

Why Votes Have a Value*

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Abstract

We perform an experiment where subjects pay for the right to participate in a vote. The outcome of the vote affects voters and non-voters alike, and moral or status considerations that may induce individuals to value the right to vote are absent from our setup. Therefore, the theoretical value of the voting right is zero if subjects are fully rational. We find that experimental subjects are willing to pay for the voting right whenever the vote has material consequences for all voters as a group. Overconfidence about individuals' own ability to make a correct decision cannot explain the price they are willing to pay for the right to vote. We conclude that individuals ignore whether they are pivotal for the outcome. Instead, they enjoy being part of a group that is influential.

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1 Introduction

In this paper we investigate experimentally why individuals value the right to vote. The observation that people generally value the right to vote is common to the literature in political science as well as in financial economics. However, no generally accepted explanation of this phenomenon has emerged, and the two disciplines just mentioned differ substantially in their approach to this problem. We consider two competing explanations. The *instrumental voting hypothesis* holds that voters value the right to vote only as a means to an end, as voting allows each voter to affect decisions and ultimately his own utility. By contrast, the *non-instrumental voting hypothesis* posits that voters attach a value to the right to vote itself, so they value this right beyond purely instrumental reasons. Our experimental evidence is inconsistent with all versions of the instrumental voting hypothesis we consider and we interpret our results as supportive of non-instrumental voting. In particular, we conclude that experimental subjects value being part of a group that influences decisions that have an effect on their own wealth, even if each individual's impact on the group's decision is negligible.

In political science the instrumental view of voting is a key element of the rational choice literature (Downs, 1957; Riker and Ordeshook, 1968). However, the instrumental view has often been criticized because with a large number of voters, the opportunity of any individual voter to affect the outcome and to be pivotal for the final result is miniscule.¹ Hence, if voting is associated with costs, however small, then it is not rational for voters to participate in elections. Several authors have therefore argued that there may be alternative benefits from voting. These theories have in common that voters do not just benefit from the votes indirectly through their ability to affect decisions in their favor, but they receive also a direct benefit from voting.² We use the term non-instrumental voting in order to describe motivations to vote other than the utility

¹ See Palfrey and Rosenthal (1983, 1985) for a non-cooperative analysis of voting and Myerson (1998) for a critique of this approach.

² To the best of our knowledge the earliest reference to this argument is Fiorina (1976). However, Fiorina credits Butler and Stokes (1969) with this distinction and refers to the "older tradition" in political science (i.e., the tradition preceding Downs, 1957) as supporting a non-instrumental view of voting. Clearly, even the canonical model of Riker and Ordeshook (1968) bases the choice among candidates on rational choice. However, in their model, the motivation to participate in the election is also motivated by appealing to a "civic duty," which already introduces a non-instrumental aspect into rational choice theory.

derived from the outcome of the vote weighted with the probability of being pivotal for the outcome.

In financial economics the right to vote has a monetary value that can be observed for those companies that issue two classes of stock with the same dividend rights. One class (henceforth referred to as A-shares) has the right to vote, whereas the other class of otherwise identical B-shares does not carry any voting rights. The difference between the prices of the two classes of shares represents the monetary value attached to voting and is referred to as the “voting premium.” Empirically this voting premium varies between 5% and 80% across countries (see Appendix A for a discussion of this literature).

Financial economists have addressed the problem of pivotality with a different, and purely instrumental argument. They argue that voting premiums reflect anticipated future takeover premiums, which are paid only to the voting shareholders. In Appendix A we review the empirical literature that analyzes whether observed voting premiums can be explained by future expected takeover premiums, and we conclude that the takeover theory and its variants alone cannot explain the voting premiums actually paid in financial markets. In particular, we also observe large voting premiums in countries with no or hardly any takeovers and we also observe large voting premiums for companies where the bylaws force bidders to pay the same price for non-voting shares as they pay for voting shares. We therefore find it difficult to reconcile the instrumental view of shareholder voting with the available evidence.

We contribute to the literature in political science as well as in financial economics by analyzing an experiment where the participants decide how much they are willing to pay for the right to vote.³ In our experiment, there are two classes of shares, which are auctioned off at the beginning. One class of shares has the right to vote and the other class has no voting right. In the first period the company pays a dividend that depends on the quality of a randomly assigned manager. The second period’s dividend is influenced by a vote where those experimental subjects who bought the voting shares decide on the replacement of the manager. Non-voting shares receive exactly the same dividends as voting shares and there are no conflicts of interest between

³ A number of experimental studies have investigated behavioral aspects of voting in the political sphere. Schram and Sonnemans (1996a, 1996b), Battaglini, Morton and Palfrey (2006), Levine and Palfrey (2007), Duffy and Tavits (2007) test various predictions of the pivotal voter model. Empirical evidence on this model based on surveys can be found in Blais et al. (2000).

the holders of the two classes of shares. There are no features (e.g., moral considerations, perceived duty to vote) in our model that could explain why the participants in the experiment should intrinsically value the right to vote. Still, we find that individuals attach a significant value to the right to vote, which equals about 13% of the value of the shares. We analyze to what extent instrumental and non-instrumental explanations can explain this finding by studying different variations of our baseline experimental setup.

We develop two different versions of the instrumental voting hypothesis:

- A. Individuals are fully rational (Nash equilibrium) and always make the right decision in the voting stage of the game. Alternatively, they may make errors, but these errors are symmetric and common knowledge.
- B. Individuals make errors and they are overconfident, i.e. they believe that they can avoid errors better than other voters.

Both cases considered in version A of the instrumental voting hypothesis predict that there should be no voting premium. The more restrictive setup assumes that all subjects are rational and that rationality is common knowledge. A somewhat milder implementation of the rational choice paradigm is an error model such as the Quantal Response Equilibrium (QRE) as proposed by McKelvey and Palfrey (1995, 1998), where voters are assumed to make random mistakes and then formulate strategies that are best responses in such a context. We show that QRE is a good model of voting behavior in our experiment, but QRE does not predict a voting premium.

In version B of the instrumental voting hypothesis we drop the assumption that rationality is common knowledge and assume instead that voters are overconfident and believe that they make fewer mistakes when voting than other participants in the same game. This leads to a voting premium, but it is orders of magnitude smaller than the voting premium actually observed. The reason is that a single investor is pivotal only with a very small probability, so even an overconfident investor should not be willing to pay much for a voting right. We therefore reject all versions of the instrumental voting hypothesis as it contributes little to understanding our experimental results.

With the help of our experimental design we can differentiate between three different versions of the non-instrumental voting hypothesis:

- A. Individuals value the right to vote because they enjoy the status of being a voter and expressing themselves, even if the outcome of the vote has no material consequences for them. We call this the “expressive voting hypothesis.”
- B. Individuals enjoy voting for the winner and joining a “bandwagon,” and they are willing to pay for this opportunity.
- C. Individuals enjoy being part of an influential group, but only in so far as the group’s decisions have material consequences.

We find that our results are consistent only with version C of the non-instrumental voting hypothesis. If the decision voters take has no material consequences, then experimental subjects are not willing to pay more for the voting shares compared to the non-voting shares, which is inconsistent with version A of the non-instrumental voting hypothesis. We also do not observe a preference for joining a majority in the voting game, and our experimental subjects are not willing to pay a premium for the opportunity to join the bandwagon, which rejects version B of the non-instrumental voting hypothesis.

Our paper contributes to the literature in political science by considering a setting that allows us to quantify the subjective value of voting. In addition, the experiment is framed in a way that makes it unlikely that moral or status considerations have an effect on the outcome. In political elections, subjects might regard voting as a civic duty in a democracy, or they may be willing to pay for the right to vote because it is valued as a sign of being a full member of society.⁴ Our experimental design also rules out the “voter’s illusion” (see Quattrone and Tversky, 1984), where the voter believes that if he incurs the costs of voting, others from the same interest group will do so as well. In our setting, the number of voters (or the “turnout”) is always constant and the question is not *how many* individuals vote, but *who* votes. Also, there are no interest groups because the incentives of all subjects are fully aligned. Our experimental setup offers a context

⁴ Note that depriving somebody of his political voting right is seen as a serious punishment that is only handed out to the worst criminals. On the other hand, not having the right to vote at an annual general meeting is unlikely to be seen as “shameful.” In addition, our experiment secures full anonymity among the participants, which also reduces the likelihood that social pressure or similar effects come into play.

that reduces the impact of all these factors, which potentially affect political elections and can therefore confound field experiments.⁵

We contribute to the literature on financial economics by offering an additional explanation for the existence of the voting premium. Our experiment shows that a voting premium may emerge in a setup without takeovers or private benefits of control. Hence, the behavioral bias to value being member of an influential group might explain the substantial gap between observed voting premiums and expected takeover premiums (see Appendix A). While similar behavioral biases have been used in many applications in financial economics, to the best of our knowledge they have never been applied to shareholder voting.⁶

The remaining part of the paper is structured as follows. Section 2 develops the model and the main hypotheses. Section 3 describes the experimental setup. Section 4 discusses our experimental evidence on the instrumental voting hypothesis, and Section 5 analyzes the non-instrumental voting hypothesis. Section 6 concludes. The appendix summarizes our reading of the literature on dual class shares, presents a proof of a theoretical result, and provides more details on the experiments.

2 The model

2.1 Setup of the model

General setup. The game has N potential risk-neutral investors with an initial endowment of cash who can bid for shares in a company. There are two classes of shares: A-shares, which give shareholders voting rights in the company, and B-shares, which have no voting rights. A-shares and B-shares are both entitled to the same dividends per share and the number of A-shares and the number of B-shares is $M < N$ for each class. At the beginning investors bid for shares in the company, and each investor can buy at most one share of each class. Then there are two periods, $t = 1, 2$, and the firm pays a dividend D_t in each period. Dividends depend on the quality of the manager employed and on a state of nature. This basic setup is the same for both periods. After

⁵ We know of only one such field experiment. Güth and Weck-Hannemann (1997) try to elicit the value of the voting right in the context of a political election. See Schram (1997) for a comment that highlights the difficulties of this approach.

⁶ See Baker, Ruback, and Wurgler (2006) for a survey of behavioral corporate finance.

observing the dividend paid in the first period, shareholders vote on the replacement of the manager and decide who runs the firm in the second period.

Technology and dividends. Managers are drawn from a pool, and the number of good managers and bad managers in the pool is the same. If the manager is good, then the dividend in period t is high ($D_t = H$) with probability $p \geq 0.5$. In the complementary state, the dividend is low ($D_t = L < H$) with probability $1 - p$. If the manager is bad, then $D_t = L$ with probability p and $D_t = H$ with probability $1 - p$. Investors know the probability p , but not the quality of the manager. Since firms draw a good manager or a bad manager from the pool with equal likelihood, the posterior probability of having a good manager is therefore p if $D_t = H$ and $1 - p$ if $D_t = L$.

Voting. Shareholders observe the dividend in the first period and then vote on the replacement of the manager by majority vote. Only owners of A-shares vote. They have one vote per share and cannot abstain from voting. For simplicity, we assume that M is odd, so the manager will be replaced whenever at least $(M + 1) / 2$ votes are cast for the replacement of the manager. Then a new manager is drawn from the same pool for the second period, so the new manager is again good or bad with equal probability. If fewer than $(M + 1) / 2$ votes are cast for the replacement of the manager, then the old manager stays in charge.

