Journal of Financial Economics 98 (2010) 90–112

Contents lists available at ScienceDirect

Journal of Financial Economics

journal homepage: www.elsevier.com/locate/jfec

Heterogeneity and peer effects in mutual fund proxy voting ☆

Gregor Matvos [a,*], Michael Ostrovsky [b]

[a] University of Chicago Booth School of Business, Chicago, IL 60637, USA
[b] Graduate School of Business, Stanford University, Stanford, CA 94305, USA

ARTICLE INFO

Article history:
Received 5 March 2009
Received in revised form
6 August 2009
Accepted 8 September 2009
Available online 1 April 2010

JEL classification:
G34
D72

Keywords:
Proxy voting
Boards of directors
Director elections
Peer effects and strategic complementarities
Supermodular games

ABSTRACT

This paper studies voting in corporate director elections. We construct a comprehensive data set of 2,058,788 mutual fund votes over a two-year period. We find systematic heterogeneity in voting: some funds are consistently more management-friendly than others. We also establish the presence of peer effects: a fund is more likely to oppose management when other funds are more likely to oppose it, all else being equal. We estimate a voting model whose supermodular structure allows us to compute social multipliers due to peer effects. Heterogeneity and peer effects are as important in shaping voting outcomes as firm and director characteristics.

The election of directors is the most important shareholder franchise. Larry Sonsini, Chairman, NYSE Proxy Working Group (NYSE, 2006).

1. Introduction

Despite its importance, voting in the elections of corporate boards remains relatively unexplored. A major obstacle for detailed analysis of voting is the lack of data on individual votes: until recently, voting was confidential, with only the aggregate outcomes reported by the firms. Of course, aggregate data on voting outcomes can be very useful. For instance, Cai, Garner, and Walkling (2009) have used these data to study firm- and director-level determinants and consequences of director votes. It is, however, hard to gain insight into shareholder-specific determinants of voting using aggregate data. In 2003, the Securities and Exchange Commission (SEC) introduced a new rule, requiring mutual funds to report their votes. In this paper, we present the results of our analysis of mutual fund proxy voting behavior, based on the votes of the funds in the first two years after the SEC rule change took effect. Our comprehensive data set contains 2,058,788 votes by 2,774 mutual funds in 13,588 director elections of 1,388 companies. This rich data set allows us to look at the behavior of individual voters.

Our first finding is that mutual funds systematically differ in their voting behavior. Some mutual funds are consistently more likely to cast votes in favor of directors sponsored by

☆ We thank Efraim Benmelech, Joshua Coval, Robin Greenwood, Guido Imbens, John Lazarev, Peter Reiss, and David Scharfstein, the anonymous referee, and especially Jeremy Stein, George Baker, and Malcolm Baker for helpful comments and suggestions. We are also grateful to Leonid Pekelis for excellent research assistance and to the Arthur and Toni Rembe Rock Center for Corporate Governance at Stanford University for financial support. An earlier draft of this paper was circulated under the title "Strategic proxy voting."

* Corresponding author.
E-mail address: gregor.matvos@chicagobooth.edu (G. Matvos).

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doi:10.1016/j.jfineco.2010.03.014

Table 1
Votes in director elections by 10 popular index funds.
This table presents sample voting data for 10 popular mutual funds tracking the S&P 500 index in the elections of directors proposed by management. The votes are for the July 2003–June 2004 and July 2004–June 2005 voting periods. All votes other than "for" and "withhold" were discarded. Data source: SEC Edgar (N-PX filings).

Mutual fund	July 1, 2003–June 30, 2004			July 1, 2004–June 30, 2005		
	# "For"	# "Withhold"	% "Withhold"	# "For"	# "Withhold"	% "Withhold"
Vanguard 500 Index Fund	2,686	559	17.2%	2,921	351	10.7%
USAA S&P 500 Index Fund	2,992	199	6.2%	3,028	223	6.9%
Schwab S&P 500 Index Fund	2,791	173	5.8%	2,888	208	6.7%
Merrill Lynch S&P 500 Index Fund	3,200	118	3.6%	3,130	107	3.3%
Morgan Stanley S&P 500 Index Fund	3,183	115	3.5%	3,112	130	4.0%
UBS S&P 500 Index Fund	2,954	103	3.4%	2,970	80	2.6%
T. Rowe Price Equity Index 500 Fund	2,942	96	3.2%	2,996	112	3.6%
Fidelity Spartan 500 Index Fund	3,089	63	2.0%	3,124	38	1.2%
Smith Barney S&P 500 Index Fund	2,920	53	1.8%	3,182	42	1.3%
Dreyfus S&P 500 Index Fund	3,176	6	0.2%	3,135	15	0.5%

the management than others. Our second finding is the presence of peer effects in mutual fund voting: a fund is more likely to oppose management when other funds are more likely to oppose it as well. These strategic interactions amplify funds' equilibrium voting responses to factors that affect fund voting. For example, a negative change in director quality will first have a direct effect: each fund is less likely to support a lower-quality director. But there is also an additional force: knowing that other funds are less likely to support the director, a fund has an additional reason to withhold its support. Thus, in equilibrium, the direct effect of any policy change will be magnified.

It is instructive to contrast these findings with hypothetical "straightforward" voting behavior. In the hypothetical case, all shareholders have the same incentive: to promote the behavior of directors that serves the best interests of the company. Each fund evaluates each director and then votes accordingly. Of course, even under such "straightforward" behavior, we would expect to see differences in fund voting behavior, simply due to random noise. However, we would not see systematic differences, and the identity or characteristics of the shareholders casting proxy votes would not play a role. In contrast, our results show that they matter. Moreover, the magnitudes of fund heterogeneity and peer effects are comparable economically to the effects of firm and director characteristics on voting outcomes.

To show that some funds are systematically more management-friendly than others, we use a fund's past voting record as an estimate of its friendliness. We find that among funds who vote on the same director in the same meeting, funds with a higher estimate of friendliness are significantly more likely to vote "for". In other words, fund friendliness, as measured by the past voting record, is an important determinant of mutual fund voting in board of directors elections.

