_B and decision quality of Protest is $1 - q_B < q_B$. CAIS has strictly higher decision quality than both iff

$$\begin{aligned}
\Pi(\hat{\sigma}) &> q_B \\
q_B q_P + [q_B(1-q_P) + (1-q_B)q_P]\pi(N) &> q_B \\
q_B(1-q_P)\pi(N) + (1-q_B)q_P\pi(N) &> q_B(1-q_P) \\
(1-q_B)q_P\pi(N) &> q_B(1-q_P)[1-\pi(N)] \\
\frac{\pi(N)}{1-\pi(N)} \cdot \frac{q_P}{1-q_p} &> \frac{q_B}{1-q_B} \\
\log\left(\frac{\pi(N)}{1-\pi(N)}\right) + \log(\frac{q_P}{1-q_p}) &> \log(\frac{q_B}{1-q_B}) \\
\ell_N + \ell_P &> \ell_B, \qquad \text{(A.1)} \\
\text{where } \ell_N := \log\left(\frac{\pi(N)}{1-\pi(N)}\right).
\end{aligned}$$

Since $\ell_N > \ell_S$ and by assumption $\ell_P > \ell_B - \ell_S$, we have $\ell_N + \ell_P > \ell_S + \ell_P > \ell_B$. Hence, CAIS leads to strictly higher decision quality than both Rubber-stamping and Protest. It induces higher costs f and c. Thus, for low enough costs, CAIS Pareto-dominates them.

Now, suppose that $\ell_P \notin (\ell_B - \ell_S, \ell_B + \ell_S)$. To show that the Pareto-efficient equilibrium is Rubber-stamping, we use again Lemma A.2. Under Assumption BIB and for $\ell_P \notin (\ell_B - \ell_S, \ell_B + \ell_S)$, only two equilibria remain: Rubber-stamping and Protest. Rubber-stamping Pareto-dominates because it leads to higher decision quality $\Pi(\sigma^{Rubber}) = q_B > 0.5 > 1 - q_B = \Pi(\sigma^{Protest})$, while it induces the same costs.

A.3 Proof of Proposition 3

Suppose there is a PA and Assumption PAF holds.[36] Let S be the set of all pure strategy profiles.[37] Let $\Pi : S \to [0,1]$ be the decision quality. Let $S^{max} \subset S$ be the set of all strategy profiles that maximize Π. As S is finite, S^{max} is non-empty.

A player's strategy is called *minimal* if the voting strategy conditions on all pieces of information that are acquired. For instance, consider information-acquisition strategy Subscribe-InvestIFF*against*: When an own signal has been acquired after vote recommendation *against*, the voting behavior must differ between signal realization a and signal

[36] We are particularly thankful to Maximilan Janisch and Thomas Lehéricy who suggested this proof idea for this proposition. Interestingly, it can be applied to asymmetric equilibria, but not to symmetric equilibria. The reason is that when studying symmetric equilibria, the space under consideration changes because deviations to strategies that thus form an asymmetric strategy profile are admitted. An alternative proof approach would consider our game as a game with a potential function in the sense of (Monderer and Shapley, 1996).

[37] Then there are 16 strategies for each shareholder. We restrict attention to pure strategies.

realization b to be part of a minimal strategy. Observe that for any strategy that is not minimal, the voting behavior can be mimicked by a strategy with lower costs, saving c or f or both. A strategy profile(!) is called *minimal* if all players' strategies are minimal *and* if any player's reduction of information acquisition (not subscribing and/or not acquiring an own signal) changes the decision quality.[38] Now let $S^* \subset S^{max}$ be the strategy profiles that are minimal and lead to maximal decision quality.

We first show, as Claim 1, that all $\sigma^* \in S^*$ are equilibria. A shareholder can only achieve higher utility than in σ^* by higher decision quality or lower costs. Higher decision quality is impossible per definition. Lower costs reduce decision quality because σ^* is minimal. As costs are by assumption sufficiently small, lower costs that reduce decision quality are not an improvement.

Second, we show, as Claim 2, that any Pareto-efficient strategy profile must belong to S^*. Suppose first that σ' is Pareto-efficient, but not in S^*. Then it is either not maximizing decision quality or not minimal. If it does not maximize decision quality, take another strategy profile, say σ^*, that does and every shareholder is better off. The reason is that any difference in decision quality is always larger than the difference in costs, which are by assumption sufficiently small; formally: $\Pi(\sigma^*) - \Pi(\sigma') > c + f \implies u_i(\sigma^*) > u_i(\sigma')$ for all i. If σ' is not minimal, there is a player who can save costs without affecting decision quality and utility of other shareholders.