Initial allocation of shares. At the beginning, each investor can submit a bid for one A-share and another bid for one B-share. No investor is allowed to bid for multiple shares of the same class, but each investor bids simultaneously for one A-share and one B-share.⁷ It is not possible not to bid, but it is possible to bid zero. The auctioneer collects the N bids for each class of shares. The shares for each class are then allocated to the investors who submitted the M highest bids. Investors pay a price equal to the $M+1^{\text{st}}$ bid submitted for this class of shares. If several investors submit identical bids so that the M^{th} bid is not unique, then the auctioneer allocates the shares by lot among these investors.

Sequence of events. We obtain the following extensive form of the game:

⁷ We impose this restriction for several reasons. At the bidding stage, this assumption greatly simplifies the potential bids of the investors, and (together with a sufficiently high budget) makes sure that investors always have enough resources to bid for all shares they want. At the voting stage, this restriction makes sure that there are always M voters, so that it is not possible to buy a majority of votes. Barclay and Holderness (1989) and Dyck and Zingales (2004) show that blocks of voting shares that confer effective control of a firm trade at substantially higher prices than individual shares in the market. This effect is precluded by our assumptions.

1. Nature draws the quality of the manager who runs the firm. Investors bid for shares in the firm.
2. The auctioneer allocates the shares of the firm to the investors and sets prices. Investors pay the price for the shares they receive.
3. The dividend for the first period is realized, becomes observable to all investors, and is paid to all shareholders.
4. A-shareholders vote on the replacement of the manager.
5. The dividend for the second period is realized, becomes observable to all investors, and is paid to all shareholders.

The setup is the simplest setup that allows us to separate the different versions of the instrumental voting hypothesis and the non-instrumental voting hypothesis, respectively. We need a minimum of two periods, so that individuals can make inferences from the first dividend regarding the quality of the manager, and then make appropriate decisions contingent on these inferences.

We use two classes of otherwise identical shares in order to control for unobservable factors that might affect individuals' valuations. In particular, our setup is robust to risk-aversion, because risk-aversion affects the prices of the two types of shares, but not the price difference, which is the quantity we are most interested in.

2.2 Instrumental voting

In this section we make theoretical predictions for the voting premium that are implied by different versions of the instrumental voting hypothesis. We first calculate the symmetric Nash equilibrium under the assumption that investors are fully rational. Then we allow for symmetric errors at the voting stage of the game that are common knowledge (Quantal Response Equilibrium), and finally introduce overconfidence as a behavioral bias.

2.2.1 Nash equilibrium

Voting. In the first period, and after a replacement in the second period, the quality of the manager is good or bad with equal probability. If the manager is good, the expected dividend is $pH + (1-p)L$; if she is bad, it is $(1-p)H + pL$. Denote by $\delta \in \{R, K\}$ the decision to replace (R) or to keep (K) the manager. The expected dividend is then:

$$E(D_1) = E(D_2 | D_1 = H, \delta = R) = E(D_2 | D_1 = L, \delta = R) = \frac{H+L}{2}. \quad (1)$$

After observing a high dividend, the posterior probability of the manager to be good is p . Hence, if the manager is kept, we obtain:

$$\begin{aligned} E(D_2 | D_1 = H, \delta = K) &= p(pH + (1-p)L) + (1-p)(pL + (1-p)H) \\ &= \frac{H+L}{2} + 2\left(\frac{1}{4} - p(1-p)\right)(H-L). \end{aligned} \quad (2)$$

Similarly, if the manager is kept after observing a low dividend:

$$\begin{aligned} E(D_2 | D_1 = L, \delta = K) &= p(pL + (1-p)H) + (1-p)(pH + (1-p)L) \\ &= \frac{H+L}{2} - 2\left(\frac{1}{4} - p(1-p)\right)(H-L). \end{aligned} \quad (3)$$

Note that $p(1-p) \leq 1/4$, with equality only if $p = 1/2$. It follows from (1), (2), and (3) that if $p > 1/2$, then A-shareholders wish to replace the manager if $D_1 = L$ and they wish to keep the manager if $D_1 = H$. If $p = 1/2$, they are indifferent between replacing and keeping the manager. In principle there are many asymmetric equilibria of this game where a majority of shareholders either votes to replace or to keep and no shareholder is pivotal for the decision. For example, in one equilibrium $(M+1)/2 + 1$ A-shareholders always vote to replace the manager and $(M-1)/2 - 1$ shareholders always vote to keep her. However, there is no central coordinating mechanism in this game to allocate different roles to shareholders. In the unique symmetric trembling-hand perfect equilibrium, all A-shareholders vote for replacing the manager if $D_1 = L$ and for keeping her if $D_1 = H$ as long as $p > 1/2$.⁸ We focus on this equilibrium here and ignore the asymmetric equilibria of the voting game. We also ignore non-responsive symmetric equilibria where all shareholders always vote for the same alternative. Note that these equilibria are not trembling-hand perfect.

Bidding and valuation. Using equations (1) to (3), we obtain from the equilibrium replacement decision:

⁸ In order to see this note that in any completely mixed strategy profile there is a positive probability for each A-shareholder to be pivotal. But then the expected second period dividend is strictly higher when the manager is

$$\begin{aligned}
V_{Nash} &= E(D_1) + \frac{1}{2}E(D_2|D_1 = H, \delta = K) + \frac{1}{2}E(D_2|D_1 = L, \delta = R) \\
&= H + L + \left(\frac{1}{4} - p(1-p)\right)(H - L).
\end{aligned} \tag{4}$$

Whenever $p > 1/2$, we have $V_{Nash} > H + L$. Without voting $V_{Nash} = H + L$. The second term in equation (4) therefore reflects the benefits from voting to shareholders, which are zero when $p = 1/2$. The intrinsic value V_{Nash} is the same for A-shares and for B-shares. The auction is a standard multi-unit Vickrey auction, so it is a weakly dominant strategy for each investor to bid the intrinsic value V_{Nash} for one A-share and also for one B-share. If all investors do this, then the unique price for the A-shares is $P_A = V_{Nash}$, and, similarly for the B-shares $P_B = V_{Nash}$. There is therefore no price difference between the two classes of shares. Since all investors bid the same amount, the auctioneer allocates the shares by lot.

2.2.2 Errors and overconfidence

It is well-known that participants in experiments deviate from their Nash strategies and that they also take into account the possibility that other players make mistakes in the formulation of their own optimal strategy. To address these shortcomings of Nash equilibrium, McKelvey and Palfrey (1995, 1998) develop the concept of a Quantal Response Equilibrium (QRE), which has been successfully applied to the analysis of experimental results.⁹ The notion of a QRE is based on the assumption that players make mistakes and that their strategies are best responses given the mistakes they anticipate other players to make. We first develop the symmetric, standard notion of QRE and show that as long as it is common knowledge that errors are symmetric across players, the valuation of the two classes of shares is the same (although lower than in Nash equilibrium). We then go one step further and analyze the case where investors are overconfident and believe that they make fewer errors than other bidders.

Rationality with errors. We denote the probability that an A-shareholder makes an error when voting on the dismissal of the manager by τ_{D_1} . So τ_L is the probability that a shareholder votes against a dismissal after observing a low dividend, and τ_H is the probability that a shareholder

replaced compared to when she is kept (given that $D_1 = L$ and $p > 1/2$) and voting to replace her is then a strictly dominant strategy for each shareholder.

⁹ See, for example, Guarnaschelli, McKelvey, and Palfrey (2000) for an application of the QRE to a voting game.

votes for dismissal after observing a high dividend. As individual errors are independent from one another, the voting equilibrium now involves a certain probability of a mistake, namely:

$$e_L = \Pr(\delta = K | D_1 = L) = \sum_{i=(M+1)/2}^M \binom{M}{i} \tau_L^i (1 - \tau_L)^{(M-i)}, \quad (5)$$

$$e_H = \Pr(\delta = R | D_1 = H) = \sum_{i=(M+1)/2}^M \binom{M}{i} \tau_H^i (1 - \tau_H)^{(M-i)}. \quad (6)$$

The manager is therefore kept after a high dividend with probability $(1 - e_H)/2$. Then the expected dividend in the second period is $E(D_2 | D_1 = H, \delta = K)$ as given in equation (2). With probability $(1 - e_L)/2$ the manager is replaced after a low dividend, and with probability $e_H/2$ the manager is replaced after a high dividend. In both cases the expected dividend then equals $(H + L)/2$ from (1). With probability $e_L/2$ the manager is kept after a low dividend and then $E(D_2 | D_1 = L, \delta = K)$ as given in equation (3). Then the value of one share is:

$$V_{QRE} = H + L + \left(\frac{1}{4} - p(1 - p) \right) (H - L) (1 - e_L - e_H). \quad (7)$$

For the case without errors, we have $e_L = e_H = 0$, and the value of the shares in the QRE becomes equal to V_{Nash} as in (4). Given the assumptions that the probability of making a mistake is symmetric across players and common knowledge, $P_A = P_B = V_{QRE}$, so there is no price difference between voting A-shares and non-voting B-shares. This argument holds for any model with symmetric errors that are common knowledge.

Responsiveness. We follow the literature on QRE and assume that the error probabilities τ_H and τ_L are smaller if the utility that is at stake in the vote is higher and parameterize this relationship using a logistic function. We define the benefits from making the correct decision relative to making an incorrect decision by ΔU from the payoffs in (1), (2), and (3) above as:

$$\Delta U = 2 \left(\frac{1}{4} - p(1 - p) \right) (H - L) \geq 0 \quad (8)$$

The probability of any A-shareholder to be pivotal is:

$$\pi_{D_1} = \binom{M-1}{(M-1)/2} \tau_{D_1}^{(M-1)/2} (1 - \tau_{D_1})^{(M-1)/2} \quad (9)$$

Then the expected payoff from making the correct decision is $\pi\Delta U$, and the probability of making an error can be written as:

$$\tau(\lambda) = \frac{1}{1 + \exp(\lambda\pi\Delta U)} \quad (10)$$

We can formulate equation (10) without reference to the dividend paid at $t=1$ because ΔU is identical for both levels of the dividend. Here, λ is the responsiveness coefficient. If $\lambda = 0$, then shareholders randomize between keeping and replacing the manager with equal probability and $\tau_H = \tau_L = 0.5$, independently of the utility difference from replacing or keeping the manager ΔU . If $\lambda = \infty$, then $\tau_H = \tau_L = 0$ and we obtain the symmetric responsive Nash equilibrium described in equation (4). Note that the definition of QRE requires that every A-shareholder chooses the error probability τ as a best response to that of all other shareholders, so that the error probabilities used in (9) are consistent with the probability of being pivotal used in (10).

Overconfidence. We now go one step further and assume that investors are overconfident in the following sense. At the voting stage they make errors as described above and the probabilities of making mistakes are the same for all investors. However, the symmetry of errors is no longer common knowledge and each investor *believes* that only other shareholders will make mistakes, whereas each investor thinks that he himself can make the correct judgment without fail at the voting stage. With this belief, investors value the right to be pivotal at the voting stage because according to their beliefs it helps them to avoid the errors other investors would make. With this assumption, the voting stage remains unchanged and the actual error probabilities are still given by (5) and (6).