A simple example of voting patterns provides an illustration of both heterogeneity and persistence of fund voting behavior. Table 1 presents the number of "for" (i.e., in support of a management-proposed director) and "withhold" (i.e., against a management-proposed director) votes for 10 large, popular mutual funds tracking the S&P 500 index for two voting seasons. While the holdings of these funds are, by construction, very similar, the votes are not. The least management-friendly fund, Vanguard 500 Index Fund, withheld support from management-proposed directors 559 times, or in 17.2% of cases, in the first voting season, and 351 times, or in 10.7% of cases, in the second one. The corresponding numbers for the friendliest fund, Dreyfus S&P 500 Index Fund, are 6 (0.2%) and 15 (0.5%)—lower than Vanguard's by a factor of almost 100 in the first voting season and almost 25 in the second. The 10 funds' voting policies are also highly persistent: the correlation between their votes in the first voting season and in the second one is equal to 0.93.

There are several reasons why mutual funds may systematically differ in their management-friendliness. One is the degree to which they worry about potential management retaliation. In particular, funds may care about the current and potential future business ties with the firm, such as managing pension plans.[1] Davis and Kim (2007) find that fund families that derive a larger part of their revenue from management fees from their portfolio firms use voting policies that are friendlier to management. It can therefore be costly for a single fund to vote against directors recommended by management. However, management may have a hard time severing business relations with many funds holding its shares. Similarly, if the firm were to retaliate by other means, such as restricting funds' access to their management,[2] its ability to punish any individual fund would be diminished if it had to retaliate against a larger number of funds. In the extreme case, if all funds vote against directors

[1] Other potential reasons include differences in proxy guidelines, differences in how proxy voting is organized and monitored within fund families, and fund manager individual differences in disutilities of opposing management and resisting the pressure to support management-nominated directors.

[2] For example, in its comments to the SEC on vote disclosure rules, a mutual fund company states that "this retaliation could be in the form of denial of access to company management in the course of our investment research on behalf of our shareholders." http://www.sec.gov/rules/proposed/s73602/rmason1.txt. Accessed July 27, 2009.

recommended by management, the management may resign and will not be able to retaliate. This "safety in numbers" externality can therefore be a source of peer effects in mutual fund proxy voting. After establishing persistent heterogeneity in fund voting behavior, we move on to testing for the presence of these peer effects and evaluating their magnitudes.

Identifying peer effects requires a careful approach, because firm and director characteristics that are not observed by the researcher but are known to the funds induce a correlation in fund votes. This correlation can be mistaken for funds' strategic interactions. We exploit the heterogeneity in funds' management-friendliness to overcome this issue. Intuitively, suppose Fidelity is voting on two otherwise identical directors, except that the first director will be voted on by management-friendly funds and the second director by unfriendly ones. The first director will get more support from funds other than Fidelity than the second director, even though they are identical. Fidelity should not intrinsically care about how management-friendly other funds are; the management-friendliness of the other funds is of interest only to the extent that it affects their votes. Therefore, if Fidelity's vote is more favorable for the first director, this indicates that Fidelity raised its vote in response to the more favorable vote by other funds. This idea forms the basis of our estimation: we use management-friendliness of other funds in an election as an instrument for their expected vote.

We first estimate a basic linear instrumental variables model. We find that funds are more likely to vote "for" when their expectations about the number of "for" votes cast by other funds are higher. To analyze the magnitudes of these effects in more detail, we also estimate a structural model of voting in board of directors elections, again exploiting the variation in fund friendliness to identify the parameters. The model incorporates our two main findings from the reduced-form analysis: heterogeneity in fund friendliness and payoff complementarities (peer effects). We find that the effect of mutual fund friendliness on voting in board of directors elections is of the same order magnitude as the effects of firm and director characteristics. This indicates that who votes on a director can potentially be as important as how good this director is.

We also find significant peer effects in fund voting behavior. The following back-of-the-envelope calculation illustrates their magnitudes. Consider a fund that is likely to withhold its vote from management with probability 20%, taking into account that other funds will withhold their vote with probability 20% as well. Suppose that the fund's expectation of how other funds will vote changes: it thinks other funds will withhold their vote with probability 10%, even though the fund's own estimate of director quality remains the same. Our estimates suggest that in response to this change in expectations, the fund will withhold its vote with probability 14.9%.

This same estimate also implies that the effects of changes in director quality will be amplified in equilibrium. Suppose a director's quality improves to such a degree that each fund in isolation would decrease its probability of voting "withhold" from 20% to 10%. In addition, each fund now knows that all other funds will lower their vote by 10%. Given our estimates, in response to this change in other funds' voting, each fund would further decrease its probability of a "withhold" vote from 10% to 7.2%. But then all funds know that as well, so they have an incentive to reduce their vote even further: an additional adjustment decreases the probability of funds voting "withhold" from 7.2% to 6.6%. Iterating this calculation eventually converges to each fund voting "withhold" with probability 6.4%. Thus, the 10% direct effect of changing director quality translates to a total effect of 13.6%: the social multiplier is 1.36, and the complete effect of changing a director characteristic is more than a third larger than it would be in the absence of peer effects.

To evaluate the economic magnitude of peer effects in practice, we compute counterfactual equilibria using the estimated structural model. For each director from a subset, we first compute the effect of an increase in quality if all funds voted in isolation. We then compute the equilibrium of the voting game for the same increase in director quality. We compare the two outcomes and find that the multipliers are often large, and differ substantially across directors. For example, the median multiplier is about 1.07, but the 75th percentile multiplier can be as high as 2.13 (depending on the details of the model). This means that for many directors, the effect of changing director quality on voting outcomes more than doubles in the presence of peer effects.

In addition to the results on proxy voting, our paper offers a methodological contribution to the literature on estimating static games with peer effects. We model voting in director elections as a supermodular game of asymmetric information (Van Zandt and Vives, 2007). This structure allows us to compute bounds on counterfactuals even in the presence of multiple equilibria. It also allows us to compute director-specific multiplier effects, taking into account director characteristics and shareholder composition. The computations can be performed using a simple, intuitive, and fast iterative process.

