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ABSTRACT

Do Shareholders vote Strategically? Evidence on the Advisory Role of Annual General Meetings*

We investigate if the proxy voting process transmits valuable information from shareholders to management. A simple strategic voting model is developed and tested in a large sample of management proposals. The evidence suggests that voting is strategic in the sense that shareholders take into account the information of the other shareholders when making their voting decisions. The structural estimation suggests that strategic voting saves up to 30% of the value at stake in a proposal compared to naive voting strategies, especially for voting on governance proposals. The data also suggest that super majority requirements are never optimal. We conclude that shareholder meetings have an advisory function in addition to the disciplining role typically emphasized in the literature.

JEL Classification: D44 and G10
Keywords: information aggregation, shareholder meeting, sincere voting, strategic voting and super majority

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Submitted 20 November 2003

1 Introduction

This paper addresses two questions on shareholder voting. First, we want to understand the advisory role of the proxy voting process and the shareholder meeting: Is valuable information transmitted from shareholders to management for decision making? Second, do shareholders vote strategically by conditioning their voting behavior on their own private information as well as on the voting behavior of other shareholders? Our approach differs from the literature on shareholder voting that emphasizes the conflict of interest between shareholders and management. We parameterize and estimate a simple model of strategic voting with roots in the literature on political voting. The model is not rejected by our data, and the evidence supports the view that shareholders vote strategically. We also find that super majority requirements are never optimal. To the best of our knowledge, this is the first empirical paper that tests a strategic voting model on field data, and also the first study of shareholder voting that uses an information-based approach.[1]

The literature on political voting has emphasized two roles of voting: preference aggregation, where voters with different utility functions over proposals or candidates need to agree, and information aggregation, where dispersed information that cannot be easily communicated is incorporated into the decision.[2] Naturally, the informational role of voting is more important if preferences across voters are homogeneous. Shareholders have a common interest to raise the stock price and more than 80% of the shares get voted in large US corporations.[3] Given these observations it is surprising that informational models of voting have so far played only a minor role in the analysis of shareholder voting. Instead, the empirical literature on shareholder voting has focussed on the wealth consequences of shareholder activism and largely failed to detect significant stock price reactions around the proxy mailing date.[4] As a result, an implicit consensus has emerged that

[1] An experimental study by Guarnaschelli, McKelvey, and Palfrey (2000) also reports evidence of strategic voting.

[2] See Austen-Smith and Banks (1996) who formulated an early model of information aggregation through strategic voting very similar to ours. Subsequent papers include Feddersen and Pesendorfer (1996), (1998). Feddersen and Pesendorfer (1997) and Maug and Yilmaz (2002) also include heterogeneous preferences.

[3] Estimates of shareholder turnout are reported by Brickley, Lease, and Smith (1988), Young, Millar, and Glezen (1992), Bethel and Gillan (2002), and below.

[4] Event studies of management proposals include DeAngelo and Rice (1983), Linn and McConnell (1983), Partch (1987), Jarrell and Poulsen (1987) and (1988), McWilliams (1990), and Bhagat and Jefferis (1991), and studies of shareholder proposals Karpoff, Malatesta, and Walkling (1996), and Strickland, Wiles, and Zenner (1996). Karpoff (2001) concludes in his survey that shareholder proposals have no measurable influence on firm value.

voting is not an important part of corporate governance, and a recent survey by Becht, Bolton, and Röell (2003) does not even mention voting models.

We analyze the behavioral implications of information-based, strategic voting from a large sample of management proposals. We use a variant of the model of Feddersen and Pesendorfer (1998) and derive new empirical tests. The model is simple: shareholders cast their votes on a binary proposal. In one state of the world, accepting the proposal increases shareholder value, in the other state of the world shareholder value is reduced. Shareholders have imperfect private information about this event, which may also be interpreted as a private interpretation of publicly available data. This information is not communicated in public to find a consensus, so some dispersion of beliefs about the quality of the proposal remains.

Now, suppose shareholders base their decision only on publicly available information and their privately observed signal without regard to what the other shareholder's may know about the proposal. In accordance with the literature we call such a naive strategy "sincere" voting. In this case, voting behavior depends only on the information structure and not on the majority requirement. As a result, the expected support for the proposal is *independent* of the majority rule, while the likelihood of passing the proposal *decreases* with the majority requirement. However, sincere voting is generally not an equilibrium (Austen-Smith and Banks, 1996). Instead, shareholders may vote "strategically" and also take into account the fact that their vote is decisive only in a small number of cases where the votes of all other shareholders would result in a tie. The situation is similar to a common value auction, where bidders condition also on the event that they submit the winning bid in order to avoid the "winner's curse." If shareholders vote strategically, then their voting behavior will depend on both the information structure and the majority rule such that the expected support for the proposal *increases* with the majority rule, whereas the likelihood of passing the proposal becomes *independent* of the majority requirement. These predictions form the basis for our empirical analysis.

We estimate the model for two types of equilibria. In the first equilibrium we assume that all shareholders behave identically given identical pieces of information. This gives rise to equilibria in mixed strategies, e.g., shareholders sometimes reject a proposal even though they have favorable private information. The second equilibrium has all shareholders playing pure strategies, but then identical shareholders behave differently, e.g., some may reject the proposal regardless of their information. We show that both equilibria have similar, but not identical implications that can be tested. Interestingly, we can reject sincere voting in favor of strategic voting, but mixed strategy equilibria cannot be empirically separated from pure strategy equilibria. The primitive parameters of the model can be imputed from the data and we can make inferences on the prior information shared by all shareholders before the vote and on the precision of their signals that could rationalize the voting results we observe in the data. A number of interesting results emerge.

Firstly, we find that strategic voting makes a substantial difference to the value of the firm, albeit only for some types of proposals. These include especially proposals on the governance structure of the firm, and, to a lesser extent, proposals on executive compensation plans and issues of new equity securities. For these, strategic voting improves the value of the firm by about 2%-30% of the value of the proposal. Consider a simple example with a proposal that stands to increase or decrease the value of the firm by $\$1bn$. Then strategic voting improves firm value by $\$2m - \$300m$ relative to sincere voting, but only if the majority requirement differs significantly from the optimum, for example by requiring a 2/3 majority where a simple majority would be optimal. The economic significance of strategic voting stands in sharp contrast to the event study results which fail to detect significant stock price reactions to the announcement of management proposals.

Secondly, we investigate when super majority requirements are optimal. We derive the optimal majority requirement as a function of the parameters of the model and test for the optimality of simple majority rules. Even though our parameter estimates are tight, we never find super majority requirements to be optimal. We conclude that super majority rules are inefficient, but also find that the costs are small. They typically amount to much less than 1% of the value of a proposal if shareholders vote strategically. If shareholders did not vote strategically, then the costs of super majority requirements would be large.

Finally, a rather puzzling implication of our model is that shareholders' information needs to be relatively precise. While we have no evidence to the contrary, we do not find this result very plausible, given that it would require shareholders to carefully evaluate proposals independently.

We would have thought that at most a small number of large shareholders would have the incentive to do this. In some sense, this is an implication of another notable observation of shareholder voting that other researchers have made before: the voting outcomes are largely known in advance.[5] For many proposals (on mergers, for example), management is assured of a majority to pass. For the model, this implies that the prior probability of accepting such a proposal is very high. Then the small number of rejections of proposals can only be rationalized by attributing precise information to shareholders.

The rest of the paper is organized as follows: Section 2 develops the basic model with an emphasis on the empirical implications. The data set is described in Section 3. The empirical analysis is carried out in Section 4. Section 5 concludes.

2 The Theory of Strategic Voting

In this section we formulate the model and present relevant theoretical results. Both old and new results are presented in order to keep the presentation self-contained. The model is similar to Feddersen and Pesendorfer (1998). They focus on the deficiency of the unanimity rule in a jury setting, while we study the relationship between the optimal and the statutory majority requirement for corporate voting.

2.1 The Model and Voting Equilibria

Structure of the Model. Consider a voting contest about a proposal (merger, compensation plan, recapitalization) that can be either accepted or rejected. The payoff v to the firm from accepting the proposal depends on the state of nature. Acceptance of the proposal increases the value of the firm by $v = 1$ with probability p and decreases it by $v = -1$ with probability $1 - p$. Hence, the ex-ante expected payoff from accepting the proposal is $E(v) = 2p - 1$.

Suppose there are N shareholders who have one vote each and acquire information in the form of a binary signal. All votes are cast simultaneously and the voting rule requires that a votes are

[5]Brickley, Lease and Smith (1988) report that 95% of management proposals related to antitakeover amendments pass, and Karpoff, Malatesta, and Walkling (1996) find that 97.5% of all shareholder proposals fail.

in favor of the proposal. The signal observed by shareholder i, $\sigma_i \in \{0,1\}$, indicates the state of the world correctly with a probability strictly less than 1:

$$\Pr(\sigma = 1|v = 1) = \Pr(\sigma = 0|v = -1) = 1 - \varepsilon, \quad 0 < \varepsilon < \frac{1}{2}. \tag{1}$$

The error probability is ε and the signal therefore correct with probability $1-\varepsilon$. The private signals are statistically independent conditional on the state of nature. The probability of receiving a good signal is:

$$\pi = p(1-\varepsilon) + (1-p)\varepsilon. \tag{2}$$

Inference. We analyze statistical inference by defining a function $\beta(\cdot)$ that maps the number of positive and negative signals into Bayesian posteriors about the probability of being in the success state where $v = 1$ as follows: Let g be the number of *good* signals ($\sigma_i = 1$) and k the total number of signals received. In Appendix A.1 we derive an expression for $\beta(g,k)$.

Benchmark. Clearly, given noisy signals from (1), any decision-rule involves errors. Denote the probability of a type I-error by e_I (rejecting a value-increasing proposal) and the probability of a type II-error by e_{II} (accepting a value-reducing proposal). We now develop a benchmark for all decision rules. There are no conflicts of interest, hence we can analyze any decision by looking at a representative shareholder who collects N signals from all shareholders to arrive at an optimal decision. Given our assumption of symmetric payoffs, the objective of the representative shareholder is to minimize the expected loss, which we denote by L:

$$L = pe_I + (1-p)\, e_{II}. \tag{3}$$

Conditional on observing a good signals, the expected value of accepting the proposal equals $2\beta\,(a,N) - 1$. Therefore, the expected loss is minimized and firm value maximized whenever $\beta(a,N) \geq 1/2$, which is formally proved in Appendix A.2. Since $\beta(a,N)$ increases with the number of good signals, the decision rule of the representative shareholder can be expressed as a simple cut-off rule, where the proposal is accepted for any $a \geq a^*$, and a^* is defined by $\beta\,(a^*,N) = 1/2$.

In Appendix A.3, we derive the following expression for the optimal cut-off rule:

$$a^* = \frac{N}{2} - \frac{1}{2\ln\left(\frac{1-\varepsilon}{\varepsilon}\right)} \ln\left(\frac{p}{1-p}\right) \tag{4}$$

subject to a^* lying between 0 and N.[6] The cutoff a^* exhibits two interesting properties. First, a^* decreases with the prior p: less plausible proposals have a lower prior and therefore need a larger number of positive signals in their favor. Second, a^* equals the simple majority $N/2$ if the amount of information collected by all shareholders is large, i.e., whenever the signals observed by shareholders are either very precise (ε is small) or the number of shareholders N is large.[7]

Information and Voting. We now consider the more realistic case where no such representative shareholder exists and information is revealed and aggregated through voting. Information is revealed perfectly through voting only if shareholders always vote "yes" whenever they observe good signals, and "no" whenever their signals are bad. In accordance with the literature we call this strategy "sincere voting."