By Claim 1 and 2 together, each Pareto-efficient strategy profile is an equilibrium with maximal decision quality. Hence, there clearly exists an equilibrium, say σ^*, with maximal decision quality. Now consider any Pareto-efficient equilibrium σ, i.e., an equilibrium that is not Pareto-dominated by any other equilibrium. This equilibrium must also maximize decision quality, i.e., $\sigma \in S^{max}$. Otherwise, it would be dominated by σ^*, as higher decision quality means strictly higher utility for every shareholder (again due to the small cost assumption). Therefore, *every Pareto-efficient equilibrium must maximize decision quality.*

Let us now turn to the model without a PA.[39] Let T be the set of all pure strategy profiles (without a PA). In full analogy to above, we define T^* as the set of strategy profiles that are maximizing decision quality and that are minimal. Now observe that any strategy profile in T (without a PA) corresponds to a strategy profile in S (with a PA) where simply no player subscribes to the PA's vote recommendation. Consequently, any decision quality obtained with a strategy profile in T can also be obtained with a strategy profile in S. Let $\tilde{\sigma} \in S$ be a strategy profile that mimicks the maximal decision quality obtainable without a PA. Let $\bar{\Pi}^{with-PA}$, respectively $\bar{\Pi}^{no-PA}$, denote the maximal decision quality in the framework with a PA, respectively without a PA (for any strategy profile in the corresponding games). Since in the Pareto-efficient Nash equilibria with a PA, decision quality is maximal, we have $\Pi(\sigma^*) = \bar{\Pi}^{with-PA} \geq \Pi(\tilde{\sigma}) = \bar{\Pi}^{no-PA}$ for any Pareto-efficient equilibrium σ^* in the game with a PA.

[38] Indeed, there are strategy profiles where all strategies are minimal, but still some players can reduce their information-acquisition without affecting the decision. For instance, when $N-1$ players play NotSubscribe-NotInvest and vote *yes* as if in Rubber-stamping and one player does not subscribe to the PA but unconditionally invests into an own signal, as in UNIS. If the latter player stops acquiring an own signal, decisions are unaffected because she is never pivotal. By definition, such strategy profiles are not minimal.

[39] There are only four strategies for each player: as in Rubber-stamping, as in Protest, as in UNIS, and voting contrary to the own signal.

References

Admati, A. R., and P. Pfleiderer. 1990. Direct and indirect sale of information. *Econometrica* 58:901--28.

Alexander, C. R., M. A. Chen, D. J. Seppi, and C. S. Spatt. 2010. Interim news and the role of proxy voting advice. *Review of Financial Studies* 23:4419--54.

Angeletos, G.-M., and A. Pavan. 2007. Efficient use of information and social value of information. *Econometrica* 75:1103--42.

Austen-Smith, D., and J. S. Banks. 1996. Information aggregation, rationality, and the Condorcet Jury Theorem. *American Political Science Review* 90:34--45.

Bar-Isaac, H., and J. Shapiro. 2020. Blockholder voting. *Journal of Financial Economics* 136:695--717.

Bhattacharya, S., J. Duffy, and S. Kim. 2017. Voting with endogenous information acquisition: Experimental evidence. *Games and Economic Behavior* 102:316--38.

Brav, A., and R. D. Mathews. 2011. Empty voting and the efficiency of corporate governance. *Journal of Financial Economics* 99:289--307.

Buechel, B., and L. Mechtenberg. 2019. The swing voter's curse in social networks. *Games and Economic Behavior* 118:241--68.

Choi, S., J. E. Fisch, and M. Kahan. 2010. The power of proxy advisors: Myth or reality? *Emory Law Journal* 59:869--907.

De Caritat, Marie Jean Antoine Nicolas, M. d. C. 1785. *Essai sur l'application de l'analyse à la probabilité des décisions rendues à la pluralité des voix*. L'imprimerie royale.

Ertimur, Y., F. Ferri, and D. Oesch. 2013. Shareholder votes and proxy advisors: Evidence from say on pay. *Journal of Accounting Research* 51:951--96.

Feddersen, T., and W. Pesendorfer. 1996. The swing voter's curse. *American Economic Review* 408--24.

---------. 1997. Voting behavior and information aggregation in elections with private information. *Econometrica* 1029--58.

---------. 1998. Convicting the innocent: The inferiority of unanimous jury verdicts under strategic voting. *American Political Science Review* 23--35.

Gerardi, D., and L. Yariv. 2007. Deliberative voting. *Journal of Economic Theory* 134:317--38.

Gershkov, A., and B. Szentes. 2009. Optimal voting schemes with costly information acquisition. *Journal of Economic Theory* 144:36--68.

Glaeser, E. L., and C. R. Sunstein. 2009. Extremism and Social Learning. *Journal of Legal Analysis* 1:263--324.

Grosser, J., and M. Seebauer. 2016. The curse of uninformed voting: An experimental study. *Games and Economic Behavior* 97:205--26.