With overconfident investors, the valuation formulae for the expected dividends and therefore the intrinsic valuation in (7) have not changed. However, overconfident investors anticipate that they can improve on this valuation if they own a voting share and become pivotal in the voting game. The investor believes that whenever he is pivotal he can change the probability of replacing the manager if $D_1 = L$ from $1 - \tau_L$ to 1 and, if $D_1 = H$ he can change it from τ_H to 0. Hence, an overconfident investor overvalues the shares conditional on being able to vote by a premium ω :

$$\omega = (\pi_H \tau_H + \pi_L \tau_L) \left(\frac{1}{4} - p(1-p) \right) (H-L) \quad (11)$$

The premium ω is the increase in intrinsic value of a share from the point of view of an overconfident investor when he can participate in the vote. This will generally not be the voting premium in equilibrium because his valuation of the B-shares depends on his ability to obtain an A-share in the auction.¹⁰ An overconfident investor also values the non-voting share above its intrinsic value (7) conditional on obtaining an A-share, because whenever he owns a voting share this also increases his valuation of the non-voting share. This interdependence makes the analysis of the equilibria of the auction game somewhat tedious, and a complete characterization of these equilibria is beyond the scope of this paper.¹¹ We summarize the theoretical results that are most important for our empirical analysis in the following proposition, which we prove in Appendix C.

Proposition 1: *Assume that each investor believes that he himself will make the optimal decision at the voting stage of the game for certain, whereas all other investors make an error with positive probability. Each investor believes that each share of the company increases in value by ω if he owns one A-share. Then: (i) There exists no symmetric equilibrium in pure strategies. (ii) There exists a continuum of asymmetric equilibria in weakly undominated pure strategies where the voting premium satisfies $0 \leq P_A - P_B \leq 2\omega$.*

Intuitively, Proposition 1 can be understood as follows. Investors are willing to pay $2(V_{QRE} + \omega)$ for both shares together. Prices below V_{QRE} cannot be sustained in equilibrium for any B-share, and, similarly, prices below $V_{QRE} + \omega$ cannot be sustained for any A-share. The reason is that those investors who bid low and receive no shares in equilibrium would otherwise be better off by bidding high for one type of share. However, the premium ω for the B-share can be allocated in any possible way between the A-share and the B-share. The highest premium results when the price of the A-share reflects the whole increase in value of both shares while the price of the B-

¹⁰ For interdependent valuations, auction theory suggests a combinatorial auction, where participants can bid on each possible bundle of the two shares. In such a setup truthful bidding remains the optimal strategy even in the presence of complementarities or substitution effects (Varian and MacKie-Mason, 1995; for a survey see Vries and Vohra, 2003). We decided against such a design because of its complexity and because a combinatorial auction could have an unwanted framing effect. When making a bid on the bundle of an A-share and a B-share, subjects could have been led to believe that A-shares and B-shares are complementary, i.e. the framing could have induced incorrect beliefs. Only the overconfidence hypothesis is affected by this consideration.

¹¹ A complete analysis of all pure-strategy equilibria of the auction game is available from the authors upon request.

share is just equal to V_{QRE} . Conversely, both shares may be priced at $V_{QRE} + \omega$ in equilibrium, so that the voting premium is zero. Any intermediate case is also possible, which gives rise to a continuum of equilibria.

2.3 Non-instrumental theories of voting

The discussion in the previous section relies on the notion of instrumental voting, where an individual's right to vote has a positive effect on the individual's payoffs. However, whenever the probabilities π_L and π_H of being pivotal are small, then the voting premium from (11) is also small. This is the paradox of voting discussed in political science, which has led to the investigation of alternative benefits of voting. We distinguish between three different notions of non-instrumental voting and discuss the related literature:

A: Expressive voting. Voters may enjoy voting because it gives them the opportunity to “make their voice heard.” The outcome and the ultimate effect of one's own vote on the outcome are secondary in this case. As Brennan and Hamlin (1998) describe the expressive motivation to vote, “voter participation just *is* the act of consumption that brings the voter to the poll” (p.156).¹² In the context of our model, we should then observe that investors value the voting right independently of how much influence voting has on their payoffs.

B: Joining the bandwagon. Voters may derive satisfaction from voting for the winner. This desire can have several reasons, for example conformity (Bartels 1988) or the hope to benefit from patronage after the election (Fiorina 1974). Callander (2007) models such preferences and examines the formation of bandwagons in sequential and simultaneous elections. Schuessler (2000) argues that citizens like to attach to collectives, and he relates this to their preference to join the majority when voting. If this is the primary motivation of the participants in our experiments, then we should see that (1) they try to vote with the majority, i.e., there is some kind of “bandwagon,” and (2) that they value votes more if they have more opportunities to join a collective. In particular, a stronger bandwagon effect should be associated with a higher voting premium.

¹² Here, we refer only to the general definition of expressive voting by Brennan and Hamlin (1998) and Brennan and Lomasky (1993). Their so-called low-cost theory of expressive voting where voters tend to vote more expressively, the more they identify with the issue that is voted on and the less they think their vote matters, is not applicable to our setup. For an experimental test of the low-cost theory of expressive voting see Tyran (2004).

C: Being part of an influential group. In this interpretation, voters enjoy voting because it is associated with the status of being part of a group that is in control of a decision that affects the payoffs of group members. The key difference to version A of the non-instrumental voting hypothesis is that the group is *influential*, i.e. the group's decisions affect the utility of all citizens or – in case of a firm – of all shareholders. In our model, the A-shareholders *collectively* exercise power over the manager and therefore over the future dividends of the firm. This version of the non-instrumental voting hypothesis differs from instrumental voting in that it does not rely on the ability of any individual to change the outcome, which is only possible if the individual is pivotal. The key aspect of this notion of non-instrumental voting is that the individual benefits from being associated with a group of individuals that collectively have an influence.

At first glance, hypothesis C seems to be identical to rule utilitarianism, which posits that individuals receive utility from following a rule that maximizes social surplus.¹³ While the welfare-maximizing decision is obvious in the voting stage of the game, it is unclear, however, how welfare should be defined in the first stage of the game when the shares are auctioned off. If welfare is set equal to the payoff of the whole group, a bid of zero for A-shares and for B-shares is the welfare-maximizing rule. In this case, the voting premium predicted by rule utilitarianism would be zero. On the other hand, if welfare includes the payoff of the experimenter, any rule concerning the bids becomes welfare maximizing, and rule utilitarianism does not yield any predictions on the voting premium. Therefore, there is no obvious way to test for rule utilitarianism in our framework.

3 Experimental setup

We implement the model described in Section 2.1 in an experiment and test if participants in our experiments value the right to vote, and if voting premiums are better explained by instrumental or by non-instrumental motivations.

All treatments have $N = 8$ investors. There are $M = 5$ A-shares and 5 B-shares, and the dividends are $H = 20$ and $L = 0$. There are four treatments:¹⁴

¹³ See Harsanyi (1980) and Feddersen and Sandroni (2006), as well as Coate and Conlin (2004) for an empirical test.

¹⁴ For each treatment, we ran two sub-treatments that only differ in the way the results of the vote were announced. In the *limited information sub-treatment*, only the decision whether or not the manager had been dismissed was

BASE: The baseline treatment has $p = 80\%$. With this parameter value, the difference between the good manager (generating an expected dividend of $E(D) = 16$) and the bad manager (with $E(D) = 4$) is substantial. However, solving the inference problem is non-trivial, so it is plausible that some players do not trust other players to vote correctly. Overconfident players can therefore be expected to overvalue the voting rights associated with the A-shares.

NU: In the no-uncertainty treatment $p = 100\%$. Then $E(D) = 20$ with a high quality manager and $E(D) = 0$ with a low quality manager, so that the stakes have increased relative to the base treatment. In addition, the inference problem is now trivial, which should reduce the number of shareholders who vote against their interest. It should also reduce the inclination of our experimental subjects to distrust other participants. This treatment therefore serves as a robustness check on the baseline treatment, in particular to detect behavior in the baseline treatment that should be attributed to errors in the statistical inference individuals need to perform.

NI: In the non-influential manager treatment $p = 50\%$. Then $E(D) = 10$ independently of the quality of the manager and the vote has no consequences for the value of the firm. The inference problem is trivial. While A-shareholders have an impact on decisions of the firm (i.e., keeping or replacing the manager), they cannot influence the distribution of future dividends with their vote. If experimental subjects are motivated by expressive reasons as postulated by version A of the non-instrumental voting hypothesis, then they should value the right to vote in this treatment.

BH: In the blockholder treatment, $p = 80\%$, just as in the baseline treatment. However, in addition to the 5 A-shares auctioned off in the beginning, there is a blockholder who owns 6 A-shares and who always votes in favor of the incumbent manager. As a result, it will never be possible to replace the manager, no matter how the 5 A-shareholders vote. This treatment is similar to the non-influential manager (NI) treatment with respect to the instrumental value of the vote, which is zero. However, from a behavioral point of view, there is a difference between joining a pre-specified majority (the “bandwagon”) and pure expressive voting. If individuals want to join the bandwagon (version B of the non-instrumental voting hypothesis), then they

announced. In the *full information sub-treatment* the computer screen also displayed the number of votes for and against dismissing the manager. For each of the four treatments, we ran five experiments with limited information and five experiments with full information. Our results are more pronounced in the *full information sub-treatment*, but the difference between the sub-treatments is never statistically significant. Therefore, we do not discuss these sub-treatments in more detail.

should be willing to pay a premium on voting shares in treatment BH but not in treatment NI. On the other hand, if they vote for expressive reasons (version A of the non-instrumental voting hypothesis), then we should observe a voting premium in both treatments, BH and NI.

Insert Table 1 here.

Table 1 shows an overview over the four different treatments and gives the parameter values for each treatment. The table also shows the Nash value of the shares from equation (4). Shares are most valuable in treatment NU with $V_{Nash} = 25$ and least valuable in treatments NI and BH with $V_{Nash} = 20$.

We ran 10 sessions for each treatment and each session lasted for about 90 minutes. In each session, eight subjects participated; no subject participated in more than one session. The participants played the same game (treatment) for 30 rounds, and no participant played more than one of the treatments. Subjects' average earnings were 28 Euros, including a show-up fee of 3 Euros. The currency in the experiment was "points," which were exchanged into real money at the end of the experiment at the exchange rate of 1 point = 3 cent. The exchange rate was known to all participants. At the beginning of the experiment, each participant was given a budget of 150 points. In order to prevent investors from running out of money after a series of zero dividends and to avoid frustration from receiving a payoff of zero in several rounds, each individual received an additional 16 points at the end of each round. Appendix B contains a translation of the instructions for the baseline treatment.

All experiments were carried out in the computer lab at Technical University Berlin between January 2006 and September 2007. We used the software tool kit z-Tree to program the experiments (see Fischbacher, 2007). Participants were students from different universities in Berlin. After the experiment, students were asked to fill in a questionnaire, and the vast majority of them stated that they did not have any experience with investing in the stock market. Therefore, we are confident that most students were not aware of the price difference between voting and non-voting shares in listed companies. It is therefore unlikely that they simply imitated behavior that they had observed outside the lab.

4 The instrumental voting hypothesis

We first investigate the different versions of the instrumental voting hypothesis by focusing on the baseline treatment and on the no uncertainty-treatment. We defer the discussion of non-instrumental approaches to Section 5.

4.1 Learning in the baseline treatment

Before addressing our hypotheses we check to what extent our experimental subjects learn to play the game during the experiment. Figure 1 shows the prices of voting and non-voting shares over time, and Figure 2 displays the frequency τ of incorrect votes, i.e. the frequency that A-shareholders vote for either replacing the manager after observing a high dividend or for keeping the manager after a low dividend.