Austen-Smith and Banks (1996) show that sincere voting is generally not an equilibrium. To see this, consider a situation where all N shareholders vote sincerely and a votes are required to pass the proposal. Now focus on the N^{th} shareholder. She has an impact on the final outcome only if she is pivotal, which is the case whenever $a-1$ of the $N-1$ other shareholders vote in favor and $N-a$ vote against. If all other shareholders vote sincerely, this implies that they observe $a-1$ good signals and $N-a$ bad signals. Then the N^{th} shareholder votes sincerely, if and only if the majority requirement a satisfies:

$$\beta(a-1, N) \leq \frac{1}{2} \leq \beta(a, N). \tag{5}$$

If the first inequality is violated, the N^{th} shareholder would vote in favor even after observing a

[6]If $a^* < 0$, then $\beta(0, N) > 1/2$ (proposal is always good), and if $a^* > N$, then $\beta(N, N) < 1/2$ (proposal is always bad).

[7]The optimality of the simple majority for large N is a consequence of the assumption that errors are symmetric, i.e., that $\Pr(\sigma = 1|v = -1) = \Pr(\sigma = 0|v = 1) = \varepsilon$. Intuitively, this symmetry implies that one good signal always cancels one bad signal, which would not be the case if the likelihood of errors were different across states.

bad signal, and if the second inequality is violated, he would do the opposite and vote against also after observing a good signal. Condition (5) implies that sincere voting is an equilibrium outcome only for a very specific majority requirement. From our discussion above it follows immediately that this majority requirement is a^*, the decision rule of the representative shareholder. However, the corporate charter specifies a statutory decision rule a which does not vary with the parameters $\{p, \varepsilon, N\}$ according to (4). As a result, the statutory majority rule may deviate from the optimal rule.

Voting if $a \neq a^*$. In this case, the model has two classes of equilibria. The first class are symmetric equilibria, which are generally in mixed strategies. The second class are equilibria in pure strategies, which are asymmetric, so shareholders with the same information may choose different strategies. Mixed strategy equilibria are economically more plausible because they do not assume that shareholders coordinate their strategies through some exogenous mechanism that assigns shareholders different roles. On the other hand, pure strategy equilibria are linear and can be estimated with ordinary least squares. Hence, we shall examine both.

Symmetric Equilibria. The symmetric equilibria of this voting game were analyzed by Feddersen and Pesendorfer (1998), who have shown that all symmetric equilibria are in mixed strategies whenever $a \neq a^*$. Denote by ω_σ the probability to vote in favor of the proposal of a shareholder who has observed the signal $\sigma \in \{0, 1\}$. Hence, any symmetric mixed strategy equilibrium can be fully described by a tuple (ω_0, ω_1). Based on the analysis of Feddersen and Pesendorfer (1998) and using (4) we prove the following proposition in Appendix B.1:

Proposition 1 ***(Mixed Strategy Equilibria).*** *There exists a responsive mixed strategy equilibrium whenever* $2a^* - N < a < 2a^* + 1$ *where the mixing probabilities* ω_σ *are given as follows:*
(i) If $2a^* - N < a < a^*$*, then* $\omega_0 = 0$ *and*

$$0 < \omega_1 = \frac{h - 1}{h(1 - \varepsilon) - \varepsilon} < 1 \quad , \tag{6}$$

where

$$h = \left(\frac{1-\varepsilon}{\varepsilon}\right)^{\frac{N+a-2a^*}{N-a}} \quad . \tag{7}$$

(ii) If $a^* + 1 < a < 2a^* + 1$, *then* $\omega_1 = 1$ *and*

$$0 < \omega_0 = \frac{f\,(1-\varepsilon) - \varepsilon}{1 - \varepsilon\,(1+f)} < 1 \tag{8}$$

where

$$f = \left(\frac{1-\varepsilon}{\varepsilon}\right)^{\frac{a-1-2a^*}{a-1}} \quad . \tag{9}$$

(iii) If $a^* \leq a \leq a^* + 1$, *then* $\omega_0 = 0$ *and* $\omega_1 = 1$, *and the equilibrium is in pure strategies.*

The proposition shows that shareholders either vote according to their information after observing a bad signal and mix after observing a good signal [case (i)], or the opposite [case (ii)]. If the majority rule is optimal [case (iii)], equilibrium is in pure strategies which means that voting is sincere. The mixing probabilities ω_0 and ω_1 increase with a and decrease with a^*. The dependence on the majority rule is a distinguishing property of strategic voting. We discuss the intuition and the implications after showing that pure strategy equilibria share the same qualitative property.

Pure Strategy Equilibria. In all pure strategy equilibria some shareholders ignore their information and vote "yes" or "no" independently of their information. We call this strategy "passive" voting. The remaining shareholders vote sincerely and we denote their number with k. We prove the following theorem in Appendix B.2:

Proposition 2 ***(Pure Strategy Equilibria)****. For any set of parameters such that* $\beta(0, N) \leq 1/2 \leq \beta(N, N)$, *a number* k *of the* N *shareholders vote sincerely:*

$$k = \max\{N - 2\,|a^* - a|\,, 0\}\,, \tag{10}$$

where a^* *is defined from condition (4). The remaining* $N - k$ *shareholders vote passively, "yes" if* $a \geq a^*$ *and "no" if* $a < a^*$*. The number of passive voters is strictly positive if* $a \neq a^*$*.*

The number of sincere voters is a linear, decreasing function of the absolute difference between the statutory and the optimal majority rule, $|a^* - a|$: if the statutory majority rule a exceeds the optimal cut-off a^*, then some shareholders passively vote "yes," otherwise some shareholders passively vote "no." The number of sincerely voting shareholders can be zero, in which case the equilibrium would be non-responsive.

2.2 Comparative Statics and Efficiency

Proportion in Favor While the mechanics of pure strategy and mixed strategy equilibria are somewhat different, they share the property that shareholders compensate for the bias inherent in the voting rule. Specifically, if the statutory majority rule exceeds the optimal rule, $a > a^*$, then shareholders vote in favor more often. In mixed strategy equilibria, all shareholders with a good signal *and* some of the shareholders with a bad signal vote in favor, and, in pure strategy equilibria, sincerely voting shareholders with a good signal *and* all the passively voting shareholders vote in favor. If the statutory majority rule is less than the optimal rule, $a < a^*$, the behavior is reversed. An immediate implication of this behavior is that the expected number of votes in favor of a proposal increases with the statutory majority rule, as can be seen in Table 1. It is convenient to normalize all numbers into proportions of the number of shareholders. Let $E(y/N)$ denote the expected proportion in favor of a proposal and define $\alpha = a/N$, $\alpha^* = a^*/N$, and $\kappa = k/N$. The bottom row in Table 1 shows that $E(y/N)$ increases with α under both strategic voting equilibria, whereas sincere voting implies that $E(y/N)$ is independent of α.

	Mixed strategy equilibria.		Pure strategy equilibria		Sincere voting
	$\alpha < \alpha^*$	$\alpha \geq \alpha^*$	$\alpha < \alpha^*$	$\alpha \geq \alpha^*$	
$E(y/N)$	$\pi\omega_1$	$\pi + (1-\pi)\omega_0$	$\pi\kappa$	$\pi\kappa + 1 - \kappa$	π
$\frac{\partial E(y/N)}{\partial \alpha}$	$\pi\frac{\partial \omega_1}{\partial \alpha} > 0$	$(1-\pi)\frac{\partial \omega_0}{\partial \alpha} > 0$	$\pi\frac{\partial \kappa}{\partial \alpha} > 0$	$-(1-\pi)\frac{\partial \kappa}{\partial \alpha} > 0$	0

Table 1: **Expected Proportion in Favor and Majority Rule**: The effect on the expected proportion in favor $E(y/N)$ from increasing the statutory majority rule α for mixed strategy equilibria, pure strategy equilibria, and sincere voting.

The relationship between $E(y/N)$ and α is illustrated numerically in Figure 1. The mixed strategy equilibria plot along the non-linear (solid) function; it is convex for $\alpha < \alpha^*$ and concave for $\alpha > \alpha^*$. The pure strategy equilibria are represented by the piecewise linear (dashed) function with a kink at $\alpha = \alpha^*$. Finally, sincere voting is given by the horizontal (dotted) line. Figure 1 emphasizes the difference between strategic and sincere voting; strategic voting implies that $E(y/N)$ increases with α, no matter which type of equilibrium is played, whereas sincere voting implies no relationship as firms always choose the statutory rule equal to the optimal rule $\alpha = \alpha^*$. Figure 1 also points out the difference between pure and mixed strategy equilibria; pure strategy equilibria are piecewise linear, while mixed strategy equilibria are non-linear. In the figure, we have chosen an extremely low value for ε in order to emphasize the nonlinearity of the mixed strategy equilibria. For larger values of ε, the nonlinearity vanishes and the function converges to that of the pure strategy equilibria.

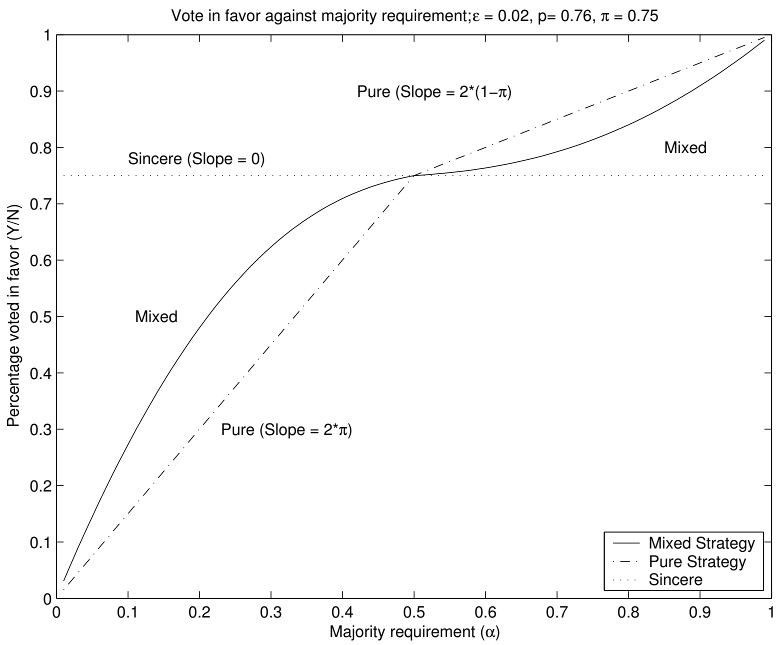

Figure 1: **Expected Proportion in Favor and Majority Rule**: The non-linear function (solid) represents the expected proportion in favor for mixed strategy equilibria, the piecewise linear function (dashed) for pure strategy equilibria, and the horizontal line (dotted) for sincere voting. Parameters are: $\pi = .75$, $p = .76$, $\varepsilon = .02$, $N = 100$, and $\alpha^* = 1/2$.