Our paper is most closely related to two strands of corporate governance literature. The first one is the literature on the determinants of board composition. These have been widely studied using outcome variables, such as board composition and director survival rates (see, e.g., Hermalin and Weisbach, 2003 for an excellent survey). Recent papers by Cai, Garner, and Walkling (2009) and Fischer, Gramlich, Miller, and White (2009) add to that literature by studying the effects and determinants of director elections using data on firm-level voting outcomes. We contribute to this stream of research by looking at the individual votes cast by mutual funds, allowing us to examine persistent differences in funds' behavior and the effects of interactions among funds on the voting outcome.

The second strand of the literature empirically analyzes the effect of mutual fund incentives on their proxy voting behavior, using the data on individual votes that became available after the SEC rule change. Davis and Kim (2007) study voting on non-binding shareholder proposals and find that fund families that depend more heavily on business ties with portfolio firms use more management-friendly voting policies. Matvos and Ostrovsky (2008) show that mutual funds' incentives to vote against bad mergers in acquiring companies are blunted because they realize a portion of merger gains in their holdings in the target, and that as a result firms with holdings in both the acquirer and the target are less likely to oppose such mergers than firms with holdings only in the acquirer. Rothberg and Lilien (2006) provide a variety of descriptive statistics about voting policies and outcomes on all voted issues for a sample of mutual fund families for the first year after the SEC rule change took effect. We contribute to this strand of literature by focusing on director elections, constructing a comprehensive data set of fund votes in these elections, and showing that differences in voting patterns among funds are persistent and have a large impact on voting outcomes.

Our paper also contributes to the literature on peer effects and social multipliers. These effects have been found in a variety of settings: crime (Glaeser, Sacerdote, and Scheinkman, 1996), education (Sacerdote, 2001; Cooley, 2010), stock market participation (Hong, Kubik, and Stein, 2004), mutual fund investment decisions (Hong, Kubik, and Stein, 2005), and many others. We show that these effects are important in corporate director elections. To the best of our knowledge, our two-step estimation approach, in which we first establish persistent heterogeneity in funds' behavior and then exploit that heterogeneity to identify peer effects, is novel. We also offer a convenient structural framework for analyzing them.

The remainder of the paper is organized as follows. In Sections 2 and 3, we provide institutional background on mutual fund voting in board of directors elections and describe the data. In Section 4, we present reduced-form results demonstrating persistent differences in voting patterns among funds and the presence of peer effects. In Sections 5 and 6, we present a structural model of strategic proxy voting and discuss our estimation methodology for that model. We present our structural estimates in Section 7, and then in Section 8 use these estimates to conduct counterfactual simulations, helping evaluate the magnitudes of social multipliers due to peer effects. We conclude in Section 9.

2. Institutional background

A board of directors in the United States is formally both a principal in its relationship to the management, and an agent with respect to the shareholders. The board is responsible for providing guidance and monitoring management on behalf of the shareholders. The nominees for boards of directors in the U.S. are selected for election by the board itself or by the board's nominating committee. The candidates, however, are often suggested by the company's management, which undertakes the effort to find and evaluate them. Once the slate has been confirmed by the board, the company can start soliciting proxy votes for its list of directors. Shareholders can prepare a competing list of directors by entering into a proxy fight, which they must finance out of their own pocket.

Unless the corporation explicitly implements confidential voting, the voting decisions of individual shareholders are revealed to management. If voting is confidential, management is in principle informed only of the final tally of the votes, and not the votes of individual shareholders. Confidentiality, however, is not absolute and can be violated in a contested election.[3] Also, after the 2003 policy change by the SEC, confidentiality no longer applies to mutual funds, who are required to annually disclose their votes to the SEC in N-PX filings (Securities and Exchange Commission, 2003). These filings are subsequently made public by the SEC, and form the basis of our data set, described in Section 3.

In the *plurality* voting system implemented by most corporations in the U.S., directors with the most "for" votes are elected. If directors run unopposed, shareholders cannot vote "against" a nominee, but can only "withhold" authority to cast the vote. The "withhold" vote therefore cannot prevent a nominee's election, and even a single "for" vote theoretically elects an unopposed director.[4] The "withhold" vote was introduced by the SEC and was later interpreted by it as a mechanism for shareholders to express their dissatisfaction with directors (Institutional Shareholder Services, 2005). While not legally binding, the withhold votes play an important role in disciplining management and allowing shareholders to publicly signal their dissatisfaction. Cai, Garner, and Walkling (2009) find that poor election outcomes lead to reduced chief executive officer (CEO) compensation and increased CEO turnover, along with removal of anti-takeover mechanisms. Similarly, Fischer, Gramlich, Miller, and White (2009) show that lower voting outcomes lead to subsequent CEO and director turnover, along with changes in investment and acquisition policies of the firms.

3. Data

Since 2004, the SEC has required mutual funds registered in the U.S. to annually report their votes in all shareholder meetings of their portfolio companies using N-PX filings. The deadline for reporting is August 31, and the votes cover the period beginning on July 1 of the previous year and ending on June 30 of the current year. For each vote, funds specify the company, the date of the meeting, a brief description of the issue being voted on (director election, merger proposal, shareholder proposal, etc.), the sponsor of the proposal (management or shareholders), management's recommendation, and the vote of

[3] See Heard and Sherman (1987), McGurn (1989), and Monks and Minow (2003) for further details about the mechanics of proxy voting and an overview of vote confidentiality issues.

[4] This is not the case in the majority voting system, where "withhold" votes have the weight of an "against" vote and a candidate gets elected only if more than half of the votes cast are "for" (Institutional Shareholder Services, 2005).

the fund. We download all available N-PX filings for two 12-month periods: 7/1/2003–6/30/2004 and 7/1/2004–6/30/2005. We then use 34 computer scripts to extract data from the 100 largest active mutual funds, for several popular fund families, and any other mutual funds which used the same format. Next, we use an algorithm to extract the director votes. The details of these algorithms are available from the authors upon request.