Insert Figures 1 and 2 here.

The figures indicate that subjects display some learning in the course of the experiment: prices increase over time and voting errors decrease over time. Figure 1 shows that learning with respect to prices takes place only during the first 10 periods; after period 10, average prices do not vary much anymore. Figure 2 shows that there is little learning with respect to voting decisions. After a high dividend, there is hardly any change at all. After observing a low dividend, individuals seem to be reluctant to fire a manager and the error rate falls from an average of about 18% during the first 10 periods to about 12% during the last 10 periods. In the following analysis, we always report averages across the last 15 periods, after which learning processes seem to have converged.

4.2 Prices in the baseline treatment

Table 2 shows statistics for the prices of voting and non-voting shares (P_A and P_B) as well as for the voting premium $P_A - P_B$ and the relative voting premium $(P_A - P_B) / V_{Nash}$. We need to scale prices because the intrinsic values of the shares change across treatments. As the prices P_A and P_B are very volatile and therefore unsuitable for scaling, we scale by the risk-neutral value of the shares in Nash equilibrium from (4), which is 21.8 in this case. Prices might be correlated within each session, so we average prices across the last 15 rounds for each session and present the results on these 10 independent observations in Panel A. For completeness, we also report the

same results for all 300 observations (10 sessions with 30 rounds each) in Panel B, where we treat every round as if it was an independent observation.

Insert Table 2 here.

With the results from Table 2, we can clearly reject the hypothesis that the voting premium is zero. Thus, individuals do value the right to vote. The voting premium is 2.91 on average with a median of 2.63. If we look at the entire sample of all 300 rounds, then the voting premium is only slightly different with a mean of 2.82 and a median of 2.00. These voting premiums are different from zero at all conventional significance levels, and, at about 13% of the expected value of the shares, they are also economically significant.

The average (median) price for an A-share is 18.52 (18.27), the average (median) price of a B-share is 15.61 (17.37). Hence, average prices are substantially below the risk-neutral Nash-equilibrium value of 21.80 in the baseline treatment (15% for A-shares, 28% for B-shares), and this difference is highly significant. One interpretation of this finding is that individuals are risk-averse and therefore value the shares at less than their risk-neutral values.

4.3 Offers in the baseline treatment

Our analysis of offers arrives at the same qualitative conclusions as the analysis of prices. Table 3 shows descriptive statistics for the 80 average offers across the last 15 rounds for each subject in Panel A. Subjects interact with one another within a session, so these 80 observations cannot be treated as independent and the p-values in Table 3 must be interpreted with care. Panel B displays the results for 2,400 individual offers (10 sessions with 8 subjects and 30 rounds). Offers are much more volatile than prices: Their standard deviation is six to eight times higher than the standard deviation of prices. Offers vary between 0 and 300, and there are no systematic changes over time (not shown in the tables) as we observe them for prices and for voting behavior (see Figures 1 and 2). Given that the maximum payout per share is 40 (if both dividends turn out to be high), any offer above 40 appears irrational at first glance. However, the five winners in the auction do not pay their own offers but the offer of the sixth highest bid, so bidding more than the intrinsic value of the share (or more than 40) is merely a weakly dominated strategy. Given that the equilibrium price is consistently lower than the expected value of the shares, subjects who make extremely high offers typically receive high payouts. So there is little incentive to refrain

from making offers that seem irrationally high as long as there are at least three subjects who offer less than the expected value of the shares. For this reason, we only interpret the median of the offers since it is less sensitive to these outliers.

Insert Table 3 here.

Median offers are by construction higher than (average or median) prices, because prices equal the sixth highest bid, i.e. the 25th percentile of all offers. Table 3, Panel B reveals that 53.8% of all 2,400 pairs of bids feature a positive voting premium and only in 10.8% of all cases do subjects bid less for an A-share than for a B-share. The remaining bids (35.4%) have the same price for both shares. Again, voting premiums are positive and statistically significant at all conventional significance levels and we conclude that our experimental subjects value the right to vote. Overall, this shows that the Nash equilibrium described in Section 2.2.1 yields a poor prediction for the outcomes of the experiment.

4.4 Voting behavior in the baseline treatment

The results may deviate from the standard Nash equilibrium simply because subjects make errors at the voting stage of the game. If sufficiently many subjects are overconfident and believe that they are better at voting than their fellow group members, then they might be willing to pay more for a voting share than for a non-voting share and drive up the voting premium. We explore this explanation by analyzing voting behavior.

Insert Table 4 here.

Table 4 displays the results of the voting stage. The table contains the results for all treatments, but we only interpret the results of the baseline treatment in this section. Panel A of Table 4 gives the individual and the collective errors from voting on the replacement of the manager. It shows that A-shareholders vote for keeping the manager after observing a low dividend 18.33% of the time, averaged over the last 15 rounds. The frequency e_L that after a low dividend more than two A-shareholders vote against replacing the manager is 7.14%. After a high dividend, 11.82% of A-shareholders vote incorrectly (i.e. for replacing the manager), which results in an actual dismissal in 3.03% of all cases. Shareholders make significantly more mistakes after a low dividend than

after a high dividend (the p-value for the χ^2 -test is 1.4%, for the Wilcoxon test it is 14.8%).¹⁷ This can be due to the fact that the subjects are more reluctant to fire a manager than to keep a manager (even though they know that the manager's role is played by the computer). In Panel C, we display the responsiveness parameters λ_L and λ_H for the voting decisions after a high dividend and after a low dividend. The parameter λ_L is smaller than λ_H , which mirrors the fact that the observed error rate is higher after a low dividend, but the difference between the two parameters is not statistically significant.

Panel B of Table 4 draws the relevant conclusions for the valuation of the shares. If the errors from decision-making at the voting stage are taken into account, then the value of shares in the Quantal Response Equilibrium, V_{QRE} is 21.69 from equations (5) to (7), so it is 0.11 lower than the Nash value of 21.8. If the subjects in our experiment are overly optimistic in the sense that they believe that only the other subjects but not they themselves make mistakes, then we can estimate the maximum premium 2ω they are willing to pay for a voting share as described in Proposition 1. This maximum premium turns out to be 0.116, which is just 4.0% of the average observed premium of 2.911, and this difference is statistically significant at the 2% level. We conclude that errors and overconfidence cannot explain a meaningful portion of the observed voting premium.

4.5 The no-uncertainty treatment

We repeated the experiment with $p = 1$, i.e. a good manager generates a high dividend with certainty and a bad manager generates a low dividend with certainty. Therefore, the inference problem at the voting stage is greatly reduced, and we expect fewer errors at the voting stage. Table 4, Panel A, shows that there are indeed fewer errors in treatment NU than in BASE. After a low dividend, 18.33% of the subjects vote for keeping the manager in the baseline treatment while only 11.03% do so in the no-uncertainty treatment. However, the difference is only marginally significant in a one-sided Wilcoxon test (p-value: 7.2%).¹⁸ Moreover, in BASE we observe inefficient voting outcomes after a low dividend in 7.14% of all cases while we do not observe any inefficient voting outcomes in NU. This difference is significant with a p-value of

¹⁷ Throughout the paper, Wilcoxon p-values are calculated from the exact distribution when the sample size is smaller or equal to 20. Otherwise, we use the t-approximation.

0.5%. After a high dividend, error rates are also lower in NU than in BASE, but here the differences are not statistically significant. Interestingly, the reluctance of some shareholders to fire the manager after a low dividend, observed in BASE, is clearly lower in treatment NU: the difference between τ_L and τ_H is not significant in NU. Note that in NU, it is certain that the manager is bad when a low dividend was paid whereas in BASE, there is still a probability of 20% after a low dividend that the manager is good. This might explain the reluctance to fire the manager after a low dividend in BASE but not in NU.

The potential loss ΔU that is incurred after a wrong decision is about three times higher in the NU treatment compared to the BASE treatment (see Table 1). If this higher potential loss is the reason for the decrease in the error rates in NU relative to BASE, then the responsiveness parameters from (10) should not differ between the two treatments. Panel C of Table 4 shows that we cannot reject this hypothesis as the responsiveness parameters λ_L and λ_H do not differ significantly between BASE and NU.

We also investigate whether overconfidence can explain the voting premium in treatment NU. Interestingly, the maximum voting premium that could be explained by overconfidence from Proposition 1 is 0.120 and therefore almost identical to that observed in the baseline treatment. There are two opposing effects here. The first is that error probabilities go down relative to BASE, which reduces the maximum voting premium with overconfidence. However, the loss ΔU caused by a wrong decision increases from 3.6 in BASE to 10 in NU (see Table 1). This second effect increases the upper bound 2ω from Proposition 1 (see equations (8) and (11)) on the voting premium. Both effects cancel each other and the maximum premium with overconfidence stays almost constant at 0.12.

Insert Table 5 here.

Table 5 shows descriptive statistics for prices (Panel A) and offers (Panel B) averaged across the last 15 rounds for the no-uncertainty treatment. Given that the Nash-value of the shares is higher in the no-uncertainty treatment than in the baseline treatment, it is not surprising that prices and offers are also generally higher. However, the differences between prices in BASE and NU are never significant. The mean (median) relative price premium of voting shares is 16.0% (12.5%)

¹⁸ We calculate for each session the error probability τ_0 and then apply a two-sample Wilcoxon signed rank test to these error probabilities. The results of this test are not shown in the tables.

in Table 5, Panel A, which is higher than in the baseline treatment, where it is 13.4% (12.1%, see Table 2, Panel A), although the difference is also not significant. Mean and median offers are slightly lower in NU than in BASE (compare Table 5, Panel B with Table 3, Panel A), but the difference is again not significant. We conclude that the results for the no-uncertainty treatment are similar to those in the baseline treatment.

Summary on the instrumental voting hypothesis. Our evidence from the baseline treatment and the no uncertainty treatment is inconsistent with the hypothesis that voters are willing to pay a premium on voting shares because they are overconfident. Altogether, this rejects all variants of the instrumental voting hypothesis presented in Section 2. Whereas voting behavior can be explained reasonably well by applying the concept of QRE, actual bidding behavior violates not only the predictions of Nash equilibrium, but also those of QRE. We therefore conclude that the voting premium must have a significant non-instrumental component.

5 Non-instrumental theories of voting

The remaining task is to distinguish the three different versions of the non-instrumental voting hypothesis from each other. We use two further treatments, the non-influential manager treatment (NI) and the blockholder treatment (BH) for this purpose (see Section 3 and Table 1 for the details of these treatments).

The blockholder and non-influential manager treatments are similar in that the vote of the A-shareholders does not affect the expected second period dividend. In treatment NI this is the case because the quality of the manager does not affect dividend payments, and in treatment BH the vote has no influence because the manager can never be replaced. However, treatment BH differs in two important respects from treatment NI. Firstly, in the blockholder treatment, it is clear what the dividend-maximizing decision is, even though this decision cannot be implemented because of the veto power of the blockholder. By contrast, in the non-influential manager treatment there is no dividend-maximizing decision. Secondly, in the blockholder treatment the outcome of the vote is given *ex ante* and known to the experimental subjects, because they know the voting behavior of the blockholder, so it is clear how the majority will vote. In the non-influential manager treatment the outcome of the vote is uncertain and there is no clear majority *ex ante*.

We begin with the non-influential manager treatment (NI). If there is a voting premium in the non-influential manager treatment (NI), then subjects must value the act of voting itself, even if it has no payoff consequences for them.