The proposed empirical test between strategic and sincere voting rests on the assumption that π does not vary with α. Brickley, Lease, and Smith (1988) and (1994) formulate an alternative hypothesis and suggest that management only put forward proposals with a high probability to pass. Therefore, the higher the majority passage requirement α, the stricter the selection of proposals with a high prior probability π. As a result of this proposal selection process, $E(y/N)$ increases with α also under sincere voting. Brickley, Lease, and Smith (1994) label this scenario the "agenda control hypothesis." This possibility is discussed after we have presented our empirical results.

Pass Rate. The probability that a proposal is accepted behaves very differently for strategic and sincere voting. In the bad state, the probability of incorrectly passing the proposal equals e_{II}. Similarly, the probability of passing the proposal in the good state is 1 minus the probability of incorrectly rejecting it, hence $1 - e_I$. In Appendix B.3 we derive the errors e_I and e_{II} for mixed strategy equilibria, and in Appendix B.4 the corresponding functions for pure strategy equilibria. Across states the pass rate equals

$$Pass = p\,(1 - e_I) + (1 - p)\, e_{II}. \tag{11}$$

For all strategic voting equilibria, the pass rate converges relatively fast to the prior probability, except near the extreme sub and super majority requirements:[8]

$$\lim_{N \to \infty} Pass = p. \tag{12}$$

Figure 2 plots the pass rate as a function of α for mixed strategy equilibria (solid), pure strategy equilibria (dotted), and sincere voting (dashed). The most remarkable property of pass rates is that they are largely independent of the majority rule under strategic voting, as the shareholders compensate for higher majority requirements precisely so that the pass rate depends only on the information $\{p, \varepsilon, N\}$ and not on α. Hence, the majority rule would not be a variable management can manipulate in order to influence the likelihood of getting certain types of proposals accepted.[9] With sincere voting, the pass rate decreases monotonically in α, which is intuitive as higher majority

[8] From arguments that parallel Proposition 2 of Feddersen and Pesendorfer (1998), the error probabilities converge to zero: $\lim_{N\to\infty} e_I = \lim_{N\to\infty} e_{II} = 0$. Then, (12) follows immediately.

[9] This relies crucially on the assumption of homogeneous shareholders. A strategic voting model with heterogeneous shareholders and conflicts of interest like Maug and Yilmaz (2002) behaves differently.

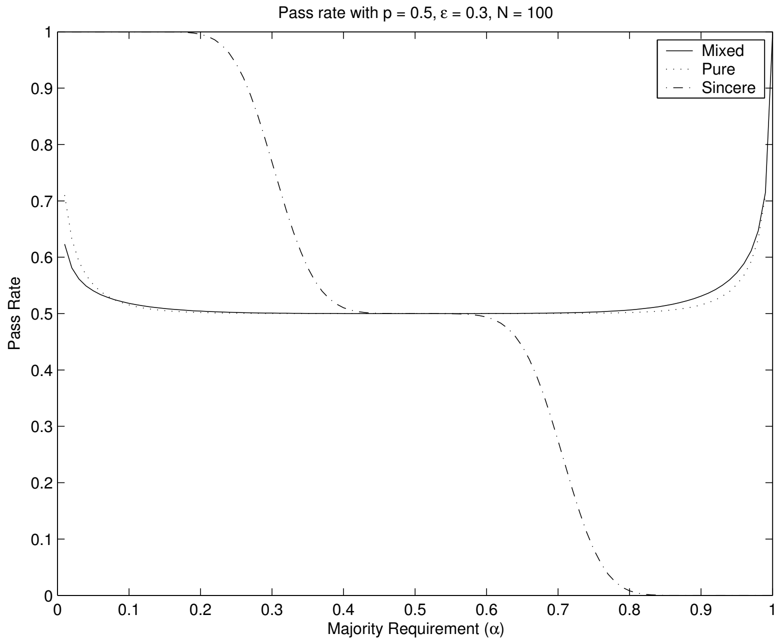

Figure 2: **Pass Rate and Majority Rule**: Probability that a proposal passes for mixed strategy equilibria (solid lines), pure strategy equilibria (dotted lines), and sincere voting (dashed lines). Parameters: $p = .5$, $\varepsilon = .3$, $N = 100$, and $\alpha^* = 1/2$.

requirements make it less likely that a sufficient number of shareholders have observed positive signals. In this case it is easy to show that the pass rate converges to p only if $\varepsilon < \alpha < 1 - \varepsilon$.[10]

Efficiency Properties of Voting Rules We are interested in the efficiency properties of voting rules in order to assess the economic significance of our empirical results. We investigate these by evaluating the loss function (3) for sincere voting, mixed strategy equilibria, and pure strategy equilibria and by comparing these to the representative shareholder's solution as a benchmark. We illustrate the results numerically in Figure 3 as a function of α. Given the parameter values assumed in the figure, the welfare loss is $L = 0$ with perfect information and $L = .5$ with no information. Between the two extremes is the representative shareholder's loss, which is approximately $L = .16$, and represented by the horizontal line.

Figure 3 makes three general points. First, the loss associated with sincere voting is always higher than that from any strategic voting equilibrium (mixed or pure) except when $\alpha = \alpha^*$, i.e.,

[10] In the bad state y/N converges to ε with sincere voting. Likewise, in the good state y/N converges to $1 - \varepsilon$. Then $\lim_{N\to\infty} Pass = 1$ for $\alpha < \varepsilon$, $\lim_{N\to\infty} Pass = p$ for $\varepsilon \leq \alpha < 1 - \varepsilon$, and $\lim_{N\to\infty} Pass = 0$ for $\alpha \geq 1 - \varepsilon$.

sincere voting is an equilibrium if and only if $\alpha = \alpha^*$. For large deviations from α^*, sincere voting—where all information is fully revealed—is almost as bad as decision making without information. Second, the economic advantage of strategic voting over sincere voting is most pronounced in the intermediate range of $|\alpha - \alpha^*|$. When the statutory rule approaches the extremes (unanimity), the welfare loss is large also under strategic voting. The inefficiency of the unanimity rule is the main insight of Feddersen and Pesendorfer (1998). In the intermediate range of $|\alpha - \alpha^*|$, strategic voting makes a bigger difference over sincere voting whenever there is more information (either ε is low or N is large). Third, pure strategy equilibria perform slightly better compared to mixed strategy equilibria, but the difference is small relative to sincere voting. This difference arises because mixing equilibria involve some noise from uncoordinated voting decisions of shareholders that is assumed away in the pure strategy equilibria.

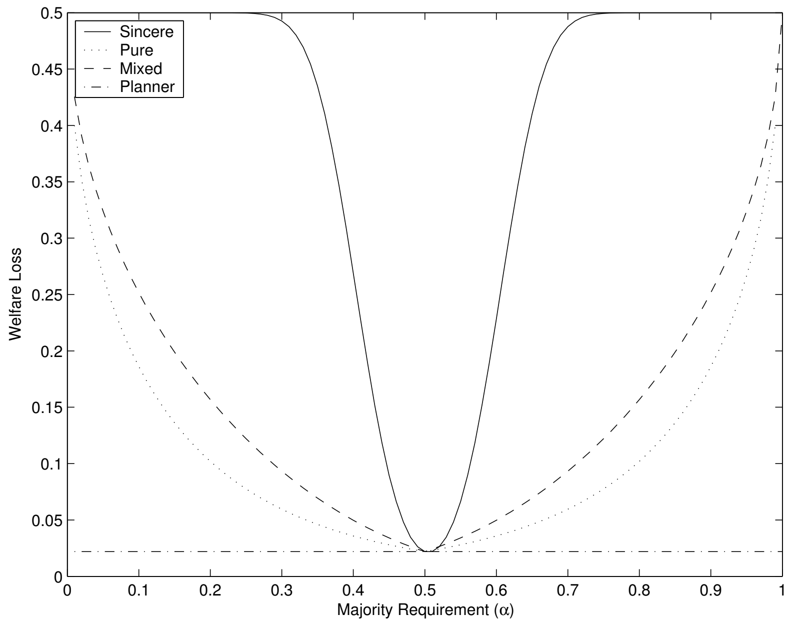

Figure 3: **Welfare Loss and Majority Rule**: Difference in firm value under perfect and imperfect information according to (3) for mixed strategy equilibria (dashed lines), pure strategy equilibria (dotted lines), and sincere voting equilibria (solid lines). The horizontal line is the welfare loss of the representative shareholder. Parameters: $p = .5$, $\varepsilon = .4$, $N = 100$, and $\alpha^* = 1/2$.

3 Institutional Description & Data

3.1 Legal Background

Shareholders' voting rights can be used at the annual general meeting, special meetings, and through shareholder action by written consent. The routine part of the annual general meeting includes approval of annual accounts, the election of the board of directors, and ratification of auditors. Corporate law also mandates shareholder voting on fundamental corporate changes such as mergers and charter amendments, but shareholders cannot vote on operating strategies, dividend policy, or fix employment contracts. Management often put forward other proposals than those required by law. One reason is that approval by the shareholder meeting reduces the probability of a law suit (Easterbrock and Fischel, 1991). Shareholders can also vote on shareholder proposals according to SEC rule 14a-8. Shareholder proposals are only advisory and not legally binding.[11]

An ownership record is established, on average, 35 days before the shareholder meeting (Young, Millar, and Glezen, 1991). Only shareholders according to this register are eligible to vote. When shares are traded after the record date, the new shareholders will not be entitled to vote at the present meeting. The proxy material is sent to shareholders, on average, 20 days before the meeting. The proxy material contains the proxy card, which can be mailed back to the firm, a presentation of the nominated directors, and a description of the proposals. The voting results are announced at the corporate meeting.

According to the prudent man rule, pension funds and mutual funds have a fiduciary duty to vote, and stock brokers must vote shares which are registered in street name when the beneficiary owner fails to do so himself (New York Stock Exchange and American Stock Exchange regulations; see Bethel and Gillan, (2002)). Broker votes apply only to "routine" proposals and the regulations specify a list of "non-routine" proposals which are exempt. Shareholder proposals are always exempt as are charter changes and new equity issues that exceed 5% of the shares. The purpose of these regulations is to enhance the likelihood that the firm's quorum requirement is met. There

[11] Any shareholder with the smaller of 1% of the outstanding shares or $1,000 worth of shares for at least one year is eligible to submit a proposal. Management is obliged to include the shareholder proposal in the proxy material along with a statement which is either in favor or in opposition to the shareholder proposal.

are no state law prohibitions of the firm's choice of quorum and majority rules (Easterbrock and Fischel, 1991). Delaware's default rule is simple majority, but several states have default super majority rules for mergers and charter amendments (2/3 typically). A few states require that the vote to change a super majority charter provision must be by an equal super majority vote.

3.2 Voting Data

Voting data are provided by the Investor Responsibility Research Center (IRRC). The division for Corporate Governance Service collects and summarizes the voting results for significant management and shareholder proposals at company annual and special meetings. Standard agenda items such as the election of the board of directors and the ratification of auditors are not included. We requested a hard paper copy covering the voting results for 1994-1996 and for the first six months of 1997. The hard copy states the company name, the meeting date, a verbal description of the proposal, an indicator of whether the proposal is shareholder sponsored, and the percentage voted *For*, *Against*, and *Abstain*. Whether the proposal passed or failed is also stated along with the decision rule.