We obtain all stock price information from the Center for Research in Security Prices (CRSP) database. Industry benchmarks are calculated for all stocks with positive prices available on CRSP in the same two-digit Standard Industrial Classification (SIC) code. We use Compustat Industrial Annual files to construct accounting and financial company information.[5] To calculate Q and book-to-market ratios, we closely follow the variable construction used in Malmendier and Tate (2008). We obtain firm governance characteristics from the Investor Responsibility Research Center (IRRC) Governance database. We assign governance characteristics of a firm in 2003 and 2005 using data from 2002 and 2004, respectively. The voting data are matched with CRSP, Compustat, and IRRC data on CUSIPs and tickers. We obtain director information from the Board Analyst Directors database, which is matched using director last name, ticker, and year. We obtain Institutional Shareholder Services (ISS) recommendations from the ISS Voting Analytics database.

Finally, we apply various cleaning procedures to remove duplicate and internally inconsistent records from the data. We restrict the sample to management-sponsored elections in which at least 10 funds cast votes and votes were cast using proxies from ordinary common shares (share codes 10 and 11). We are left with a sample of 2,058,788 director votes.

3.1. Summary statistics

Our data set covers 13,588 director elections in 2,528 shareholder meetings of 1,388 companies. In these elections, we observe 2,774 mutual funds casting 2,058,788 votes. The summary statistics are presented in Panel A of Table 2. The average number of directors elected in a shareholder meeting is 5.38. The variation in the number of directors voted on in a shareholder meeting is substantial, ranging between two and 10 for the 10th percentile and the 90th percentile of elections, respectively. Each director is voted on by an average of 152 funds. A director election at the 10th percentile of the number of funds voting has 49 funds casting votes on a director, while the 90th percentile election has 300 funds casting their votes on a director.

The average director in our sample receives support from 89.8% of funds. The distribution of voting outcomes, by director, is very skewed, as 96.5% of funds vote "for" the median director. The 10th percentile of directors, however, obtains only 59.5% support.

The summary statistics of director characteristics in our sample are presented in Panel B of Table 2. Insiders (i.e., employees) represent 16.7% of directors up for election; 70.7% are outside directors, and 12.6% are outside related directors, whose employer has a financial relationship with the firm or who are former employees of the firm.[6] CEOs comprise 10.1% of our sample. Panel C shows the distributions of some characteristics of the firms in our sample. S&P 500 companies comprise 28.9% of our data set, but the sample spans a wide range of companies by size, profitability, and other measures.

Simple comparisons of means in Panel A of Table 3 provide the first look at which director characteristics are correlated with voting outcomes.[7] Two groups of directors are particularly likely to receive less support: founders and outside directors. Outside related directors receive only 83.01% of "for" votes (vs. 91.92% for insiders and 93.18% for unrelated outsiders). One possible explanation for the difference is that mutual funds understand that both outside related and inside directors are not free of conflicts of interests, and therefore, they obtain a lower vote than unrelated directors. Moreover, outside related directors have available substitutes in outside directors, while inside directors, who have significantly more information about the company, do not.

Founders receive only 85.61% of "for" votes (vs. 91.68% for non-founders). Unlike other directors, they frequently own a significant share of the company and, while on the board, can wield substantial control. Because they started the company, they may then be prone to promoting their own agenda, which may differ from maximizing the value of the company. While strong in a univariate setting, the founder effect becomes smaller in magnitude and statistically insignificant in our full specification in Section 7.2.

CEOs and Chairmen are often the targets of shareholder discontent, but also have more power to retaliate against shareholders. CEOs get 1.64% more support, on average, than non-CEOs, while Chairmen get 1.14% more support than other directors. We should interpret the results on director characteristics, which are economically small but statistically significant, with caution, since funds' focus on various governance characteristics may change over time. For example, it is possible that when the media are focusing on executive compensation, funds pay more attention to votes on this dimension than they do at other times. We use only two years of voting data in our analysis, and so some of our results on director characteristics may be specific to that period and thus require future testing on a longer data set.

Panels B and C of Table 3 present voting outcomes cut by firm characteristics. Firm size and S&P 500

[5] For our book value of assets, we use total assets (item 6). We define capex-to-assets as the ratio of capital expenditures (item 128) to total assets (item 6). We calculate cash flow-to-assets as income before extraordinary items (item 18) plus depreciation plus amortization (item 14) divided by total assets (item 6). We define leverage as liabilities (item 181) over total assets (item 6) and return on assets (ROA) as income before extraordinary items (item 18) over total assets (item 6).

[6] For a small number of directors, our data do not contain information on whether they are insiders, outsiders, or related outsiders.

[7] A more detailed analysis of these effects in the context of the estimated model of voting is presented in Section 7.2.

Table 2
Summary statistics.

The sample in Panel A contains 2,528 board of director elections of 13,588 directors sponsored by the management between 2003 and 2005. The sample contains 2,774 mutual funds, with 6,136 fund-year observations. Number of directors up for election is the number of directors voted on in a shareholder meeting on a given date. Number of funds voting on a director is the number of funds casting votes on a director in a board of directors election on a given day. The average "for" vote per director is the percentage of funds casting a "for" vote in a given director election. Average "for" vote per fund-year is the percentage of "for" votes cast by a fund in a given year. Panel B contains data on 13,588 directors who were up for election to a board of directors between 2003 and 2005 and were recommended for election by the management. The sample in Panel C contains 2,528 firm-year observations on firms that held director elections between 2003 and 2005. The industry return is the value-weighted return of the firm's two-digit SIC industry. Data sources: SEC Edgar (N-PX filings), CRSP, Compustat, IRRC governance database, Board Analyst directors database.