Insert Table 6 here.

Table 6 reports the results for the non-influential manager treatment. It is structured like Table 5, with average prices in Panel A and average offers in Panel B. From Panel A we can see that the voting premium becomes very small and statistically indistinguishable from zero. Moreover, the voting premium is significantly smaller under the NI treatment than under either the BASE treatment or the NU treatment. All tests for the premium are significant, with p-values below 5% for comparisons with the baseline treatment and below 1% for comparisons with the no uncertainty treatment. If subjects valued the act of voting in itself as hypothesized by the expressive voting hypothesis, then we should not observe any significant difference between the treatment NI on the one hand and treatments BASE and NU on the other hand. The results from treatment NI in Table 6 therefore reject version A of the non-instrumental voting hypothesis.

Insert Table 7 here.

Table 7 reports the results for the blockholder treatment. It is structured like Tables 5 and 6. From the discussion above, a voting premium in the blockholder treatment (BH) can be explained by a propensity to vote for the winner, i.e. the bandwagon effect. This would be consistent with version B of the non-instrumental voting hypothesis. Utility from voting for the winner (version B) would require (1) that subjects value the voting right and pay a premium for it and (2) that they vote with the blockholder. Table 7 shows that there is no voting premium in treatment BH. The premium is 0.29 on average, but no test can reject the null hypothesis that it is zero even at the 10%-level. By contrast, all tests reject the hypothesis that the premium under the BH treatment is the same as under the BASE treatment or the NU treatment. Table 4, Panel A shows that voting behavior in the BH treatment is also inconsistent with the bandwagon hypothesis as the number of votes for keeping the manager is always lower in the BH treatment than in the NI treatment, which generates exactly the same payoffs. A bandwagon effect would require that the number of votes in favor of the management is actually higher in treatment BH than in treatment NI. We therefore find no evidence to support version B (“bandwagon-effect”) of the non-instrumental voting hypothesis.

Summary on the non-instrumental voting hypothesis. The blockholder and non-influential manager treatments clearly reject the hypothesis that voters are willing to pay a premium for the right to vote if they have no influence collectively on the final outcome. No premium is paid if the outcome of the vote itself does not matter, as in the non-influential manager treatment, nor when somebody else effectively makes the decision, as in the blockholder treatment. However, all observations are consistent with version C of the non-instrumental voting hypothesis, which stipulates that voters value the right to be part of a group that makes relevant decisions, even though their own contribution to the decision-making process (i.e., their probability to be pivotal) is small.

The results of the non-influential manager treatment and the blockholder treatment allow us to address a potential criticism of our experiment, which holds that subjects pay for the right to vote for the mere entertainment value of voting: They might value the right to vote simply to avoid looking at a blank screen while the other participants in the experiment vote. This argument implies that a positive voting premium should be found in all our treatments. Our results show, however, that individuals are not willing to pay for the right to vote when the voting decision does not have any material consequences.

6 Conclusion

We perform an experiment where experimental subjects pay for the right to vote. The main conclusion from our analysis is that the participants are willing to pay a significant premium for the right to vote. This voting premium cannot be explained by any version of the instrumental voting hypothesis. Even overconfident subjects who believe that they can avoid mistakes other subjects would make should not be willing to pay more than 4% of the voting premium we actually observe in our experiment. Our results therefore strongly suggest that individuals value the right to vote, and that they do so for reasons not addressed by the instrumental voting hypothesis.

We distinguish between three non-instrumental theories of voting. (A) Purely expressive voting implies that individuals value the right to vote independently of their impact on the outcome, but we find no evidence for this hypothesis. The voting premium vanishes in both treatments where voting does not influence the dividend paid to the shareholders. (B) We also investigate whether

individuals value the opportunity to be part of a majority and join the bandwagon, In the blockholder treatment, voting behavior as well as bidding behavior is inconsistent with this notion. (C) We argue that experimental subjects might value the right to vote in order to be part of an influential group. Our evidence is consistent only with the third hypothesis (C), which can explain why the voting premium is high if individuals collectively influence the outcome, even though their individual probability of affecting decisions is small.

A frequently voiced objection against results from experiments is that sophisticated investors are likely to behave differently from average students. Our results may accordingly have little explanatory value for observed voting premiums. However, there is little evidence for this in the literature. Drehmann, Oechssler, and Roider (2005) find no differences between the behavior of students and a group of consultants from an international consulting firm in an experiment on herding in financial markets. Similarly, Coval and Shumway (2005) analyze the behavior of traders on the Chicago Board of Trade and find many behavioral biases that have previously been documented in laboratory experiments.

Some conclusions may be specific to our setup and should therefore not be generalized without further investigations. For example, the bandwagon effect has been documented in the literature in a number of contexts (see Bartels, 1988). Individuals might value being part of a majority under certain circumstances, for example, when they know each other or when they have to identify themselves with a particular group or opinion in public. The study of these important nuances of non-instrumental voting is left for future research.

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Appendix A: Empirical evidence on voting premiums from dual class shares

Many countries allow dual class shares, where the inferior class of shares has no or less voting power than the superior class.²³ The price difference between the two classes of shares (the “voting premium”) varies widely across countries. The theoretical literature (Grossman and Hart, 1988; Bergström and Rydqvist, 1992; Zingales, 1995; Rydqvist, 1996) explains the voting premium with corporate takeovers. They argue that a bidder in a takeover contest will bid more for voting shares (which confer control) than for non-voting shares (which are useless for gaining control). The voting premium is then equal to the future expected difference in the takeover prices of the two types of shares. In many empirical studies, this theory turned out to be successful in explaining the *relative* size of the voting premium. However, for most countries for which evidence is available, the takeover theory cannot explain the *absolute* size of the voting premium, because takeovers are too infrequent and takeover premiums are too small.

To substantiate this claim, Table 8 displays some key results of eleven empirical studies on the value of the voting right. The table focuses only on those studies that report information on the voting premium and differential tender offers for the *same* sample. The first three columns describe the analyzed sample. The fourth column displays the *ex ante* voting premium, i.e. the average relative price difference between voting and non-voting shares. This price difference varies between 5.4% for the US and 81.5% for Italy. In addition, the table shows the number of tender offers with differential bids that are reported in these studies, the average premium paid for voting shares relative to non-voting shares in these tender offers, and the *ex post* voting premium, which is the average tender offer premium multiplied by the number of differential tender offers and divided by the number of firms in the sample. If a shareholder buys one voting share in a randomly selected firm at the beginning of the sample period and holds it over the entire sample period, he on average receives the *ex post* voting premium compared to an investment into a single non-voting share of the same company. In order to obtain this *ex post* premium, the shareholder has to pay the *ex ante* premium when he buys the voting share (instead of the non-voting share) at the beginning of the sample period. Note that the takeover theory does

²³ See Adams and Ferreira (2008) for a survey of the empirical evidence on dual-class shares.

not predict that the two premiums must be identical, because shareholders might speculate on a differential bid after the end of the sample period. Nevertheless as the length of the sample period increases, the *ex post* premium should approach the *ex ante* premium. The table shows that even for the US and the UK, the *ex post* voting premium is much lower than the *ex ante* voting premium. In addition, the studies for Sweden, Germany, and Italy report a large discrepancy between the *ex ante* and *ex post* voting premium.²⁴ Only for Canada, *ex ante* and *ex post* voting premiums are of comparable size. Hence, Table 8 suggests that the takeover theory cannot explain the observed *ex ante* voting premium.

One might try to reconcile the evidence presented in Table 8 with the takeover theory by recognizing that there are events other than tender offers that can terminate the dual class structure. Frequently, dual class firms choose to convert non-voting shares into voting shares in order to simplify their share structure. If non-voting shares are treated unfavorably in such dual class stock unifications, these stock unifications might explain the discrepancy between *ex ante* and *ex post* voting premium in Table 8. The empirical evidence shows, however, that this is not the case, at least for the U.S., Israel, Germany, Switzerland, and Italy. On the contrary, non-voting shares are typically converted one-to-one into voting shares without any compensation to voting shareholders. In those cases where voting shareholders receive a compensation, the compensation is considerably lower than the previous voting premium. Hence, compared to the *ex ante* voting premium, non-voting shares clearly benefit from dual class stock unifications.²⁵ Only for the U.K., there is evidence that voting shareholders receive a compensation in dual class stock unifications that justifies the observed *ex ante* voting premium (see Ang and Megginson, 1989). Other differences between the two types of shares, like their liquidity or different dividend rights, do not help to explain voting premiums either, because they often work in the opposite direction: Non-voting shares often receive more dividends and are more liquid than voting shares. To sum up, the takeover theory can explain the size of the *ex ante* voting premium for Canada

²⁴ The data for the German *ex post* voting premium are based on our own research. We are also indebted to Philipp Pohlmann for valuable information on some differential takeover bids in Germany. It turns out that there have been only seven differential takeover bids in post-war Germany, four of which took place after 1998. In all except one case, the differential bid has been justified by the price difference at which the two types of shares traded in the market. Hence, the price difference seemed to determine the differential bid rather than the other way round.

²⁵ See Lease, McConnell and Mikkelson (1983), Hauser and Lauterbach (2004), Kunz (2002), Bigelli (2004), and Dittmann and Ulbricht (2008) for an empirical analysis of the terms of conversion in, respectively, U.S., Israeli, Swiss, Italian, and German dual class stock unifications.

and the U.K. For the U.S., Israel, Germany, Switzerland, and Italy, however, a large part of the voting premium cannot be attributed to takeovers or stock unifications.

There is also more direct evidence that the takeover hypothesis cannot be the whole story. Maynes (1996) analyzes 46 Canadian dual class firms, 19 of which have a so-called “participation coattail”, i.e. a company bylaw which states that, in case of a takeover bid, the holders of restricted voting shares have the right to convert their shares one-to-one into superior voting shares and tender them to the bidder. This bylaw effectively prevents tender offers with differential bids. Consequently, the takeover theory predicts that the voting premium should be zero for firms with such a participation coattail. Maynes (1996) finds however that the voting premium is still 5.5 percent for firms with a participation coattail compared to 8.2 percent for firms without a coattail provision. Altogether, the empirical literature shows clearly that the existing theory cannot fully explain the observed size of the voting premium for many countries.

Appendix B: Instructions for the baseline treatment

This appendix contains a translation of the German instructions given to our experimental subjects. To conserve space, we only present the instructions for the baseline treatment. For the other three treatments we changed as little as possible. For instance for the treatment NI, we merely replaced the probability 0.8 of the baseline treatment with the probability 0.5.

Welcome! This is an experiment in behavioral economics. You and the other participants in the experiment will participate in a situation where you have to make a decision. In this situation, you can earn money that will be paid out to you in cash at the end of the experiment. How much you will earn, depends on the decisions that you and the other participants in the experiment make.

These instructions describe the situation in which you have to make a decision. The instructions are identical for all participants in the experiment. It is important that you read the instructions carefully so that you understand the decision-making problem well. If something is unclear to you while reading, or if you have other questions, please let us know by raising your hand. We will then answer your questions individually.

Please do not, under any circumstances, ask your question(s) aloud. You are not permitted to give information of any kind to the other participants. You are also not permitted to speak to other participants at any time throughout the experiment. Whenever you have a question, please raise your hand and we will come to you and answer it. If you break these rules, we may have to terminate the experiment.