We scanned this information from the hard copy into our own electronic data base, which contains the voting results on 6,408 proposals put forward at 3,530 shareholder meetings conducted by 1,716 firms. The firms are many of the largest U.S. corporations of which about 45% are listed on the New York Stock Stock Exchange, 11% on the American Stock Exchange, and the remaining 44% on NASDAQ. In 3,211 cases, there is one shareholder meeting per firm and year, in 158 cases, there are two meetings per firm and year, while in one case there are three meetings conducted by the same firm in one year. General meetings constitute 90.6% of the sample, and special meetings most of the remaining 9.4%. There are five cases where the shareholders act by written consent.[12] About 70% of the general meetings take place in April and May, while about 20% of the special meetings are carried out in December.

We limit our attention to the management proposals for which we have sufficient variation in the majority requirement. Shareholder proposals are common and constitute 1,088 of the 6,408

[12]The ability to act by written consent is constrained by a unanimity requirement in 32 states, and often ruled out by the corporate charter of firms incorporated in one of the other states.

proposals (17%), but there are only ten proposals which are subject to super majority. We further limit our study to the 4,943 management proposals with complete voting results. Data are missing for 255 proposals with no voting results and 122 observations where we know the percentage voted *For*, but not the percentages voted *Against* and *Abstain*.

3.3 Descriptive Statistics

Let the proportion voted in favor of a proposal be y/N. The IRRC data states three different proportions depending on how abstentions and non-voted shares are counted. First, in 1,100 cases (22.2%), the number of shares voted in favor of the proposal is stated as a proportion of the shares voted for and against:

$$y/N = \frac{For}{For + Against} \quad . \tag{13}$$

Second, in 2,647 other cases (53.6%), the number of shares voted in favor is defined as a proportion of the shares voted, including the abstentions:

$$[y/N]_{voted} = \frac{For}{For + Against + Abstain} \quad . \tag{14}$$

Third, in the remaining 1,196 cases (24.2%), the number of shares voted in favor is stated as a proportion of the shares outstanding, including both abstentions and non-voted shares:

$$[y/N]_{outst} = \frac{For}{For + Against + Abstain + Nonvoted} \quad . \tag{15}$$

The theory in Section 2 assumes that votes are cast either in favor or against the proposal and is silent about abstentions and non-voted shares. Therefore, we transform all numbers into proportion of the shares voted for and against according to (13). For consistency, we also redefine the pass/fail variable:

$$\text{PASS} = \begin{cases} 1 & , \text{if } y/N \geq \alpha \quad , \\ 0 & , \text{if } y/N < \alpha \quad . \end{cases} \tag{16}$$

Summary statistics for the dependent variables are provided in Table 2. The average proportion in favor is 89.3% and the pass rate equals 99.7%. Hence, with near certainty, management proposals pass. The fact that the average proportion in favor is less than one, and sometimes substantially less, suggests that shareholders have differences of opinion as some vote "yes" and others "no" on a given proposal.

	mean	std.	min	max
y/N	.893	.101	.154	1.000
PASS	.997	.055	.000	1.000

Table 2: **Voting Results:** Summary statistics for the proportion in favor and the pass rate. There are 4,943 observations.

The distribution of the independent variable can be seen in Table 3. Statutory majority rules range from simple majority to super majority. The statistical inference below is based on how voting on the 197 super majority proposals differs from voting on the mass of 4,746 simple majority proposals.

	Statutory majority rule					Sum
	1/2	3/5	2/3	3/4	4/5	
Number	4,746	2	170	17	8	4,943
Proportion	.960	.000	.034	.003	.002	1.000

Table 3: **Statutory Majority Rules:** A proposal passes if the percentage of the shares in favor exceeds the majority rule.

When the voting results are expressed as proportions of the shares outstanding as in (15), we know the proportion of the shares which are voted. The average shareholder turnout for this subset of our data is 82.4%, which is similar to the estimates reported elsewhere. Abstentions are generally small and average to 1.47% of the shares voted [measured as in (14)], but the extreme observation is 34.4%.

4 Empirical Analysis

4.1 Testing Methodology for Pure Strategy Equilibria

In a pure strategy equilibrium, the probability to vote "yes" equals π. If all shareholders vote sincerely ($\kappa = 1$), then the expected proportion in favor of a proposal is simply $E(y/N) = \pi$ and independent of the statutory majority requirement. Under strategic voting the expected proportion in favor of a proposal is an increasing function of the statutory majority requirement. Combining Table 1 with equation (10) we obtain:[13]

$$E(y/N) = \begin{cases} \pi\kappa & = \pi - 2\pi\alpha^* + 2\pi\alpha \quad \text{if } \alpha < \alpha^* \quad , \\ \pi\kappa + 1 - \kappa & = \pi - 2(1-\pi)\alpha^* + 2(1-\pi)\alpha \quad \text{if } \alpha \geq \alpha^* \quad . \end{cases} \tag{17}$$

We assume the following relationship between the observed and predicted proportion in favor of a proposal:

$$y/N = E(y/N) + \xi \quad , \tag{18}$$

where ξ is an idiosyncratic noise term that arises when π and α^* deviate from their sample averages.[14] Then, we can specify a simple regression model from $E(y/N) = \gamma_0 + \gamma_1\alpha$, such that

$$y/N = \gamma_0 + \gamma_1\alpha + \xi \quad . \tag{19}$$

Combining (17) and (19) by equating corresponding coefficients, we obtain:

$$\begin{aligned} \gamma_0 &= \pi - 2\pi\alpha^* \quad , \gamma_1 = 2\pi \quad , \text{if } \alpha < \alpha^* \quad , \\ \gamma_0 &= \pi - 2(1-\pi)\alpha^* \quad , \gamma_1 = 2(1-\pi) \quad , \text{if } \alpha \geq \alpha^* \quad . \end{aligned} \tag{20}$$

[13]A similar test of strategic versus sincere voting can be derived for the variance and the higher order moments. Given π, the variance of a vote is a constant under sincere voting and a function of α under strategic voting. Since the passive votes have no variance, the variance of a vote peaks at $\alpha = \alpha^*$ when $\kappa = 1$ and decreases when the majority requirement deviates from the optimum ($\kappa < 1$). We omit these tests from the paper, because they rest heavily on the assumption that π is a constant which cannot be ensured in our data.

[14]Small errors may also arise from the shareholders' private information. By the law of large numbers, these errors approach zero as N increases.

Equations (19) and (20) define a piecewise linear regression with the kink at α^*. The upper line of (20) defines the steeper line to the left in Figure 1 where $\alpha < \alpha^*$, and the lower line defines the flatter line to the right where $\alpha \geq \alpha^*$. Each line in (20) represents a system of two linear equations in two unknowns with unique solutions given by:

$$\begin{array}{lll} \pi = \frac{\gamma_1}{2} & , \alpha^* = \frac{1}{2} - \frac{\gamma_0}{\gamma_1} & , \text{if } \alpha < \alpha^* \quad , \\ \pi = 1 - \frac{\gamma_1}{2} & , \alpha^* = \frac{1-\gamma_0}{\gamma_1} - \frac{1}{2} & , \text{if } \alpha \geq \alpha^* \quad . \end{array} \tag{21}$$

Our strategy is to estimate γ_0 and γ_1 from (19) and compute estimates of π and α from (21) and perform tests based on these estimates. Strategic voting implies that $\gamma_1 > 0$ and sincere voting that $\gamma_1 = 0$. We shall also test whether the model parameters fall within the allowed range: $\pi, \alpha^* \in [0, 1]$. In addition, we are interested in testing whether the simple majority is optimal, $\alpha^* = 1/2$. The implied restriction on the regression parameters, from the second line of (21), equals:

$$\gamma_0 + \gamma_1 = 1 \quad \text{if } \alpha \geq \alpha^* = 1/2 \quad . \tag{22}$$

For this test, we can focus on the parameter region $\alpha \geq \alpha^*$, because we have only super majority and no sub majority proposals in our data set.

4.2 Testing Methodology for Mixed Strategy Equilibria

For mixing equilibria, the analog to (17) is (see Table 1):

$$E\left(y/N\right) = \pi\omega_1\left(\varepsilon, p, \alpha, N\right) + \left(1 - \pi\right)\omega_0\left(\varepsilon, p, \alpha, N\right) \quad , \tag{23}$$

where we have written the randomizing probabilities as functions of the exogenous parameters ε, p, α, and N. Posit that $y/N = E(y/N) + \xi$ where ξ is defined as above. We derive an expression for $E(y/N)$ in Appendix C and apply non-linear least squares to estimate:

$$y/N = \begin{cases} \gamma_0 \left(\frac{(1-\gamma_1)^{\frac{\alpha+\gamma_2}{1-\alpha}} - \gamma_1^{\frac{\alpha+\gamma_2}{1-\alpha}}}{(1-\gamma_1)^{\frac{1+\gamma_2}{1-\alpha}} - \gamma_1^{\frac{1+\gamma_2}{1-\alpha}}} \right) + \xi & \text{if } \alpha < \alpha^*, \\ \\ \gamma_0 + (1-\gamma_0) \left(\frac{(1-\gamma_1)\gamma_1^{\frac{\gamma_2}{\alpha}-1} - \gamma_1(1-\gamma_1)^{\frac{\gamma_2}{\alpha}-1}}{(1-\gamma_1)^{\frac{\gamma_2}{\alpha}} - \gamma_1^{\frac{\gamma_2}{\alpha}}} \right) + \xi & \text{if } \alpha \geq \alpha^*, \end{cases} \tag{24}$$

where $\gamma_0 = \pi$, $\gamma_1 = \varepsilon$, and

$$\gamma_2 = \begin{cases} 1 - 2\alpha^* & \text{if } \alpha > \alpha^*, \\ 2\alpha^* & \text{if } \alpha \geq \alpha^*. \end{cases}$$

We can test whether the model parameters are plausible: $\pi, \alpha^* \in [0, 1]$ and, from (2):

$$\begin{array}{ll} \varepsilon \in [0, \pi] & , \text{ if } \pi < .5 \quad , \\ \varepsilon \in [0, 1-\pi] & , \text{ if } \pi \geq .5 \quad . \end{array} \tag{25}$$

As with the pure strategy equilibria, we are also interested in testing whether the simple majority rule is optimal, $\alpha^* = 1/2$. The implied parameter restriction is:

$$\gamma_2 = 1 \quad \text{if } \alpha \geq \alpha^* = 1/2 \quad . \tag{26}$$

4.3 Empirical Results

We begin with the pure strategy equilibria in Table 4. The table reports the estimated regression coefficients (20) and the model parameters (21) for each parameter region. The estimation procedure assumes that $\alpha < \alpha^*$ or $\alpha \geq \alpha^*$, so we impute the break point α^* using (21), and finally test whether the identifying assumption is valid. Table 4 reports the results of ordinary least squares and restricted least squares.[15]

[15] The regression equation (19) is heteroscedastic, because the variables are proportions confined to the unit interval. A weighted least squares procedure means that we estimate:

$$\xi^2 = \delta_0 + \delta_1 \alpha + \nu,$$

and generate regression weights:

$$W = 1/\sqrt{\delta_0 + \delta_1 \alpha}.$$

	Regression				$\alpha < \alpha^*$		$\alpha \geq \alpha^*$	
	γ_0	γ_1	F-test	R^2	π	α^*	π	α^*
Ordinary least squares	.761	.260	n.a.	.0085	.130	-3.433	.870	.420
	(.020)	(.040)			(.020)	(.527)	(.020)	(.064)
Restricted least squares	.782	.218	1.11	.0083	n.a.	n.a.	.891	.500
	(.003)	(.003)	(.293)				(.001)	(.000)

Table 4: **Linear Least Squares Estimation of Pure Strategy Equilibria**: Regression of the proportion in favor on the statutory majority rule. The F-statistic tests the parameter restriction (22). Standard errors are reported below the estimated parameters and p-values below the F-statistics. The standard error of α^* is computed with the delta method. There are 4,943 observations.