Panel A: Election and fund characteristics

Variable	Mean	St. dev.	p10	Median	p90	N
Number of directors up for election	5.38	3.19	2	4	10	2,528
Number of funds voting on director	151.52	125.08	49	107	300	13,588
Average "for" vote per director	89.8%	17.3%	59.5%	96.5%	100.0%	13,588
Average "for" vote per fund-year	91.0%	14.7%	80.3%	95.1%	100.0%	6,136

Panel B: Director-meeting characteristics

Variable	Mean	N
CEO	10.1%	13,588
Chairman	9.8%	13,588
Founder	1.9%	13,588
Inside director	16.7%	13,176
Outside director	70.7%	13,176
Outside related director	12.6%	13,176
Audit chair	0.5%	13,588
Audit member	36.9%	13,588
Compensation chair	4.5%	13,588
Compensation member	35.8%	13,588
Executive chair	1.4%	13,588
Executive member	15.3%	13,588
Governance chair	3.6%	13,588
Governance member	30.2%	13,588
Nominating chair	3.9%	13,588
Nominating member	33.9%	13,588

Panel C: Firm-year characteristics

Variable	Mean	St. dev.	N
Last year return	13.0%	60.9%	2,504
ROA	4.0%	10.1%	2,528
Assets	13,855	70,712	2,528
Q	1.89	1.18	2,506
Book-to-market	0.51	0.36	2,506
Leverage	0.57	0.24	2,524
Cash flow-to-assets	0.76	1.86	2,391
Capex-to-assets	0.21	0.15	2,232
S&P	500	28.9%	2,528

membership reveal the largest differences. In the largest size quintile, 92.98% of the votes are "for", while that number drops to 89.28% for the firms in the smallest size quintile. Similarly, directors in S&P 500 firms on average obtain 93.07% of "for" votes, while directors of other firms obtain 89.03%. There are several possible reasons why directors of larger firms obtain more votes. First, the standard free-rider problem may be more prominent in large firms, decreasing the benefits to voting "withhold." Second, larger firms may be more important clients for money managers, decreasing funds' incentives to vote "withhold." Third, the management of large firms might also have more funds at their disposal to hire proxy solicitors and investor relations firms to help them manage the voting.

Somewhat surprisingly, directors in better performing firms receive fewer "for" votes than directors in worse performing firms: 89.87% for the firms in the highest quintile of absolute returns versus 92.40% for the firms in the lowest quintile. Comparing firms on their returns relative to their industry paints a similar picture. The univariate results on performance are to a large degree reversed when we estimate the full specification in which we can properly interpret the magnitudes: we discuss those results in detail in Section 7.2.

Table 3
Average vote by director and firm characteristics.

Panels A and B present the percentage of funds which cast "for" votes in director elections by director and firm characteristics. Column 1 presents the percentage of "for" votes cast by funds on directors without the characteristic, and column 2 the percentage of "for" votes cast on directors with the characteristic. The last column presents the difference in the means for the two groups. Panel C presents the percentage of votes cast "for" in director elections in the highest and lowest quintile of firms sorted on firm characteristics. The last column presents the difference in the mean of the highest and lowest quintile. Data sources: SEC Edgar (N-PX filings), CRSP, Compustat, IRRC governance database, Board Analyst directors database. (***) Indicates statistical significance at the 1% level.

Panel A: *Director characteristics*

	Statistic	(1) No	(2) Yes	(2)–(1) Difference
CEO	Mean vote "for"	91.42%	93.05%	1.64%
	N	1,859,111	199,677	(***)
Chairman	Mean vote "for"	91.47%	92.60%	1.14%
	N	1,865,170	193,618	(***)
Founder	Mean vote "for"	91.68%	85.61%	−6.07%
	N	2,023,205	35,583	(***)
Audit member	Mean vote "for"	91.52%	91.67%	0.15%
	N	1,309,106	749,682	(***)
Compensation member	Mean vote "for"	92.15%	90.51%	−1.64%
	N	1,339,713	719,075	(***)
Executive member	Mean vote "for"	91.59%	91.51%	−0.08%
	N	1,713,586	345,202	
Governance member	Mean vote "for"	91.72%	91.26%	−0.46%
	N	1,401,004	657,784	(***)
Nominating member	Mean vote "for"	91.89%	90.96%	−0.93%
	N	1,354,773	704,015	(***)
Inside director	Mean vote "for"		91.92%	
	N		325,724	
Outside director	Mean vote "for"		93.18%	
	N		1,444,383	
Outside related director	Mean vote "for"		83.01%	
	N		241,373	

Panel B: *Firm characteristics*

	Statistic	(1) No	(2) Yes	(2)–(1) Difference
S&P 500	Mean vote "for"	89.03%	93.07%	4.04%
	N	763,647	1,295,141	(***)
Return below industry quartile	Mean vote "for"	91.50%	91.93%	0.42%
	N	1,661,176	390,133	(***)

Panel C: *Firm characteristics* (*lowest versus highest quintile*)

	Statistic	(1) Lowest quintile	(2) Highest quintile	(2)–(1) Difference
Return quintile	Mean vote "for"	92.40%	89.87%	−2.53%
	N	355,779	315,643	(***)
Size quintile	Mean vote "for"	89.28%	92.98%	3.71%
	N	155,737	886,864	(***)
Book-to-market quintile	Mean vote "for"	92.36%	92.73%	0.37%
	N	511,885	306,066	(***)

4. Reduced-form results

In this section, we first show that funds differ in their management-friendliness, i.e., in how likely they are to vote for directors proposed by management, holding all else equal. These differences are persistent. We then exploit this persistent heterogeneity to establish the presence of peer effects in voting, using a linear instrumental variables approach. While this approach allows us to establish the presence of these effects, it is not suitable for estimating and interpreting their magnitudes. In subsequent sections we address this issue by presenting and estimating a structural voting model.

4.1. *Fund heterogeneity*

If funds' votes responded only to director characteristics and behavior, we would not expect to observe *systematic* differences in fund voting patterns.[8] Of course, even if all funds had identical voting policies and preferences, but their decisions were subject to some random noise or idiosyncratic preferences, we would still observe some of them voting for the management more often than others, simply due to chance. In this section, we show that the differences in voting patterns are persistent.