Once everyone has read the instructions and there are no further questions, we will conduct a short quiz where each of you will complete two short tasks on your own. We will walk around, look over your answers, and solve any

remaining comprehension problems. The only purpose of the quiz is to ensure that you thoroughly understand the crucial details of the decision-making problem.

As a matter of course, your anonymity and the anonymity of the other participants will be guaranteed throughout the entire experiment. You will neither learn about the identity of the other participants, nor will they learn about your identity.

1. General

The experiment consists of several rounds in which decisions must be made and information must be processed. With your decisions, you can earn points. These points represent your income and will be converted into euros at the end of the experiment and paid out in cash. The exact sequence of the stages of the experiment, the different decisions, and the payment modalities will be explained in detail in the following.

2. The allocation of roles

You will find yourself in a situation where you have to make decisions. This situation will be repeated for 30 rounds. This situation can be compared to a simple stock market. In this stock market, there is one single company issuing shares. You can buy shares of this company and thus take on the role of a shareholder. The amount of dividends paid out on the shares depends on how good or bad the manager of the company is. Chance plays an important role here: it determines whether the manager of the company is good or bad. The computer takes on the roles of company, manager, and it performs the chance moves.

3. Two possible stock market conditions

At the beginning of *each round*, the computer draws the quality of the manager randomly. You can visualize this as a drawing of one ball out of a hat that contains five balls labeled with the words “good manager” and another five labeled with the words “bad manager.” Neither you nor any of the other participants know the quality of the manager. You only know the following: there is a 50% probability of a good manager, and a 50% probability of a bad manager. The quality of the manager influences the probability that the company will make a profit. We first consider the situation that arises in the case of a good manager.

4. The stock market condition in the (unobservable) case of a good manager

If the manager is good (which neither you nor any of the others know), there is an 80% probability that the company will make a profit. You can visualize the situation with a good manager as if the computer picked a ball randomly out of a hat containing eight balls labeled with the words “profit”, and two balls labeled with the words “no profit.” Whether or not the company makes a profit is important for you only because it affects the dividend payments of the shares.

If the company makes a profit, the dividends on shares amount to 20 points per share. If the company does not make a profit, however, the dividends amount to 0 points per share.

Now we will look at the situation in the (also unobservable) case of a bad manager.

5. The stock market condition in the (also unobservable) case of a bad manager

If the manager is bad, there is a 20% probability that the company will make a profit. You can visualize the situation with a bad manager as if the computer picked a ball randomly out of a hat containing two balls labeled with the

words “profit”, and eight balls labeled with the words “no profit.” Whether or not the company makes a profit is important for you only because it affects the dividend payments of the shares.

If the company makes a profit, the dividends on shares amount to 20 points per share, as before. If the company does not make a profit, however, the dividends amount to 0 points per share.

Obviously, a dividend of 20 points per share is more likely if the manager is good. Conversely, a dividend of 0 points per share is more likely if the manager is bad.

Please keep in mind that the quality of the manager is unknown to all participants and that both qualities are equally likely at the beginning of each round.

6. The auctioning of shares

There are two types of shares: type-A shares and type-B shares. The next section will explain the difference between them. The dividends are the same for both types.

In every round, five type-A shares and five type-B shares are sold.

Apart from you, there are seven other persons who can buy shares of the company: namely, the other participants in the experiment. So in total, there are eight persons in the market who can bid for the shares. All these persons are subject to the same rules. These rules will be explained to you in the following.

You can buy a maximum of one share of each type per round. In total, therefore, you can buy a maximum of two shares per round: one type-A share and one type-B share. You can try to buy the shares of your choice by taking part in two auctions that are conducted simultaneously. In one auction, type-A shares are sold, and in the other auction, type-B shares are sold.

You will be asked to make a bid for each share type. In each of the two auctions, the following rule applies: the five participants in the experiment who submit the five highest bids for the type of shares offered in that auction will each receive one share of that type. The price they will each pay for their share will be the amount of the sixth-highest bid in that auction. (If two or more bids in one auction are identical, the computer will randomly determine their order.) Those participants who made the sixth-to-eighth-highest bids will not receive any share of the type offered and also will not pay anything in this auction.

The most sensible thing you can do in both of these auctions is to submit a bid that corresponds to your true valuation of the share in question, in other words, the maximum amount you would be willing to pay for it.

After all participants have placed their bids in the two simultaneous auctions, everyone will be informed about the price of type-A and type-B shares, and about the dividends per share (which is the same for both types of shares). You will always be given this information, no matter whether you have purchased shares or not. Furthermore, everyone will be told which share, if any, he or she has acquired. You will not receive any information on which shares, if any, others have acquired.

The winners of the auction will then receive the five type-A shares and the five type-B shares. If you have purchased at least one share, your interim earnings will amount to, in points:

The *dividends* on the shares you purchased, multiplied by the *number* of shares you purchased, minus the *price(s)* you had to pay.

You can also have negative earnings.

If you did not acquire any share, your interim earnings amount to zero.

You (and only you) will be told your interim earnings.

In the next section, the difference between A shares and B shares will be explained.

7. The share types

When you purchase a type-A share, you acquire the right to participate in a vote. You do not acquire such a right with type-B shares, however.

All five participants who have purchased a type-A share participate in a vote whose outcome determines whether or not the company manager will be retained. This vote takes place after all share purchases have been made and after you have been told your interim earnings from that round. At this point in time, you therefore know whether the shares paid out dividends of 0 or 20 points.

If the majority of the participants who own a type-A share are in favor of keeping the same manager, she will be retained. Retaining the same manager means that the computer does not again randomly generate the quality of the manager. If retained, the manager has the same quality as before the vote. If the majority of participants who have a type-A share vote to fire the manager, she will be fired and a new manager will be hired. Firing means that the computer will again randomly generate the quality of the new manager. Then there is again a 50% probability that the new manager is good and a 50% probability that the new manager is bad.

8. The second dividend payout on shares

After the vote on the manager, the company will again become active on the market, either with the old or with a new manager depending on the outcome of the vote.

Depending on the quality of the manager and the corresponding probability of the company's success, the computer again determines the dividends on the shares. The dividends again amount to 20 points in the case that the company is successful and 0 points in the case that the company is unsuccessful. As before, the probability of earning 20 points is higher, when the manager is good (namely, 80% for a good manager in comparison to 20% for a bad manager).

You will then be told your final earnings from that round. In the next round, the situation will be repeated with a new manager. So all rounds have the same structure.

9. Your finances

At the beginning of the experiment, you receive an initial budget of 150 points. You will also be paid a fixed amount of 16 points each round, in addition to your profits (or losses) in that round. Your final payout consists of the sum of the payouts from all rounds. Furthermore, you receive 3 euro if you arrived 10 minutes before the beginning of the experiment. The exchange rate used to convert points into cents is:

1 point = 3 cents.

10. The sequence of events of one round at a glance

1. The manager's ability is determined randomly but not disclosed. The auctions for type-A shares and type-B shares take place.

2. All participants are informed about the prices and dividends of the shares. Furthermore, each of you individually receives information about which share(s) you have acquired.
3. The dividends of 0 or 20 points per share are announced. You are told your interim earnings from that round.
4. The vote on retaining or firing the manager takes place among all holders of type-A shares. Depending on the results of the vote, either the same manager is retained or a new manager is hired.
5. The result of the vote is announced to all participants.
6. The second dividend payout of 0 or 20 points per share is announced. You receive the total payout in this round, which is made up as follows: if you did not purchase any shares, you only receive the fixed amount of 16 points in this round. If you purchased one or two shares, your profits from this round consist of the dividends of the shares that you own, minus the price(s) you had to pay for these share(s), plus the fixed payment of 16 points.

This procedure is repeated 30 times.

After the end of the 30th round, you will be asked to fill in a questionnaire containing questions on your behavior during the experiment. After everyone has completed the questionnaire, you will be told your total earnings. You will not learn anything about the earnings of the other participants.

Please remain seated and wait quietly until we come to you and pay out your total earnings in cash. Please do not talk to the other participants. After your total earnings have been paid out, please leave the room quietly.

If there was anything you did not understand, please let us know by raising your hand. We will answer your questions on an individual basis.

Thank you for participating!

Appendix C: Proof of Proposition 1

Denote by Π^i the profits of investor i and by α^i, β^i the probability that the i^{th} investor obtains an A-share, respectively, a B-share in the auction. We denote bids by B_A^i and B_B^i and equilibrium prices by P_A and P_B . Then equilibrium profits for each investor can be written as:

$$\Pi^i = \alpha^i (V + \omega - P_A) + \beta^i (V + \alpha^i \omega - P_B) . \quad (12)$$

Part 1: Non-existence of symmetric pure strategy equilibria.

We prove this part by contradiction. Hence, assume that a symmetric pure strategy equilibrium exists where each investor bids the equilibrium prices P_A and P_B . Then each investor is rationed in equilibrium, and $\alpha = \beta = M/N$. Also, it must be the case that $\partial \Pi / \partial \alpha = \partial \Pi / \partial \beta = 0$. If $\partial \Pi / \partial \alpha < 0$ ($\partial \Pi / \partial \alpha > 0$), then the investor has an incentive to reduce (increase) his bid for the A-share, and analogously for the B-share. We therefore obtain the following prices for the conjectured equilibrium from (12):

$$\begin{aligned}\frac{\partial \Pi}{\partial \alpha} = 0 &\Rightarrow P_A = V + \left(1 + \frac{M}{N}\right) \omega, \\ \frac{\partial \Pi}{\partial \beta} = 0 &\Rightarrow P_B = V + \frac{M}{N} \omega.\end{aligned}\tag{13}$$

For any other set of prices, each investor would have an incentive to deviate from the conjectured equilibrium strategy. However, with these prices, we obtain $\Pi = -(M/N)^2 \omega < 0$. Hence, all investors would make negative profits. This cannot be the case, because each investor has the option not to bid in the auction and receive zero profits.

Part 2: Existence of asymmetric pure strategy equilibria.

Denote by $\varepsilon > 0$ the smallest increment by which investors can increase their bids. We now construct an asymmetric pure strategy equilibrium as follows.

$$\begin{aligned}B_A^i &= V + (1 + \gamma) \omega, \quad i = M + 1 \dots N, \\ B_A^i &= V + (1 + \gamma) \omega + \varepsilon, \quad i = 1 \dots M, \\ B_B^i &= V + (1 - \gamma) \omega, \quad i = M + 1 \dots N, \\ B_B^i &= V + (1 - \gamma) \omega + \varepsilon, \quad i = 1 \dots M,\end{aligned}\tag{14}$$

where: $0 \leq \gamma \leq 1$.

The parameter γ describes how the valuation premium for the B-share is allocated between the price for B-shares and the price for A-shares. Then $\alpha^i = \beta^i = 1$ for the M highest bidders, $i = 1 \dots M$, who win all the shares in equilibrium. Also, $\alpha^i = \beta^i = 0$ for the $M-N$ other bidders, $i = M+1 \dots N$, who never win a share in any auction. The profits of the winners in the auction are then:

$$\Pi = V + \omega - (V + (1 + \gamma) \omega) + V + \omega - (V + (1 - \gamma) \omega) = 0.\tag{15}$$

The losers in the auctions make zero profits, too. The profits of a winner who would deviate by reducing his bid below the stipulated equilibrium price in one of the auctions (and without changing the strategy in the other auction) would be:

$$\begin{aligned}\Pi^{Winner}(\text{bid} < B_B^{M+1}) &= V + \omega - (V + (1 + \gamma) \omega) = -\gamma \omega \leq 0 \\ \Pi^{Winner}(\text{bid} < B_A^{M+1}) &= V - (V + (1 - \gamma) \omega) = -(1 - \gamma) \omega \leq 0.\end{aligned}\tag{16}$$

Bidding lower in both auctions results in profits of zero. If winners increase their bids above those in (14), this has no consequence unless one of the losing bidders also increases his price, in which case they would overpay. Hence, bidding higher is a weakly dominated strategy.