We want to emphasize two results. First, the proportion in favor increases significantly with the statutory majority rule. This is consistent with strategic voting and inconsistent with sincere voting. Second, the sum of the regression coefficients is approximately one, $\gamma_0 + \gamma_1 = 1.021$ with standard error of only .020, which means that we cannot reject the hypothesis that the simple majority rule is optimal.[16] As a result, we can focus on the parameter region where $\alpha \geq \alpha^*$, so $\pi = .870$ and $\alpha^* = .420$.[17] These model parameters are consistent with the pure strategy equilibria.

Table 5 summarizes our non-linear least squares estimations for mixed strategy equilibria. Overall, we find that the estimated parameters are such that the mixed strategy equilibria converge to the linear pure strategy equilibria. Therefore, we cannot reject the mixed strategy equilibria and the simple majority is optimal.

Specifically, Table 5 displays the results from three regressions: the unrestricted regression (24) in the top, a restricted regression in the middle using (26), and another restricted regression in the bottom under the joint restriction that $\varepsilon = 1 - \pi$ and $\alpha^* = .5$ [from (25) and (26)]. We report only the results for the parameter region $\alpha \geq \alpha^*$, because the identifying condition $\alpha < \alpha^*$ is violated in the other region. As can be seen in the rightmost column, neither set of model restrictions is rejected and therefore consistent with the data. In all three regressions, the parameter estimates

The weighted least squares reduce the standard errors by about one third. Since these results do not alter any conclusions, they are omitted.

[16]The sum of weighted least squares coefficients is even closer to one, 1.012 with standard error .013.

[17]The standard error of α^* has been computed with the delta method which assumes that the underlying function is continuous. This is consistent with the estimation procedure where γ_0 and γ_1 have been estimated under the assumption that all data points fall either to the left or to the right of the break point α^*.

for π and α^* are close to those of the pure strategy equilibria and consistent with the theory. The mixed strategy equilibria also allow us to impute a point estimate for ε. The regressions in top and the middle show that $\varepsilon \approx .5$, which falls outside the allowed range in (25). However, in the bottom regression, we force the point estimate to be inside the range from 0 to $1-\pi$. Since the restriction cannot be rejected, the parameter estimates of this regression are consistent with the theory.

	γ_0	γ_1	$\gamma_2/2$		Wald
	π	ε	α^*	p	χ^2
Unrestricted least squares	.881	.500	.460	n.a.	n.a.
	(.010)	(.291)	(.032)		
Restricted least squares	.891	.500	.500	n.a.	1.55
	(.001)	(.193)	n.a.		(.213)
Restricted least squares	.891	.109	.500	1.000	3.14
	n.a.	(.001)	n.a.	n.a.	(.208)

Table 5: **Non-Linear Least Squares Estimation of Mixed Strategy Equilibria**: Estimates for the parameter region $\alpha \geq \alpha^*$. The Wald χ^2-statistic of the second regression tests the hypothesis that $\alpha^* = .5$ (26), and the χ^2-statistic of the third regression the joint hypothesis that $p = 1$ and $\alpha^* = .5$ [(25) and (26)]. Standard errors are below the estimated parameters and p-values below the χ^2-statistics. The standard error of the prior probability p is computed with the delta method. The prior p cannot be computed reliably when $\varepsilon \approx .5$. There are 4,943 observations.

The nature of these regressions can seen in Figure 4. We have drawn the estimated restricted least squares regression line (dashed) through the five sample means along with the corresponding mixed strategy equilibria (solid), and sincere voting (dotted, horizontal line). The five sample means are supplemented with vertical lines that represent plus/minus two standard errors away from the mean. As above, we pick an extremely low value, $\varepsilon = .02$, to emphasize the non-linearity of the mixed strategy equilibria. The mass of observations at $\alpha = 1/2$ forces all three functions to pass through the conditional sample mean of the simple majority. The restriction $\alpha^* = 1/2$ [pure strategy equilibria (22) and mixed strategy equilibria (26)], forces the $E(y/N)-$functions to pass through $(1, 1)$. The conditional mean of the other mass point in the data, $\alpha = 2/3$ with 170 (86.3%) of the 197 super majority proposals, lies *above* the pure strategy equilibria line. Therefore, the non-linear least squares-estimator chooses ε such that the $E(y/N)-$function becomes as concave as possible, which occurs when ε approaches .5 and the function becomes linear. When we impose the constraint $\varepsilon \leq 1-\pi$, the estimation procedure chooses $\varepsilon = .109$ which is the maximum allowed.

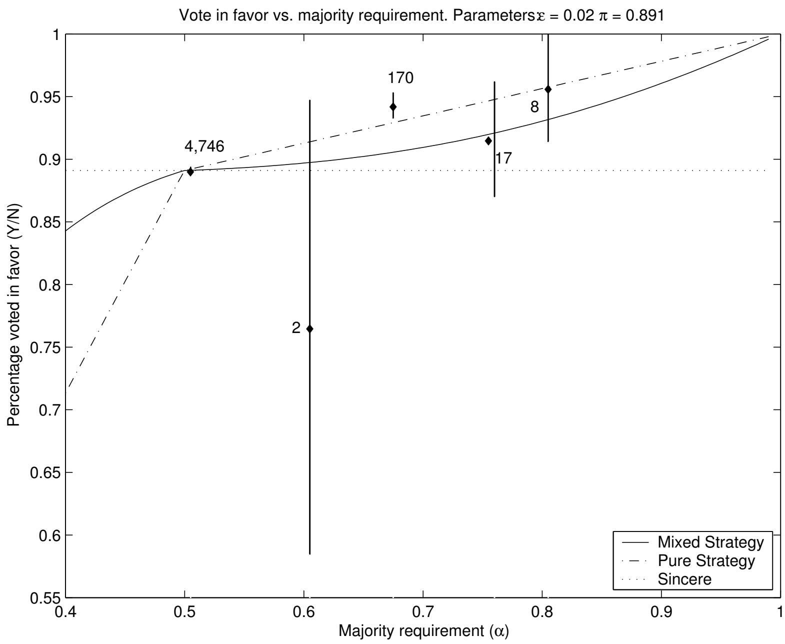

Figure 4: **Predicted and Observed Proportion in Favor**: Mixed strategy equilibria (solid), pure strategy equilibria (dashed), sincere voting (dotted), and conditional sample means *(marked with a cross)*. The labels indicate the number of observations. The vertical lines represent the +/- 2 standard error-bounds around the conditional sample means. Parameters are taken from the restricted least squares regression in Table 4. For mixed strategy equilibria, we assume $\varepsilon = .02$.

Finally, we analyze the pass rate, which is .998 for simple majority proposals (10 failed of 4,746 proposals) and .975 for super majority proposals (5 failed of 197).[18] Table 6 reports the results from regressing PASS on α using both regression analysis and probit. In the top row, we report the ordinary least squares estimates and in the bottom row the weighted least squares estimates using the conditional number of observations as weight, $\sqrt{n_\alpha}$. The weighting procedure takes into account that the pass rate is measured with a great deal of uncertainty for super majority proposals with only a few observations. We can see in Table 6 that the ordinary least squares suggest a significantly negative relationship between pass rate and majority rules. The estimated slope coefficient is similar to the estimate of -.16 reported by Brickley, Lease, and Smith (1988) and (1994). However, the weighted least squares show that the relationship is insignificantly different from zero. This result is consistent with the predictions of strategic voting (see Figure 2), but probably also consistent with sincere voting. Numerical analysis shows that the pass rate function for sincere voting (11) is relatively flat when we use the imputed model parameters in (27) below.

	Regression analysis			Probit analysis			
	Constant	Slope	R^2	Constant	Slope	#Pass	#Fail
Ordinary least squares	1.074	-.152	.0100	5.388	-5.030	4,928	15
	$(98.0)^a$	$(-7.1)^a$		$(9.2)^a$	$(-4.7)^a$		
Weighted least squares	1.033	-.070	.0001	4.782	-3.840	4,933	10
	$(19.4)^a$	(-0.7)		(1.2)	(-0.5)		

Table 6: **Pass Rate and Majority Rule**: Regression of the pass/fail variable on the statutory majority rule. Ordinary least squares and weighted least squares using the conditional number of observations as weight. t-statistics are reported below in parentheses. Symbol ^{a} denotes significance level 5% or better. The actual count at zero is 15, while the weighted count is only 10.

[18]The actual number of failed proposals is 63 (pass rate 98.7%) compared to 15 after scaling (pass rate 99.7%). Scaling does not materially affect our results: 16 (25.4%) of the 63 actual failed proposals are subject to super majority compared to 5 (33.3%) among the remaining 15 failed proposals after scaling.

4.4 Interpretation and Economic Significance

From the restricted least squares in Table 4, the observed pass rate in Table 2, and using (12), we get the following model parameters:

$$\begin{cases} \alpha^* &= .5, \\ \pi &= .891, \\ p &= .997, \\ \varepsilon &= .107. \end{cases} \tag{27}$$

For convenience, we analyze only the pure strategy equilibria while keeping in mind that the parameters of the mixed strategy equilibria are empirically indistinguishable. Several interpretations can be made.

Simple Majority is Optimal. First, $\alpha^* = .5$ means that the simple majority rule is optimal, which is consistent with the theory if shareholders have a lot of private information, i.e., ε is small or N is large. In Table 7 below, we show that the economic cost of super majority is usually small as a result of the shareholders' strategic voting behavior. Nevertheless, the widespread use of super majority in our data set begs the question what is the offsetting benefit. Super majority requirements may help to mitigate conflicts of interest among the shareholders, but analyzing this possibility is outside the scope of our model.[19]

Voting Outcomes are Highly Predictable. Second, $p = .997$ means that management proposals have a high prior probability to be good.[20] This is consistent with the fact that shareholders delegate corporate decision making to experts on running the firm, i.e., management. In addition, management may use their control over the agenda to bias the selection towards high-p proposals,

[19]For example, the Swedish corporate law requires super majority for changing the corporate charter. The purpose is to protect minority shareholders from abuse by large shareholders. The higher the presumption of a conflict of interests, the higher the super majority requirement. For example, changing the economic rights of some shares, but not all, requires 90% quorum and unanimity. Other charter changes such as altering the number of shares and the number of board members requires 2/3 quorum and 2/3 super majority. Also for the purpose of minority protection, there are several rules that allow a sub minority to force certain decisions against the will of all the other shareholders.