We construct the proxy for fund friendliness by using a fund's past voting record. To proxy for a fund's type in year t, we average its votes in year $t-1$. Furthermore, to avoid any mechanical correlation, we calculate the fund's proxy by excluding its votes in the firm whose votes we are trying to explain. Our proxy is simple and is designed to avoid mechanical correlation. Despite its simplicity, this proxy performs well empirically.

The past voting record of a fund in other companies is a highly statistically significant predictor of fund voting. Column 1 in Table 4 shows the results from a basic regression of a fund's vote on a director of company A on the fund's average vote in the previous year on all directors in companies other than A.[9] A 10% decrease in the proxy decreases the probability that a fund will vote "for" a director by 5.5%. From Table 2, the standard deviation of the distribution of the funds' average votes is 14.7%. Hence, a two-standard-deviation increase in fund friendliness corresponds to an increase of 16% in the likelihood of the fund voting "for" a director.

Of course, a fund's past voting record could simply proxy for the characteristics of firms in which the fund invests and their directors. To control for this possibility, we include various firm- and director-level measures. Column 2 in Table 4 presents the results after including these controls: a fund's vote is still correlated with its past voting record in other firms, and the magnitude of the coefficient is virtually unchanged.[10]

There is still a possibility that some directors are better than others, but that this quality is not captured by the controls in our data. To address this issue, we compare funds' voting on the same director in an election, therefore controlling for all director characteristics. Funds whose average vote last year in other firms was higher should be more likely to vote for this director. Columns 3 and 4 of Table 4 show that this is indeed the case. Column 3 reports the results with a separate fixed effect for each shareholder meeting, and in column 4 there is a fixed effect for each director election (usually, there are votes on multiple directors in each meeting). In all specifications, the past voting record predicts fund voting in an election, and the effect is highly statistically significant. In other words, some funds are more management-friendly than others, and their past voting records capture these differences.

There are several possible reasons for this persistent heterogeneity in management-friendliness. First, business ties between fund families and portfolio firms change little over time (Davis and Kim, 2007). Second, the organization of voting and proxy guidelines in fund families remain relatively constant over time as well. Furthermore, a fund manager's preferences should not change much over time, i.e., if a fund manager does not mind opposing managers one year, she will not experience a lot of disutility from opposing them the year after. Finally, a potential source of persistent heterogeneity is funds trying to build a reputation for management-friendliness, which is useful only if it persists over time.

4.2. Peer effects

Armed with a proxy for mutual fund management-friendliness, we can now show that mutual funds are more likely to vote "for" a director if they think other funds are more likely to vote "for" her as well. We cannot simply regress a fund's vote on the actual votes of other funds in the same election. Director characteristics observed by the funds are only partially known to the researcher, inducing correlation in votes from the researcher's perspective even in the absence of strategic considerations. A similar problem is induced by unobservable firm characteristics, such as firms' business ties to funds, or their ability to manage their relationships with investors. To circumvent these problems, we exploit the heterogeneity in funds' management-friendliness. We estimate a reduced-form linear probability instrumental variables model: we are predicting a fund's probability to vote "for" a director given the average vote of other funds voting on this director. Our instrument for the average vote of other funds is their estimated management-friendliness. The identification assumption in this approach is that funds care about other funds' management-friendliness only to the extent that it influences other funds' votes. Because more management-friendly funds are more likely to vote for a director *holding all else equal*, we can exploit this variation to generate variation in other funds' expected votes. If a fund is to vote in two identical firms, where one is held by friendly funds and the other by unfriendly funds, it would vote "for" more frequently in the former if there were strategic considerations present. We discuss the validity of the identification assumption in Section 4.3.

We begin with the most basic specification of the regression (Table 5, column 1). In that specification, the

[8] Preferences of mutual funds may differ in mergers and acquisitions: e.g., two funds may have the same stakes in the acquirer and different stakes in the target, resulting in different preferences over the outcome of the proposed acquisition (Matvos and Ostrovsky, 2008). However, such differences in preferences seem unlikely for director elections.

[9] The number of observations in this regression is 1,766,982, which is less than the total number of votes in our data set, 2,058,788. This is because the only votes on the left-hand side of this regression are the ones for which we can estimate the voting fund's management-friendliness based on the prior year.

[10] We cannot interpret the effects of the controls on voting in this specification. First, the regression specification does not take into account how peer effects affect voting, but subsumes them with director fixed effects. Second, the underlying non-linearity of voting is exacerbated by the fact that the mean probability of voting "for" is very close to one, making the linear approximation problematic. Because of non-linearity, we also do not interpret the effects of controls in Section 4.2. We defer this discussion to Section 7.2, where we estimate the coefficients in a structural model and can interpret their magnitudes.

Table 4
Past vote as a measure of management-friendliness.

The sample consists of 1,766,982 votes by mutual funds in director elections in years 2004 and 2005. The dependent variable is a dummy that takes the value of one if the vote is "for" and zero otherwise. Fund management-friendliness is the average vote of the fund in the previous year in director elections in firms other than the one under consideration. The governance index is the governance index from Gompers, Ishii, and Metrick (2003). The omitted category from Outside director and Outside related director is an Inside director. Standard errors are clustered on fund-year in columns 1 and 2, on the shareholder meeting in column 3, and on director election in column 4. Data sources: SEC Edgar (N-PX filings), CRSP, Compustat, IRRC governance database, Board Analyst directors database.