The losers of the auction could bid higher in one or both auctions. In order to win, they would have to increase their bids at least to B_A^M and B_B^M (then they would be rationed) or by an increment ε higher to win with probability one. The payoffs from bidding B_A^M and B_B^M are (note that ε , α , and β are all strictly positive):

$$\begin{aligned}
\Pi(\text{bid } B_A^M \text{ for A}) &= \alpha^i (V + \omega - (V + (1 + \gamma)\omega + \varepsilon)) \\
&= -\alpha^i (\gamma\omega + \varepsilon) < 0 \\
\Pi(\text{bid } B_B^M \text{ for B}) &= \beta^i (V - (V + (1 - \gamma)\omega + \varepsilon)) = -\beta^i ((1 - \gamma)\omega + \varepsilon) < 0 \\
\Pi(\text{bid } B_A^M \text{ and } B_B^M) &= \alpha^i (V + \omega - (V + (1 + \gamma)\omega + \varepsilon)) \\
&\quad + \beta^i (V + \alpha^i \omega - (V + (1 - \gamma)\omega + \varepsilon)) \\
&= -\alpha^i (\gamma\omega + \varepsilon) - \beta^i ((1 - \gamma - \alpha^i)\omega + \varepsilon) < 0.
\end{aligned} \tag{17}$$

Bidding above B_A^M and B_B^M increases the probability of winning to one and generates even lower payoffs. Hence, the losers of the auction have no incentive to deviate by bidding higher for either the A-share or the B-share or both. Thus, the voting premium is

$$P_A - P_B = B_A^{M+1} - B_B^{M+1} = 2\gamma\omega. \tag{18}$$

Since γ can be any number in the unit interval, it holds that $0 \leq P_A - P_B \leq 2\omega$.

Figures

Figure 1: Prices over time in the baseline treatment

This figure shows, for each period, the prices P_A and P_B of voting A-shares and non-voting B-shares (averaged across the 10 sessions). In addition, the plot shows a cubic spline that smoothes the observations across periods. The solid line represents the smoothed price of a voting A-share, and the broken line the smoothed price of a nonvoting B-share.

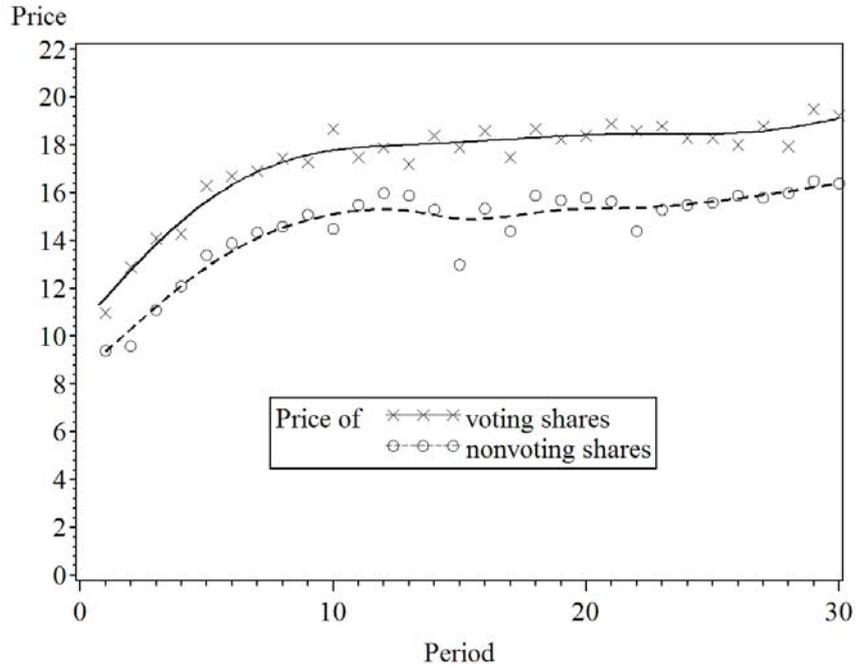
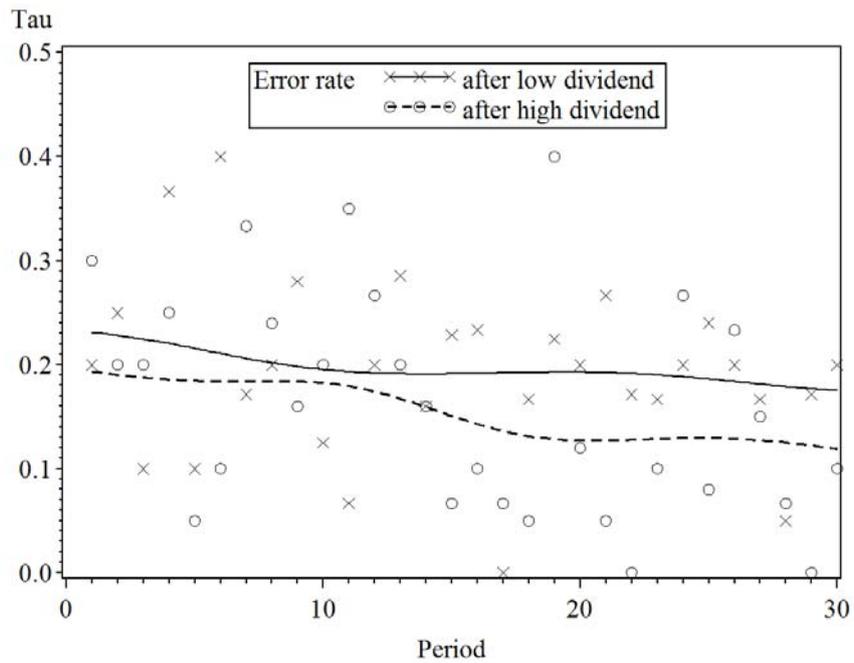


Figure 2: Incorrect votes over time in the baseline treatment

This figure shows, for each period, the frequency τ of wrong votes conditional on the observed first dividend D_1 . In addition, the plot shows non-parametric regression, which smoothes the observations across periods. The solid line represents the smoothed error rate after a low dividend, and the broken line represents the smoothed error rate after a high dividend.



Tables

Table 1: Overview over the different treatments

This table shows the two defining parameters for each treatment, i.e. the probability p that the dividend is high (low) when the manager is good (bad), and the number of shares held by a blockholder who always votes in favor of the manager. In addition, the table shows the utility gain or loss ΔU from equation (8) that is at stake in the vote, the Nash value of the shares, V_{Nash} , from equation (4), the number of sessions, the number of rounds per session, and the number of subjects per session.

Treatment	Link p between skill and dividend	Shares held by blockholder	ΔU	V_{Nash}	Sessions	Rounds per session	Subjects per session
Baseline treatment (BASE)	80%	0	3.6	21.8	10	30	8
No uncertainty (NU)	100%	0	10.0	25.0	10	30	8
Non-influential manager (NI)	50%	0	0.0	20.0	10	30	8
Blockholder (BH)	80%	6	0.0	20.0	10	30	8

Table 2: Prices in the baseline treatment (BASE)

This table contains statistics on four variables for the baseline treatment: the price of voting A-shares, the price of non-voting B-shares, the difference between these two prices (the premium), and the premium scaled by the Nash value of the shares (the relative premium). The table shows mean, median, standard deviation, and the p-values of two tests, the t-test for zero mean and the Wilcoxon signed rank test for zero median. For the prices of voting and non-voting shares, the table also shows the mean difference between the price and the Nash value, and the p-value of the t-test for this difference to be zero. In Panel A, we first calculate one value of the respective variable for each session by averaging the variable across the last 15 rounds of the session. In the second step, we calculate the statistics across the 10 sessions. Panel B shows the results for the pooled sample of all sessions and rounds.

Panel A: Average of last 15 rounds

Variable	Obs.	Mean	Median	Standard deviation	T-test p-value	Wilcoxon p-value	Difference to Nash	
							Mean	T-test p-value
Voting A-share	10	18.52	18.27	4.65	0.000	0.002	3.28	0.053
Non-voting B-share	10	15.61	17.37	5.41	0.000	0.002	6.19	0.006
Premium	10	2.91	2.63	2.50	0.005	0.004		
Relative premium	10	13.35%	12.08%	11.49%	0.005	0.004		

Panel B: All rounds

Variable	Obs.	Mean	Median	Standard deviation	T-test p-value	Wilcoxon p-value	Difference to Nash	
							Mean	T-test p-value
Voting A-share	300	17.41	18.00	4.63	0.000	0.000	4.39	0.000
Non-voting B-share	300	14.60	15.76	5.30	0.000	0.000	7.20	0.000
Premium	300	2.82	2.00	3.31	0.000	0.000		
Relative premium	300	12.92%	9.17%	15.20%	0.000	0.000		

Table 3: Offers in the baseline treatment (BASE)

This table contains statistics on four variables for the baseline treatment: the offer for voting A-shares, the offer for non-voting B-shares, the difference between these two offers (the premium), and the premium scaled by the Nash value of the shares (the relative premium). The table shows mean, median, standard deviation, and the p-values of two tests, the t-test for zero mean and the Wilcoxon signed rank test for zero median. For the premium, the table also shows the frequencies that the premium is negative or, respectively, positive. In Panel A, we first calculate one value of the respective variable for each subject by averaging the variable across the last 15 rounds. In the second step, we calculate the statistics across the 80 subjects. Panel B shows the results for the pooled sample of all subjects and rounds.

Panel A: Average of last 15 rounds

Variable	Obs.	Mean	Median	Standard deviation	T-test p-value	Wilcoxon p-value	Frequency	
							negative	positive
Voting A-share	80	29.41	20.17	37.81	0.000	0.000		
Non-voting B-share	80	23.95	18.40	33.58	0.000	0.000		
Premium	80	5.46	1.67	13.91	0.001	0.000	16.3%	70.0%
Relative premium	80	25.05%	7.65%	63.81%	0.001	0.000		

Panel B: All rounds

Variable	Obs.	Mean	Median	Standard deviation	T-test p-value	Wilcoxon p-value	Frequency	
							negative	positive
Voting A-share	2,400	27.76	20.00	36.43	0.000	0.000		
Non-voting B-share	2,400	22.65	18.00	32.18	0.000	0.000		
Premium	2,400	5.11	1.00	17.39	0.000	0.000	10.8%	53.8%
Relative premium	2,400	23.42%	4.59%	79.77%	0.000	0.000		

Table 4: Voting behavior

This table describes the voting outcomes for all four treatments based on data from the last 15 rounds of the session. Panel A shows for each treatment (1) the frequency τ_L that A-shareholders vote for keeping the manager after a low dividend, (2) the frequency e_L that a manager is actually kept after a low dividend (from equation (5)), (3) the frequency τ_H that A-shareholders vote for replacing the manager after a high dividend, and (4) the frequency e_H that a manager is actually replaced after a high dividend (from equation (6)). In addition, the table shows the p-value of the χ^2 -test and the Wilcoxon signed rank test that τ_L equals τ_H . The χ^2 -test assumes that every vote cast is an independent observation. The Wilcoxon test allows for dependence within a group. Here we calculate for each group the difference between the percentage of wrong votes after a high dividend and the percentage of wrong votes after a low dividend, and apply the Wilcoxon test to these 10 differences per treatment. Panel B displays the Nash value of the shares, V_{Nash} , from equation (4), the Quantal Response Equilibrium value, V_{QRE} , when the empirical error probabilities are taken into account (from equations (5) to (7)), the maximum voting premium 2ω from Proposition 1 and equation (11), the observed voting premium and the p-values of the Wilcoxon signed rank test that the observed voting premium differs from, respectively, zero and the maximum voting premium 2ω . Panel C shows for the treatments BASE and NU, the responsiveness coefficients λ_L and λ_H calculated from τ_L and, respectively, τ_H as shown in equation (10). This panel also displays the p-values of three tests that, respectively, $\lambda_L = \lambda_H$, that the λ_L are identical in the two treatments, and that the λ_H are identical in the two treatments. For these tests, we first calculate the λ 's for each session and then test for equal location of the λ 's between the two groups with a two-sample Wilcoxon signed rank test.