Hellwig, C., and L. Veldkamp. 2009. Knowing What Others Know: Coordination Motives in Information Acquisition. *Review of Economic Studies* 76:223--51.

Iaryczower, M., X. Shi, and M. Shum. 2018. Can Words Get in the Way? The Effect of Deliberation in Collective Decision Making. *Journal of Political Economy* 126:688--734.

Iliev, P., and M. Lowry. 2015. Are mutual funds active voters? *Review of Financial Studies* 28:446--85.

Jensen, M., and W. H. Meckling. 1976. Theory of the firm: Managerial behavior, agency costs, and ownership structure. *Journal of Financial Economics* 3:305--60.

Jeong, D. 2019. Using cheap talk to polarize or unify a group of decision makers. *Journal of Economic Theory* 180:50--80.

Kawamura, K., and V. Vlaseros. 2017. Expert information and majority decisions. *Journal of Public Economics* 147:77--88.

Larcker, D. F., A. McCall, and G. Ormazabal. 2013. Proxy advisory firms and stock option repricing. *Journal of Accounting and Economics* 56:149--69.

---------. 2015. Outsourcing shareholder voting to proxy advisory firms. *Journal of Law and Economics* 58:173--204.

Levit, D., and N. Malenko. 2011. Nonbinding voting for shareholder proposals. *The Journal of Finance* 66:1579--614.

Levit, D., N. Malenko, and E. Maug. 2021. The Voting Premium. *Working Paper.*

---------. 2022. Trading and Shareholder Democracy. *The Journal of Finance* forthcoming.

Levy, G., and R. Razin. 2015. Correlation neglect, voting behavior, and information aggregation. *American Economic Review* 105:1634--45.

Li, T. 2018. Outsourcing corporate governance: Conflicts of interest within the proxy advisory industry. *Management Science* 64:2473--972.

Liu, S. 2019. Voting with public information. *Games and Economic Behavior* 113:694--719.

Ma, S., and Y. Xiong. 2021. Information bias in the proxy advisory market. *Review of Corporate Finance Studies* 10:82--135.

Malenko, A., and N. Malenko. 2019. Proxy advisory firms: The economics of selling information to voters. *The Journal of Finance* 74:2441--90.

Malenko, A., N. Malenko, and C. Spatt. 2021. Creating controversy in proxy voting advice. *Working Paper*.

Malenko, N., and Y. Shen. 2016. The role of proxy advisory firms: Evidence from a regression-discontinuity design. *Review of Financial Studies* 29:3394--427.

Matsusaka, J. G., and C. Shu. 2021. Does proxy advice allow funds to cast informed votes? *Working Paper*.

Matvos, G., and M. Ostrovsky. 2006. Strategic Proxy Voting. *Working Paper*.

Maug, E. 1999. How effective is proxy voting? Information aggregation and conflict resolution in corporate voting contests. *Working Paper*.

Maug, E., and K. Rydqvist. 2009. Do shareholders vote strategically? Voting behavior, proposal screening, and majority rules. *Review of Finance* 13:47--79.

Maug, E., and B. Yilmaz. 2002. Two-class voting: A mechanism for conflict resolution. *American Economic Review* 92:1448--71.

McCahery, J. A., Z. Sautner, and L. T. Starks. 2016. Behind the scences: The corporate governance preferences of institutional investors. *Journal of Finance* 71:2905--32.

Mechtenberg, L., and J.-R. Tyran. 2019. Voter motivation and the quality of democratic choice. *Games and Economic Behavior* 116:241--59.

Meirowitz, A., and S. Pi. 2022. The Shareholder's Dilemma: Voting and Trading. *Journal of Financial Economics* 146:1073--96.

Monderer, D., and L. S. Shapley. 1996. Potential games. *Games and Economic Behavior* 14:124--43. ISSN 0899-8256. doi:https://doi.org/10.1006/game.1996.0044.

Morton, R., and J.-R. Tyran. 2011. Let the experts decide? Asymmetric information, abstention, and coordination in standing committees. *Games and Economic Behavior* 72:485--509.

Nitzan, S., and J. Paroush. 1982. Optimal decision rules in uncertain dichotomous choice situations. *International Economic Review* 289--97.

Parlasca, M., and P. Voss. 2023. Voting and trading on proxy advice. *Available at SSRN 4673547* .

Persico, N. 2004. Committee design with endogenous information. *Review of Economic Studies* 71:165--91.

Sangiorgi, F., and C. Spatt. 2017. The economics of credit rating agencies. *Foundations and Trends in Finance* 12:1--116.

Van Wesep, E. D. 2014. The Idealized Electoral College voting mechanism and shareholder power. *Journal of Financial Economics* 113:90--108.