	(1) Vote "for"	(2) Vote "for"	(3) Vote "for"	(4) Vote "for"
Fund management-friendliness	0.554	0.551	0.543	0.542
	[0.0410]***	[0.0417]***	[0.0118]***	[0.0043]***
Last year return		−0.006		
		[0.0014]***		
ROA		0.210		
		[0.0361]***		
Industry return		0.001		
		[0.0053]		
Return below industry quartile		0.002		
		[0.0013]		
Log assets		−0.001		
		[0.0007]*		
Q		−0.003		
		[0.0005]***		
Book-to-market		0.007		
		[0.0026]***		
Leverage		0.037		
		[0.0030]***		
Cash flow-to-assets		−0.131		
		[0.0351]***		
Capex-to-assets		0.082		
		[0.0176]***		
S&P 500		0.029		
		[0.0027]***		
Governance index		0.001		
		[0.0002]**		
Outside director		0.055	0.043	
		[0.0020]***	[0.0062]***	
Outside related director		−0.054	−0.057	
		[0 0018]***	[0 0075]***	
CEO		0.022	0.014	
		[0.0015]***	[0.0054]**	
Chairman		0.016	0.009	
		[0.0008]***	[0.0042]**	
Founder		−0.023	−0.004	
		[0.0022]***	[0.0137]	
Audit chair		0.000	0.000	
		[0.0000]	[0.0000]	
Audit member		−0.014	−0.009	
		[0.0006]***	[0.0031]***	
Compensation chair		0.003	0.005	
		[0.0019]	[0.0056]	
Compensation member		−0.032	−0.027	
		[0.0020]***	[0.0034]***	
Executive chair		0.007	0.006	
		[0.0021]***	[0.0065]	
Executive member		−0.010	0.000	
		[0.0008]***	[0.0047]	
Governance chair		0.020	−0.004	
		[0.0049]***	[0.0253]	
Governance member		0.003	0.001	
		[0.0017]*	[0.0079]	
Nominating chair		−0.022	−0.006	
		[0.0051]***	[0.0250]	
Nominating member		−0.018	−0.020	
		[0.0017]***	[0.0079]***	
Constant	0.419	0.379	0.424	0.429
	[0.0381]***	[0.0389]***	[0.0122]***	[0.0039]***
Observations	1,766,982	1,493,621	1,726,148	1,766,982
R^2	0.08	0.11	0.11	0.11
Shareholder meeting fixed effects			Y	
Director election fixed effects				Y

Robust standard errors in brackets.
* Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5
Determinants of voting behavior: reduced-form instrumental variables regression.

The dependent variable is a vote cast by a fund in a board of directors election; it takes the value of one if the vote is "for" and zero otherwise. The vote of other funds is the average vote of other funds voting on the director. The instrument for the vote of other funds is: the average management friendliness of other funds in columns 1, 2, and 5; and the mean, standard deviation, skewness and kurtosis of the management-friendliness of other funds in columns 3, 4, and 6. The management-friendliness of other funds is calculated as the average vote of a fund in the previous calendar year on firms other than the firm under observation. The industry return is the value-weighted return of the firm's two-digit SIC industry. The governance index is the governance index from Gompers, Ishii, and Metrick (2003). The ISS Recommendation is one if Institutional Shareholder Services recommended a "for" vote on a director and zero otherwise. The omitted category from Inside director and Outside related director is an Outside director. Data sources: SEC Edgar (N-PX filings), CRSP, Compustat, IRRC governance database, Board Analyst directors database.

	(1) Vote "for"	(2) Vote "for"	(3) Vote "for"	(4) Vote "for"	(5) Vote "for"	(6) Vote "for"
Vote of other funds	0.6324	0.3246	0.7041	0.5857	0.0947	0.1627
	[0.0331]***	[0.0386]***	[0.0316]***	[0.0336]***	[0.0486]*	[0.0469]***
Firm characteristics						
Last year return		−0.0036		−0.0016	0.0014	0.0014
		[0.0012]***		[0.0012]	[0.0011]	[0.0011]
Industry return		−0.0121		−0.0097	0.0039	0.0031
		[0.0036]***		[0.0034]***	[0.0033]	[0.0033]
ROA		0.1145		0.071	0.0865	0.0801
		[0.0340]***		[0.0325]**	[0.0319]***	[0.0318]**
Return below industry quartile		0		−0.0005	0.0012	0.001
		[0.0012]		[0.0012]	[0.0012]	[0.0012]
Log assets		0.0012		0.0011	0.0018	0.0017
		[0.0005]**		[0.0005]**	[0.0005]***	[0.0005]***
Q		−0.0009		−0.0002	0.0011	0.0011
		[0.0004]**		[0.0004]	[0.0004]**	[0.0004]**
Book-to-market		0.0028		0.0012	0.0022	0.0019
		[0.0021]		[0.0020]	[0.0020]	[0.0020]
Leverage		0.0241		0.0145	0.0065	0.0059
		[0.0030]***		[0.0028]***	[0.0025]**	[0.0025]**
Cash flow-to-assets		−0.0601		−0.0337	−0.0314	−0.0284
		[0.0314]*		[0.0301]	[0.0296]	[0.0295]
Capex-to-assets		0.0493		0.0299	0.0274	0.0253
		[0.0166]***		[0.0159]*	[0.0158]*	[0.0157]
S&P 500		0.025		0.0132	0.0052	0.0044
		[0.0023]***		[0.0021]***	[0.0017]***	[0.0017]**
Governance index		0.0004		0.0002	0.0004	0.0003
		[0.0002]**		[0.0002]	[0.0002]*	[0.0002]*
Director characteristics						
Inside director		0.0369		0.0228	0.0103	0.0096
		[0.0024]***		[0.0021]***	[0.0015]***	[0.0015]***
Outside related director		0.074		0.0457	0.0124	0.0115
		[0.0041]***		[0.0034]***	[0.0016]***	[0.0016]***
CEO		0.015		0.0095	0.0033	0.0031
		[0.0013]***		[0.0013]***	[0.0011]***	[0.0011]***
Chairman		0.0105		0.0062	0.0019	0.0017
		[0.0009]***		[0.0008]***	[0.0007]***	[0.0007]**
Founder		−0.0137		−0.0076	0.0014	0.0015
		[0.0022]***		[0.0020]***	[0.0018]	[0.0018]
Audit member		−0.0091		−0.0056	−0.0033	−0.003
		[0.0007]***		[0.0006]***	[0.0005]***	[0.0005]***
Compensation chair		0.0004		0.0004	0.001	0.0009
		[0.0019]		[0.0019]	[0.0019]	[0.0019]
Compensation member		−0.0217		−0.0137	−0.0114	−0.0106
		[0.0022]***		[0.0021]***	[0.0021]***	[0.0021]***
Executive chair		0.004		0.0029	−0.0019	−0.0016
		[0.0016]**		[0.0016]*	[0.0016]	[0.0016]
Executive member		−0.0065		−0.0043	−0.0054	−0.0051
		[0.0007]***		[0.0007]***	[0.0006]***	[0.0006]***
Governance chair		0.0141		0.0087	0.0106	0.0098
		[0.0045]***		[0.0043]**	[0.0042]**	[0.0042]**
Governance member		0.0021		0.0016	0.0004	0.0004
		[0.0015]		[0.0015]	[0.0014]	[0.0014]
Nominating chair		−0.0172		−0.0106	−0.0068	−0.0063
		[0.0047]***		[0.0045]**	[0.0043]	[0.0043]
Nominating member		−0.0118		−0.0076	−0.0009	−0.0009
		[0.0016]***		[0.0015]***	[0.0014]	[0.0014]
ISS Recommendation					0.4718	0.4364
					[0.0261]***	[0.0254]***
Fund-year fixed effects	Y	Y	Y	Y	Y	Y
Observations	1,766,982	1,493,620	1,766,982	1,493,620	1,493,112	1,493,112