Panel A: Individual and collective errors

Treatment	τ_L	e_L	τ_H	e_H	P-value for $\tau_L = \tau_H$	
					χ^2	Wilcoxon
Baseline treatment (BASE)	18.33%	7.14%	11.82%	3.03%	0.014	0.148
No uncertainty (NU)	11.03%	0.00%	10.56%	1.39%	0.836	0.625
Non-influential manager (NI)	56.32%	64.47%	21.89%	8.11%	0.000	0.010
Blockholder (BH)	31.16%	15.12%	23.75%	7.81%	0.025	0.742

Panel B: Valuation

Treatment	V_{Nash}	V_{QRE}	Voting premium		Wilcoxon p-value: Voting premium different from	
			Max = 2ω	Observed	Zero	Max = 2ω
			Baseline treatment (BASE)	21.80	21.69	0.116
No uncertainty (NU)	25.00	24.89	0.120	3.993	0.002	0.006
Non-influential manager (NI)	20.00	20.00	0.000	0.403	0.158	0.004
Blockholder (BH)	20.00	20.00	0.000	0.293	0.219	0.002

Panel C: Responsiveness

Treatment	λ_L	λ_H	Wilcoxon p-value for		
			$\lambda_L = \lambda_H$	$\lambda_L^{NU} = \lambda_L^{BASE}$	$\lambda_H^{NU} = \lambda_H^{BASE}$
Baseline treatment (BASE)	3.09	8.57	0.700		
No uncertainty (NU)	3.62	4.00	0.922	0.700	0.922

Table 5: Prices and offers in the no-uncertainty treatment (NU)

This table describes prices (Panel A) and offers (Panel B) for the no-uncertainty treatment (NU). Panel A shows statistics on the price of voting A-shares, the price of non-voting B-shares, the difference between these two prices (the premium), and the premium scaled by the Nash value of the shares (the relative premium). The table shows mean, median, standard deviation, and the p-values of two tests, the t-test for zero mean and the Wilcoxon signed rank test for zero median. In addition, it shows the p-values of the two-sample t-test and the two-sample Wilcoxon signed rank test that the location of the distribution is identical under the NU and the BASE treatment. We first calculate one value of the respective variable for each session by averaging the variable across the last 15 rounds of the session. In the second step, we calculate the statistics across the 10 sessions. Panel B displays the same statistics for individual offers.

Panel A: Average prices of the last 15 rounds

Variable	Obs.	Mean	Median	Standard deviation	T-test p-value	Wilcoxon p-value	P-value two-sample comparison with BASE	
							T-test	Wilcoxon
Voting A-share	10	20.90	20.77	4.37	0.000	0.002	0.254	0.289
Non-voting B-share	10	16.91	17.37	2.96	0.000	0.002	0.518	0.796
Premium	10	3.99	3.13	3.27	0.004	0.002	0.417	0.393
Relative premium	10	15.97%	12.53%	13.07%	0.004	0.002	0.640	0.684

Panel B: Average offers of the last 15 rounds

Variable	Obs.	Mean	Median	Standard deviation	T-test p-value	Wilcoxon p-value	P-value two-sample comparison with BASE	
							T-test	Wilcoxon
Voting A-share	80	25.89	22.70	17.21	0.000	0.000	0.450	0.203
Non-voting B-share	80	22.16	19.77	13.23	0.000	0.000	0.659	0.127
Premium	80	3.72	1.53	17.42	0.060	0.000	0.487	0.766
Relative premium	80	14.90%	6.13%	69.69%	0.060	0.000	0.338	0.567

Table 6: Prices and offers in the non-influential manager treatment (NI)

This table describes prices (Panel A) and offers (Panel B) for the non-influential manager treatment (NI). Panel A shows statistics on the price of voting A-shares, the price of non-voting B-shares, the difference between these two prices (the premium), and the premium scaled by the Nash value of the shares (the relative premium). The table shows mean, median, standard deviation, and the p-values of two tests, the t-test for zero mean and the Wilcoxon signed rank test for zero median. In addition it shows the p-values of the two-sample t-test and the two-sample Wilcoxon signed rank test for two hypotheses: (1) that the location of the distribution is identical in treatments NI and BASE, and (2) that the location of the distribution is identical under treatments NI and NU. We first calculate one value of the respective variable for each session by averaging the variable across the last 15 rounds of the session. In the second step, we calculate the statistics across the 10 sessions. Panel B displays the same statistics for individual offers.

Panel A: Average prices of the last 15 rounds

Variable	Obs.	Mean	Median	Standard deviation	T-test p-value	Wilcoxon p-value	P-value two-sample comparison with BASE		P-value two-sample comparison with NU	
							T-test	Wilcoxon	T-test	Wilcoxon
Voting A-share	10	16.38	17.03	2.63	0.000	0.002	0.225	0.159	0.014	0.014
Non-voting B-share	10	15.98	16.47	2.72	0.000	0.002	0.851	0.565	0.475	0.424
Premium	10	0.40	0.28	0.67	0.089	0.158	0.012	0.015	0.007	0.001
Relative premium	10	2.01%	1.40%	3.34%	0.089	0.158	0.013	0.018	0.008	0.001

Panel B: Average offers of the last 15 rounds

Variable	Obs.	Mean	Median	Standard deviation	T-test p-value	Wilcoxon p-value	P-value two-sample comparison with BASE		P-value two-sample comparison with NU	
							T-test	Wilcoxon	T-test	Wilcoxon
Voting A-share	80	19.45	18.10	9.09	0.000	0.000	0.024	0.010	0.004	0.000
Non-voting B-share	80	18.55	18.07	7.51	0.000	0.000	0.164	0.529	0.035	0.014
Premium	80	0.91	0.07	4.26	0.060	0.000	0.006	0.001	0.164	0.005
Relative premium	80	4.54%	0.33%	21.30%	0.060	0.000	0.008	0.001	0.207	0.009

Table 7: Prices and offers in the blockholder treatment (BH)

This table describes prices (Panel A) and offers (Panel B) for the blockholder treatment (BH). Panel A shows statistics on the price of voting A-shares, the price of non-voting B-shares, the difference between these two prices (the premium), and the premium scaled by the Nash value of the shares (the relative premium). The table shows mean, median, standard deviation, and the p-values of two tests, the t-test for zero mean and the Wilcoxon signed rank test for zero median. In addition it shows the p-values of the two-sample t-test and the two-sample Wilcoxon signed rank test for two hypotheses: (1) that the location of the distribution is identical in treatments BH and BASE, and (2) that the location of the distribution is identical in treatments BH and NU. We first calculate one value of the respective variable for each session by averaging the variable across the last 15 rounds of the session. In the second step, we calculate the statistics across the 10 sessions. Panel B displays the same statistics for individual offers.

Panel A: Average prices of the last 15 rounds

Variable	Obs.	Mean	Median	Standard deviation	T-test p-value	Wilcoxon p-value	P-value two-sample comparison with BASE		P-value two-sample comparison with NU	
							T-test	Wilcoxon	T-test	Wilcoxon
Voting A-share	10	13.14	12.97	4.08	0.000	0.002	0.013	0.024	0.001	0.000
Non-voting B-share	10	12.85	12.73	4.02	0.000	0.002	0.212	0.123	0.020	0.030
Premium	10	0.29	0.33	0.93	0.346	0.219	0.010	0.034	0.006	0.001
Relative premium	10	1.47%	1.67%	4.67%	0.346	0.219	0.011	0.042	0.007	0.001

Panel B: Average offers of the last 15 rounds

Variable	Obs.	Mean	Median	Standard deviation	T-test p-value	Wilcoxon p-value	P-value two-sample comparison with BASE		P-value two-sample comparison with NU	
							T-test	Wilcoxon	T-test	Wilcoxon
Voting A-share	80	24.96	15.20	37.28	0.000	0.000	0.454	0.000	0.840	0.000
Non-voting B-share	80	22.56	15.00	29.45	0.000	0.000	0.781	0.014	0.913	0.000
Premium	80	2.40	0.00	16.70	0.203	0.185	0.209	0.001	0.624	0.003
Relative premium	80	11.99%	0.00%	83.48%	0.203	0.185	0.268	0.001	0.811	0.006

Table 8: Empirical literature on differential tender offers and the voting premium

This table summarizes 11 empirical papers that include information on the voting premium *and* on the frequency of tender offers with differential bids. For each line, all numbers refer to a single dataset, so that *ex ante* and *ex post* voting premiums can be directly compared. The *ex ante* voting premium is the average relative price difference between voting and non-voting shares (or superior and inferior-voting shares), i.e. $(P^v - P^m)/P^m$. The average tender offer premium is $(TO^v - TO^m)/TO^m$, where TO^v is the tender offer (in money or stock) on voting shares and TO^m on non-voting shares. The *ex post* voting premium is the average tender offer premium multiplied by the number of differential tender offers and divided by the number of firms in the sample. The studies only take successful tender offers into account.

Country	Sample period	Number of firms in the sample	<i>Ex ante</i> voting premium	Number of differential tender offers	Average tender offer premium	<i>Ex post</i> voting premium	Source
USA	1940-1978	26	5.4%	0	N/A	0%	Lease, McConnell and Mikkelson (1983)
USA	1984-1990	94	10.5%	2	81.5%	1.7%	Zingales (1995)
USA	1960-1980	144	N/A	4	130.9%	3.6%	DeAngelo and DeAngelo (1985)
UK	1955-1982	152	13.3%	37	32.1%	7.8%	Meggison (1990)
Canada	1981-1992	98	10.4%	20	57.2%	11.7%	Smith and Amoako-Adu (1995)
Israel	1981	25	45.5%	N/A	N/A	N/A	Levy (1982)
Sweden	1980-1990	65	15.2%	9	27%	3.7%	Bergström and Rydqvist (1992)
Germany	1956-1998	101	17.2%	3	20.6%	0.6%	Daske and Ehrhardt (2002) and own research
Switzerland	1973-1983	45	22.4%	N/A	N/A	N/A	Horner (1988)
Switzerland	1990-1991	29	18%	N/A	N/A	N/A	Kunz and Angel (1996)
Italy	1987-1990	96	81.5%	0	N/A	0%	Zingales (1994)