[20]Similarly, a low pass rate for shareholder proposals can be attributed to a high prior probability that the proposal is bad.

and management may settle with dissident shareholders before the meeting to ensure a high probability of passage. These behaviors do *not* bias our results, they only shift the distribution towards high$-p$ proposals. As a result of the high prior, the expected pass rate is high and the outcome of a vote is known in advance most of the time.

Private Information is Precise. Third, $\varepsilon = .107$ means that the shareholders' private information is highly accurate. It suggests that shareholders independently of each other invest considerable time in evaluating management proposals, which is hard to reconcile with standard free riding arguments and the notion of a "paradox of voting." Shareholders have also access to information from intermediaries such as Institutional Shareholder Service, whose business is to help institutional shareholders with recommendations how to vote. However, information of this type, which is available to many shareholders, is better captured by the common prior p and not attributed to independently collected, private information. Hence, the accuracy of the shareholders' private information is a puzzle that emerges from our results. The small ε could be an artefact of the simple binary information structure. A model with a richer signal space, where some shareholders have more accurate information than others might have only a small number of well-informed shareholders.

Agenda Control Hypothesis. We have documented two empirical results: (i) A positive relationship between the proportion in favor and the majority rule, and (ii) the regression coefficients sum to approximately one. We interpret the first result (i) that voting is strategic and the second result (ii) that the simple majority rule is optimal. Brickley, Lease, and Smith (1988) and (1994) also report the result (i) and propose as an explanation that the higher the majority requirement, the stricter the selection of proposals with a high prior probability to pass. In terms of our model, this proposal selection process would imply a higher prior for proposals that are subjected to higher majority requirements. This is a qualitative statement which is difficult to refute by any data. Hence, we cannot reject their explanation for the positive relationship between the proportion in favor and the majority rule [result (i)]. However, their explanation is silent about the sum of the regression coefficients [result (ii)], while the strategic voting model offers a specific economic interpretation: The simple majority rule is optimal whenever N is large or ε is small. We think the richer implications of our model puts us ahead in this race.

Economic Significance. The underlying assumptions are that shareholders possess valuable information and, at the same time, are sophisticated enough to condition their vote on their own information as well as the information of all the other shareholders. An implication of those assumptions is that the expected proportion in favor of a management proposal increases from .891 with simple majority to .927 with 2/3 super majority (using the restricted least squares estimates from Table 4). Is the increase by 3.63 percentage points economically significant?

A measure of the welfare gain from strategic over sincere voting can be constructed from the loss function (3). Let L_S and L_{PSE} denote the loss under sincere voting and pure strategy equilibria, respectively. We shall compute the welfare gain both in relative terms, $(L_S - L_{PSE})/L_S$ and in absolute terms, $L_S - L_{PSE}$. These measures are based on the distance between the lines for strategic and sincere voting in Figure 3 above. In addition, we are interested in the cost of super majority rules, which can be measured by $L_{PSE} - L$.

It is instructive to break up the sample into subsets and let the probability π_i vary across proposals. We assume that $\alpha^* = .5$ and impute π_i by estimating the restricted regression model (19) for each category separately. The estimation results are presented in Panel (a) and the model parameters in Panel (b) of Table 7. The most common proposals are the approval of management and employee compensation plans, which constitute 72.3% of all management proposals. The other categories are recapitalization, asset restructuring, charter amendments, and corporate governance proposals.[21] The last category are proposals which regulate the balance of power between management and shareholders and includes proposals known in the literature as antitakeover amendments. The corporate governance proposals are divided into those that give management more power and less power, respectively.[22] We notice that super majority rules are used for all types of proposals,

[21] Some proposals are not easily classified as they are complex packages of several sub proposals. We take the view that proposals are packaged and subject to a single vote to avoid inconsistency. For example, a proposal to restructure the firm's operations is often combined with a proposal to issue stock to finance the restructure. Danielson and Karpoff (1998) use factor analysis to identify proposals that tend to complement each other. See Bhagat and Jefferis (1991) for a different view on proposal packaging.

[22] Many firms which adopted antitakeover measures in the 1980s asked their shareholders to remove these measures ten years later.

although super majority is relatively more frequent for restructuring, charter amendments, and corporate governance proposals.

The welfare measures are summarized in Panels (c), (d), and (e). There are three results. First, Panel (c) shows that strategic voting reduces the likelihood of errors in decision making by about 94%-99% relative to sincere voting. Second, as seen in Panel (d), the welfare gains are economically significant for some proposals, but not for others. The gains are the smallest for charter amendments and the largest for corporate governance proposals that increase managerial power. If a corporate governance proposal puts \$1*bn* of shareholder value at stake, the welfare gain is between \$70m and \$320m relative to sincere voting. The welfare gains for compensation proposals—the majority of management proposals—are also substantial and raise firm value by 0.5%-7% of the value of the proposal. Third, as demonstrated in Panel (e), the cost of super majority rules is negligible for most proposals, given shareholders' compensating behavior.

4.5 Robustness of Empirical Results

The analysis of the paper has been centered around the positive empirical relationship between the proportion in favor and the majority rule. In this section, we show that this result is robust and holds for subsets of the data where we control for the vote count method and other variables that may influence the voting results.

First, we check that the positive relationship is not spuriously generated by the transformation of the dependent variable. Panel (a) of Table 8 reports separate regressions for each subset of the data where the voting results are measured as in (13), (14), and (15). For consistency with the theory, we define y/N as in (13) for each subset. The slope coefficient is positive in all three regressions, albeit statistically significant only in the third category where we have most proposals subject to super majority. We also notice that the coefficients sum to approximately one in all three regressions.

Second, in Panel (b) we show that the empirical results are robust to various firm-specific variables which may influence voting results. Brickley, Lease, and Smith (1988) find that the proportion in favor decreases with institutional ownership and increases with insider ownership and

	Compen-. sation[a]	Recapita- lization[b]	Asset re- structuring	Charter amendments[d]	Corp. governance[e] "Less"	"More"
			(a) Restricted least squares			
γ_0	.769	.809	.942	.912	.825	.524
γ_1	.231	.191	.058	.088	.175	.476
#Super	9	63	40	43	22	19
#Obs	3,686	703	193	201	58	98
			(b) Model parameters			
π	.885	.905	.971	.956	.913	.762
ε	.114	.093	.029	.039	.057	.196
p	.999	.997	1.000	.995	.966	.931
			(c) Relative loss reduction			
$\alpha = 2/3$	.992	.977	n.a.	.985	.974	.940
$\alpha = 3/4$	.995	.986	n.a.	.991	.985	.956
$\alpha = 4/5$	.996	.990	n.a.	.994	.989	.962
			(d) Absolute loss reduction			
$\alpha = 2/3$	.0050	.0015	n.a.	.0000	.0001	0.0694
$\alpha = 3/4$	.0207	.0076	n.a.	.0001	.0006	0.1630
$\alpha = 4/5$	.0694	.0319	n.a.	.0009	.0043	0.3163
			(e) Cost of super majority			
$\alpha = 2/3$	.0000	.0000	n.a.	.0000	.0000	0.0039
$\alpha = 3/4$	.0001	.0001	n.a.	.0000	.0000	0.0069
$\alpha = 4/5$	.0002	.0003	n.a.	.0000	.0000	0.0119

Table 7: **Improvement in Value from Strategic Voting**: Proposals have been sorted into five categories and sorted from the most common to the least. Corporate governance proposals have been divided into proposals which give management "less" power and "more" power, respectively. Panel (a) presents restricted least squares results, separately for each proposal category. Panel (b) computes model parameters. Panels (c) and (d) evaluate the gain in value from strategic voting (pure strategy equilibria) over sincere voting. No reduction in L can be computed if $p = 1$. Panel (e) evaluates the cost of super majority rules under strategic voting (pure strategy equilibria) relative to the representative shareholder.

[a] Approve stock option plan, stock award plan, deferred benefit plan, cash bonus plan, and employee stock ownership, dividend reinvestment plan, performance plan, exchange underwater options.

[b] Authorize management to issue common stock, preferred stock, debt, stock split.

[c] Approve merger, acquisition, asset restructuring, spinoff, liquidation.

[d] Technical charter amendments, name change, board size change, director liability and indemnification.

[e] Super majority, classified board, fair price provision, cumulative voting, dual class shares, confidential voting, shareholders' right to call special meeting, advance notice requirement, right to act by written consent, shareholders' preemptive rights, remove director for cause only, director right to fill board vacancy, reincorporate Delaware, poison pill, golden parachute, greenmail, mandatory retirement.

	Regression				$\alpha \geq \alpha^*$		Sample	
	γ_0	γ_1	F-test	R^2	π	α^*	#Super	#Obs
	(a) Vote count method (ordinary least squares)							
For and against	.766	.256	.07	.0020	.872	.414	10	1,100
	(.086)	(.171)	(.795)		(.086)	(.276)		
Voted	.667	.432	1.98	.0035	.784	.271	19	2,647
	(.071)	(.141)	(.160)		(.071)	(.088)		
Outstanding	.829	.157	.43	.0113	.921	.585	168	1,196
	(.023)	(.043)	(.510)		(.021)	(.153)		
	(b) Firm-specific variables							
Ordinary least squares	.639	.435	n.a.	.0556	.782	.329	128	284
	(.063)	(.107)			(.053)	(.065)		
Restricted least squares	.734	.266	2.64	.0468	.867	.500	128	284
	(.002)	(.002)	(.105)		(.001)	(.000)		

Table 8: **Robustness**: Linear least squares regression of the proportion in favor on the statutory majority rule for the sub sample of shareholder meetings with simultaneous votes on simple and super majority proposals (284 proposals). The F-statistic tests the parameter restriction (22). Standard errors are reported below the estimated parameters and p-values below the F-statistics. The standard error of α^* is computed with the delta method.

firm size, and Bethel and Gillan (2002) document that "routine" proposals receive more support. Instead of adding control variables, we estimate (19) for the small subset of shareholder meetings where the shareholders vote on at least one simple majority proposal and one super majority proposal at the same time. If the relationship between y/N and α is positive within each firm, we can be sure that the relationship is not driven by omitted control variables. As can be seen in Panel (b), the slope coefficient remains significantly positive and the sum of coefficients is close to one.

5 Conclusions

We have estimated a simple strategic voting model and demonstrated:

- Shareholders vote strategically. Higher majority requirements are associated with a higher vote cast in favor of the proposal.
- Strategic voting is economically important for governance and compensation proposals in that the likelihood of error (accepting a bad or rejecting a good proposal) is reduced significantly

compared to a situation where shareholders would ignore strategic considerations when casting their votes.

- Simple majority requirements are optimal, although the cost of super majority rules is relatively small as a result of shareholders' compensating behavior.

Our paper emphasizes the advisory role of shareholder voting. Similar to related analysis of the board of directors, we believe that the shareholder meeting ultimate serves advisory as well as disciplining purposes, where the advisory function prevails in normal times and the disciplining role under more exceptional circumstances. However, our model incorporates only the former but not the latter.

The main limitation of our model is its simplicity. We have purposely imposed a binary signal structure with symmetric errors and payoffs. This narrows down the number of free model parameters to be identified from only three empirical parameters, two from the regression line and one from the average pass rate. With additional model parameters, we would not be able to identify the model. The finding that shareholders have precise information may be an artefact of the highly stylized model that cannot accommodate shareholders with signals of different quality. Also, our model ignores agency problems and, as a result, we cannot explain the widespread use of super majority rules.

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6 Appendix

A General Results

A.1 Derivation of $\beta(a, k)$

Denote by $\Pr(g, k|v)$the probability that g out of k signals are positive conditional on the state of the world v. Then:

$$
\begin{aligned}
\beta(g,k) &= \frac{\Pr(g,k\,|v=1)}{\Pr(g,k\,|v=1)+\Pr(g,k\,|v=-1)} \\
&= \frac{\binom{k}{g} p(1-\varepsilon)^g \varepsilon^{k-g}}{\binom{k}{g} p(1-\varepsilon)^g \varepsilon^{k-g} + \binom{k}{k-g}(1-p)\varepsilon^g (1-\varepsilon)^{k-g}}
\end{aligned}
\tag{28}
$$

Observe that $\binom{k}{g} = \binom{k}{k-g}$and simplify to obtain:

$$\beta(g,k) = \frac{p}{p+(1-p)\left(\frac{\varepsilon}{1-\epsilon}\right)^{2g-k}}. \tag{29}$$

A.2 Minimizing Loss

The loss function (3) can be written more explicitly by writing the errors e_I, e_{II} as a function of the cut-off rule a. The loss is minimized for a cut-off rule a if $L(a-1) \geq L(a)$ and $L(a+1) \geq L(a)$. The second condition gives:

$$
\begin{aligned}
& p\left[e_I(a+1) - e_I(a)\right] + (1-p)\left[e_{II}(a+1) - e_{II}(a)\right] \\
&= p\Pr(a,N|v=1) - (1-p)\Pr(a,N|v=-1) \geq 0.
\end{aligned}
$$

Multiplying the last line by

$$\Pr(a,N) = p\Pr(a,N|v=1) + (1-p)\Pr(a,N|v=-1)$$

gives:

$$\beta(a,N) - (1-\beta(a,N)) \geq 0,$$

which is equivalent to $\beta(a,N) \geq 1/2$. Similarly, from $L(a-1) \geq L(a)$ we obtain $\beta(a-1,N) \leq 1/2$.

A.3 Derivation of (4)

Recall that a^* is defined from $\beta(a^*,N) \geq \frac{1}{2} \geq \beta(a^*-1,N)$. We simplify by using $\beta(a^*,N) = \frac{1}{2}$ and rewrite:

$$\frac{p}{1-p} = \left(\frac{1-\varepsilon}{\varepsilon}\right)^{N-2a^*} \quad . \tag{30}$$

Taking logs on both sides and rewriting gives the desired result.

B Proofs

B.1 Proof of Proposition 1

Denote the probability of vote "yes" as a function of the state v by:

$$\pi(v=1) = \pi_1 = (1-\varepsilon)\omega_1 + \varepsilon\omega_0 \quad ,$$
$$\pi(v=-1) = \pi_0 = \varepsilon\omega_1 + (1-\varepsilon)\omega_0 \quad .$$

Then denote the beliefs of any shareholder conditional on knowing that $a-1$ of the other $N-1$ shareholders have voted in favor of the proposal by $\beta(a-1,N-1)$. Beliefs $\beta(a-1,N-1)$ summarize all information the $i-th$ shareholder obtains from being pivotal, but not the signal received by the $i-th$ shareholder herself.

$$\begin{aligned}\beta(a-1,N-1) &= \frac{p\pi_1^{a-1}(1-\pi_1)^{N-a}}{p\pi_1^{a-1}(1-\pi_1)^{N-a} + (1-p)\pi_0^{a-1}(1-\pi_0)^{N-a}} \\ &= \frac{p}{p+(1-p)X(a-1,N-1)}\end{aligned}$$

where

$$X(a-1,N-1) = \left(\frac{\pi_0}{\pi_1}\right)^{a-1}\left(\frac{1-\pi_0}{1-\pi_1}\right)^{N-a} \quad .$$

Now denote beliefs of any shareholder conditional on being pivotal and on her signal σ by β_σ. Any shareholder who randomizes after observing a certain signal σ has to be indifferent between voting "yes" and voting "no," so that $\beta_\sigma = \frac{1}{2}$ after that signal. We have:

$$\begin{aligned}\beta_1 &= \frac{\beta(a-1,N-1)(1-\varepsilon)}{\beta(a-1,N-1)(1-\varepsilon)+(1-\beta(a-1,N-1))\varepsilon} \\ &= \frac{p}{p+(1-p)X(a-1,N-1)\frac{\varepsilon}{1-\varepsilon}} \quad .\end{aligned} \tag{31}$$

Similarly:

$$\begin{aligned}\beta_0 &= \frac{\beta(a-1,N-1)\varepsilon}{\beta(a-1,N-1)\varepsilon+(1-\beta(a-1,N-1))(1-\varepsilon)} \\ &= \frac{p}{p+(1-p)X(a-1,N-1)\frac{1-\varepsilon}{\varepsilon}} \quad .\end{aligned} \tag{32}$$

We can see immediately by direct calculation that:

$$\beta_1 - \beta_0 = \frac{p(1-p)X\left(\frac{1-2\varepsilon}{\varepsilon(1-\varepsilon)}\right)}{\left(p+(1-p)X\frac{1-\varepsilon}{\varepsilon}\right)\left(p+(1-p)X\frac{\varepsilon}{1-\varepsilon}\right)} > 0$$

since we assume that $\varepsilon < 1/2$. Hence, we have either that $\beta_1 = 1/2$ or that $\beta_0 = 1/2$, but never both. For a pure strategy equilibrium we need $\beta_0 \leq 1/2 \leq \beta_1$ with at least one inequality being strict.We can therefore distinguish three cases.

Case 1: $\beta_1 = 1/2$. If $\beta_1 = 1/2$, then $\beta_0 < 1/2$ and the shareholder strictly prefers rejection of the proposal after observing a bad signal, so $\omega_0 = 0$. Solving the condition $\beta_1 = 1/2$ gives:

$$\frac{p(1-\varepsilon)}{(1-p)\varepsilon} = X(a-1,N-1) = \left(\frac{\varepsilon}{1-\varepsilon}\right)^{a-1}\left(\frac{1-\varepsilon\omega_1}{1-\omega_1(1-\varepsilon)}\right)^{N-a} \quad .$$

Rearranging:

$$\frac{1-\varepsilon\omega_1}{1-\omega_1(1-\varepsilon)} = \left(\frac{p}{1-p}\left(\frac{1-\varepsilon}{\varepsilon}\right)^{a}\right)^{\frac{1}{N-a}} = h \quad . \tag{33}$$

We substitute for $\frac{p}{1-p}$ from (30), which gives (7). Solving (33) for ω_1 as a function of h then gives (6). The equilibrium is responsive whenever $\omega_1 > 0$, which requires $h > 1$. The equilibrium is in mixed strategies if $\omega_1 < 1$, which is equivalent to $h < \frac{1-\varepsilon}{\varepsilon}$. ¿From (7) this result obtains whenever the exponent of $\frac{1-\varepsilon}{\varepsilon}$ is positive, or $a > 2a^* - N$. The equilibrium is in mixed strategies if$\omega_1 < 1 \Longleftrightarrow h < \frac{1-\varepsilon}{\varepsilon}$. This requires the exponent of h in (7) to be less than 1, whichis equivalent to $a < a^*$. Hence, for $a \geq a^*$ we always have $\omega_1 = 1$.

Case 2: $\beta_0 = 1/2$. If $\beta_0 = 1/2$, then $\omega_1 = 1$ and the condition can be written as:

$$\frac{p}{1-p}\frac{\varepsilon}{1-\varepsilon} = X(a-1, N-1) = \left(\frac{\varepsilon + (1-\varepsilon)\,\omega_0}{1-\varepsilon\,(1-\omega_0)}\right)^{a-1} \left(\frac{1-\varepsilon}{\varepsilon}\right)^{N-a} \quad .$$

Rearranging:

$$\frac{\varepsilon + (1-\varepsilon)\,\omega_0}{1-\varepsilon\,(1-\omega_0)} = \left(\frac{p}{1-p}\left(\frac{\varepsilon}{1-\varepsilon}\right)^{N-a+1}\right)^{\frac{1}{a-1}} = f \quad . \tag{34}$$

Using (30) to substitute for $\frac{1-p}{p}$gives (9). Solving (34) for ω_0 as a function of f then gives (8). We have a mixing equilibrium if $\omega_0 > 0$, which requires $f > \frac{\varepsilon}{1-\varepsilon}$. Then the exponent of $\frac{1-\varepsilon}{\varepsilon}$ in (9) has to exceed -1, which is equivalent to $a > a^* + 1$. Hence, for any $a \leq a^* + 1$ we have $\omega_0 = 0$. For the equilibrium to be responsive we need $\omega_0 < 1$, or $f < 1$, hence the exponent of $\frac{1-\varepsilon}{\varepsilon}$ in (9) has to be negative, or $a < 2a^* + 1$.

Case 3: Pure strategy equilibria. From the discussion of Case 1 above we know that $\omega_1 = 1$ whenever $a \geq a^*$. Also, from the discussion of Case 2 we know that $\omega_0 = 0$ whenever $a \leq a^* + 1$. Hence, for $a^* \leq a \leq a^* + 1$ the equilibrium is in pure strategies.

B.2 Proof of Proposition 2

We demonstrate the result in four steps. We first analyze those parameter ranges where some shareholders always vote "no." The second step analyzes those parameter ranges where some shareholders passively vote "yes." Then we show that these two cases and the case of sincere voting by all shareholders cover all possible cases. These three steps complete the description of equilibrium. Step 4 derives equation (10).

Step 1: $N-k > 1$ shareholders always vote "no." We show that for any proposal and for any majority requirement where the parameters satisfy

$$\beta(a, N) \leq \frac{1}{2} \leq \beta(a, a) \tag{35}$$

there always exists an equilibrium where k shareholders vote sincerely, $k \geq a$, and the remaining $N-k>1$ shareholders always vote "no."

Consider the k^{th} sincere voter. She is marginal if $a-1$ sincere voters observe good signals and the remaining $k-a$ observe bad signals. Then sincere voting is a best response if and only if

$$\beta(a-1,k) \leq \frac{1}{2} \leq \beta(a,k) \quad . \tag{36}$$

Now consider one of the other $N-k$ passive voters. This voter is pivotal whenever $a-1$ sincere voters observe good signals and the remaining $k+1-a$ observe bad signals. Then voting "no" even after observing a good signal is a best response if $\beta(a,k+1) \leq \frac{1}{2}$. This together with condition (36) implies that the proposed equilibrium exists whenever

$$\beta(a,k+1) \leq \frac{1}{2} \leq \beta(a,k) \tag{37}$$

since $\beta(a,k+1) > \beta(a-1,k)$ from (29). Condition (37) implies that the proposed equilibrium exist for k satisfying the above parameters. Since $\beta(a,k)$ increases in a and decreases in k, condition (37) can only be satisfied for some $a < a^*$ if $k < N$, where k is increasing in a. Moreover, any k such that $a \leq k \leq N-1$ defines an interval where the proposed equilibrium exists. Since β is decreasing in k, the lowest value β can take is for $k = N-1$, otherwise the number of shareholders voting "no" would be zero. Then beliefs are $\beta(a, N-1)$. Conversely, the highest value beliefs can take is for the lowest value of k, a, then: $\beta = \beta(a,a)$. Hence, letting k run from a to $N-1$ partitions the interval (35) into $N-a$ subintervals, and that value of k for which condition (37) is satisfied defines one of these subintervals uniquely.

Step 2: $N-k>1$ shareholders always vote "yes." Next, we show that for any proposal and any majority requirement where the parameters satisfy

$$\beta(0,N-a+1) \leq \frac{1}{2} \leq \beta(a-1,N) \tag{38}$$

there always exists an equilibrium where k shareholders vote sincerely, where $N-a+1 \leq k \leq N-1$.

It is evident that $N-k \leq a-1$ otherwise the proposal would always be accepted, independently of the information available to all shareholders. Hence, $N-a+1 \leq k \leq N-1$. Consider again one of the k sincere voters. This shareholder is pivotal if and only if the other $k-1$ sincere voters have received exactly $a-1-(N-k)$ good signals and $N-a$ bad signals. Hence, the beliefs of the shareholder support her conjectured equilibrium voting strategy if and only if

$$\beta\left(a-(N-k)-1, k\right) \leq \frac{1}{2} \leq \beta\left(a-(N-k), k\right) \quad . \tag{39}$$

Now consider one of the passive "yes"-voters. She follows her equilibrium strategy only if she rejects the proposal even if she receives adverse information. Whenever she is pivotal, and has observed bad information, she knows $k+1$ signals. Of these, $N-a+1$ are bad and $a-(N-k)$ are good. Hence, her passive voting strategy is optimal iff:

$$\beta\left(a-(N-k), k+1\right) \geq \frac{1}{2} \quad . \tag{40}$$

Since $\beta\left(a-(N-k), k\right) > \beta\left(a-(N-k), k+1\right) > \beta\left(a-(N-k)-1, k\right)$, conditions (39) and (40) together imply:

$$\beta\left(a-(N-k), k+1\right) \geq \frac{1}{2} \geq \beta\left(a-(N-k)-1, k\right) \quad . \tag{41}$$

Moreover, for any k such that $N-a+1 \leq k \leq N-1$ the proposed equilibrium exists. Since $\beta\left(a-(N-k), k\right)$ is increasing in a and k, condition (41) can only be satisfied for some $a > a^*$ if $k < N$, where k is decreasing in a. Also, the lowest value β can take is for $k = N-a+1$. Then beliefs at the lower bound of (41) are $\beta\left(0, N-a+1\right)$. Conversely, for the upper limit of the interval (41), the highest value β can take is for the highest value of k, $N-1$, then $\beta = \beta\left(a-1, N\right)$. Hence, letting k run from $N-a+1$ to $N-1$ partitions the interval (38) into $a-1$ subintervals, and that value of k for which condition (41) is satisfied defines one of these subintervals uniquely. Hence, these conditions define a unique value for k where the proposed equilibrium exists.

Step 3: Uniqueness. The intervals (5), (35) and (38) together cover the interval:

$$\beta\left(0, N-a+1\right) \leq \frac{1}{2} \leq \beta\left(a, a\right) \quad . \tag{42}$$

We can see that for $a = 1$ the lower bound of (42) is $\beta\left(0, N\right)$, and for $a = N$ the upper bound is $\beta\left(N, N\right)$, hence for any $a \in [1, N]$ there exists an equilibrium with at least one sincere voter.

Finally, we have to show that the equilibria characterized so far are unique. We need to rule out equilibria with k sincere voters, where l shareholders always vote 'yes,' and the remaining $N-k-l$ shareholders always vote 'no.' We prove that this is not possible by contradiction. Every shareholder is pivotal whenever there are $a-1$ "yes"-votes. The shareholders passively voting "yes" are pivotal if sincere shareholders have observed $a-1-(l-1)$ good signals. Hence, a shareholder voting "yes" who has observed a bad signal only votes "yes" if:

$$\beta\left(a-l, k+1\right) \geq \frac{1}{2} \quad . \tag{43}$$

Conversely, a shareholder voting "no" is pivotal if the sincere voters have observed $a-1-l$ good signals, and votes "no" even though she has observed a favorable signal only if:

$$\beta\left(a-l, k+1\right) \leq \frac{1}{2} \quad . \tag{44}$$

Conditions (43) and (44) are consistent only if $\beta\left(a-l, k+1\right) = \frac{1}{2}$, which is generically not true.

Step 4: Derivation of (10). We proceed as in the derivation of (4) and require that $\beta\left(a, k\right) = \frac{1}{2}$. Then, after solving and taking logs we obtain:

$$a = \frac{k}{2} - \frac{1}{2\ln\frac{1-\varepsilon}{\varepsilon}} \ln\frac{p}{1-p} \quad . \tag{45}$$

Using $a^* = \alpha^* N$ yields:

$$\left|a^* - a\right| = \frac{N-k}{2} \quad .$$

Defining $\kappa = k/N$ gives (10) immediately.

B.3 Errors for Mixed Strategy Equilibria

Conditional on being in the good state ($v = 1$), each shareholder observes the good signal with probability $1-\varepsilon$ and the bad signal with probability ε. Hence, the probability of voting yes in the good state is $\left(1-\varepsilon\right)\omega_1 + \varepsilon\omega_0$. Similarly, the probability of voting yes in the bad state is $\varepsilon\omega_1 + \left(1-\varepsilon\right)\omega_0$. Then the probabilities of a type I-error e_I and a type II-error e_{II} are:

$$e_I = \sum_{i=0}^{a-1} \binom{k}{i} \left((1-\varepsilon)\,\omega_1 + \varepsilon\omega_0\right)^i \left(1 - (1-\varepsilon)\,\omega_1 - \varepsilon\omega_0\right)^{k-i} \tag{46}$$

$$e_{II} = \sum_{i=a}^{N} \binom{k}{i} \left(\varepsilon\omega_1 + (1-\varepsilon)\,\omega_0\right)^i \left(1 - \varepsilon\omega_1 - (1-\varepsilon)\,\omega_0\right)^{k-i} \tag{47}$$

B.4 Errors for Pure Strategy Equilibria

In the pure strategy equilibrium (10), $N-k$ shareholders always vote against if $a \leq a^*$, so the probability of incorrectly rejecting a good proposal is the probability that fewer than a of the k sincerely voting shareholders observe a positive signal. Conversely, if $a > a^*$, we only need $a-(N-k)$ additional sincere votes. Therefore, the probability of a type I error equals:

$$e_I = \begin{cases} \sum_{i=0}^{a-1} \binom{k}{i} (1-\varepsilon)^i \varepsilon^{k-i} & \text{, if } a \leq a^*, \\ \sum_{i=0}^{a-N+k-1} \binom{k}{i} (1-\varepsilon)^i \varepsilon^{k-i} & \text{, if } a > a^*. \end{cases} \tag{48}$$

Similarly, the probability of a type II error equals:

$$e_{II} = \begin{cases} \sum_{i=a}^{k} \binom{k}{i} \varepsilon^i (1-\varepsilon)^{k-i} & \text{, if } a \leq a^*, \\ \sum_{i=a-N+k}^{k} \binom{k}{i} \varepsilon^i (1-\varepsilon)^{k-i} & \text{, if } a > a^*. \end{cases} \tag{49}$$

C Testing Methodology for Mixed Strategy Equilibria

Case 1: $\alpha < \alpha^*$. Use $\alpha = a/N$ and $\alpha^* = a^*/N$ in (7) to obtain:

$$h = \left(\frac{1-\varepsilon}{\varepsilon}\right)^{\frac{2(a-a^*)}{N-a}+1} = \left(\frac{1-\varepsilon}{\varepsilon}\right)^{\frac{2(\alpha-\alpha^*)}{1-\alpha}+1}.$$

Rewrite the exponent as:

$$\frac{2\left(\alpha-\alpha^*\right)}{1-\alpha} + 1 = \frac{\alpha}{1-\alpha} + \underbrace{\frac{2\alpha^*-1}{1-\alpha}}_{=C}.$$

Write expected fraction of votes as:

$$E\left(y/N\right)=\pi\omega_1=\pi\left[\frac{\left(\frac{1-\varepsilon}{\varepsilon}\right)^{\frac{\alpha}{1-\alpha}+C}-1}{\left(1-\varepsilon\right)\left(\frac{1-\varepsilon}{\varepsilon}\right)^{\frac{\alpha}{1-\alpha}+C}-\varepsilon}\right]$$
$$=\pi\left[\frac{\left(1-\varepsilon\right)^{\frac{\alpha}{1-\alpha}+C}-\varepsilon^{\frac{\alpha}{1-\alpha}+C}}{\left(1-\varepsilon\right)^{\frac{\alpha}{1-\alpha}+C+1}-\varepsilon^{\frac{\alpha}{1-\alpha}+C+1}}\right].$$

The last expression gives the first line of (24) from $\frac{\alpha}{1-\alpha}+1=\frac{1}{1-\alpha}$.

Case 2: $\alpha>\alpha^*$. We use

$$E\left(\frac{y}{N}\right)=\pi+\left(1-\pi\right)\omega_0,$$

where ω_0 is given by (8) and f is given by (9). Then, with $\alpha=a/N$ and $\alpha^*=a^*/N$we rewrite the exponent as:

$$-\frac{2a^*}{a-1}+1=-\frac{2\alpha^*}{\alpha-1/N}+1\approx-\frac{2\alpha^*}{\alpha}+1=-E,$$

so that $E+1=\frac{2\alpha^*}{\alpha}$. Then:

$$\omega_0=\frac{f\left(1-\varepsilon\right)-\varepsilon}{1-\varepsilon\left(1+f\right)}=\frac{\left(\frac{1-\varepsilon}{\varepsilon}\right)^{-E}\left(1-\varepsilon\right)-\varepsilon}{1-\varepsilon-\varepsilon\left(\frac{1-\varepsilon}{\varepsilon}\right)^{-E}}$$
$$=\frac{\left(1-\varepsilon\right)^{1-E}\varepsilon^E-\varepsilon}{1-\varepsilon-\left(1-\varepsilon\right)^{-E}\varepsilon^{E+1}}=\frac{\left(1-\varepsilon\right)\varepsilon^E-\varepsilon\left(1-\varepsilon\right)^E}{\left(1-\varepsilon\right)^{E+1}-\varepsilon^{E+1}}$$
$$=\frac{\left(1-\varepsilon\right)\varepsilon^{\frac{2\alpha^*}{\alpha}-1}-\varepsilon\left(1-\varepsilon\right)^{\frac{2\alpha^*}{\alpha}-1}}{\left(1-\varepsilon\right)^{\frac{2\alpha^*}{\alpha}}-\varepsilon^{\frac{2\alpha^*}{\alpha}}}.$$

The last expression gives the second line of (24).