Robust standard errors clustered on fund-year in brackets.
* Significant at 10%; ** significant at 5%; *** significant at 1%.

instrument for the average expected vote of other funds in an election is their average friendliness, i.e., the average of their average votes in the previous year in other firms. We regress a fund's vote on a particular director on the instrumented average vote of other funds, controlling for fund-year fixed effects. The coefficient on the average vote of other funds is positive at 0.63 and statistically significant at 1%. This result implies that if the average vote of other funds increases by 10%, a fund becomes 6.3% more likely to vote for a director. In column 2, we add several firm and director characteristics that might influence a fund's vote: firm performance characteristics, standard financial controls, and information on the director, such as her position in the firm, whether she is an insider, and which committees she is a member of. After adding these controls, the coefficient decreases to 0.32, but is still statistically significant at 1%.

Next, we consider an alternative way of instrumenting for the average vote of other funds. Management-friendliness may impact future votes non-linearly, and while the average friendliness of other funds may predict their average vote well, other moments of the distribution of their friendliness may contain additional information. In the alternative specification, in the first stage, we add three additional moments of the distribution of other funds' management-friendliness as instruments: the standard deviation, skewness, and kurtosis.[11] The results from this alternative specification are presented in columns 3 and 4. The estimated coefficient on the average vote of other funds is higher in these two regressions than in the corresponding regressions that only use the average management-friendliness as an instrument, and are highly statistically significant.

Our final set of specifications includes an additional control: voting recommendations of Institutional Shareholder Services (ISS), a popular proxy voting advisor.[12] Including their recommendation may control for a potentially important part of the mutual funds' information about the quality of directors. This variable, however, has an important drawback for our purposes: one of the key inputs that ISS uses in forming their recommendations are discussions with the institutional shareholders of that director's company.[13] Therefore, the interaction between fund votes and ISS recommendations occurs in both directions. First, ISS recommendations may reflect director quality and provide information to the funds, influencing their votes. At the same time, ISS recommendations may incorporate the expected vote of other funds, thereby acting as a proxy for other funds' vote. It is therefore hard to interpret regression coefficients on this variable and the impact of its inclusion on the coefficients on other variables, especially given the non-linear structure of the environment. While we cannot disentangle these two effects, including ISS recommendations in the regressions is a useful robustness check, and we perform it in columns 5 and 6 of Table 5. In these specifications, coefficients on the average vote of other funds are smaller in magnitude (0.09 and 0.16) than those in columns 2 and 4, but both of them are still statistically significant, confirming the presence of peer effects.

4.3. Alternative explanations

Before proceeding to our structural model, we first address some alternative explanations of the voting complementarity discussed in the previous section and show that they are unlikely to hold. Our main concern is that mutual funds do not randomly select stocks for investment. If friendly funds hold different stocks from unfriendly ones, then holdings could induce a correlation in fund voting that would be mistaken for strategic interaction. In particular, if unfriendly funds hold companies in which directors have a low unobservable quality, our identification assumption would be invalid: A firm held by friendly funds would have better directors than what's predicted by its observable characteristics, and so the positive coefficient on the average vote of other funds would arise simply because the friendliness of other funds (and hence, their predicted average vote) would proxy for unobserved firm or director characteristics. Clearly, stock selection cannot be the only explanation of heterogeneous voting behavior by the funds: as pointed out in Section 1, even S&P 500 index funds, which have little choice regarding their investments, exhibit a high degree of heterogeneity in their average votes. However, to show that it is at best a minor driver of voting behavior and is unlikely to explain the strategic effects discussed in the previous section, we need a more detailed analysis.

First, we examine which *observable* firm characteristics are correlated with the average friendliness of funds holding the firm. If unfriendly funds are more likely to acquire shares in lower-quality companies, we should expect them to hold firms that are worse on both observable and unobservable characteristics. In fact, observable firm characteristics such as past returns and governance characteristics should be particularly strongly correlated with fund friendliness, if we expect unobservable firm quality, which is neither captured by accounting numbers nor by stock returns, to matter as well. Table 6 presents the correlation of observable firm characteristics with the average friendliness of funds holding shares in the firm. If unfriendly mutual funds acquire shares in lower-quality companies, one would expect these firms to also exhibit bad past performance. This is not the case. Neither last year's stock return nor the firm's accounting return on assets is positively correlated with the average management-friendliness of funds holding shares in the firm. Similarly, looking at relative returns, firms in the bottom quartile of their industries are not more likely to be held by unfriendly funds. If anything, the coefficients in these regressions (columns 2 and 4) suggest that worse performing firms are held by friendlier

[11] We have also considered other parameterizations of the distribution. Details are available upon request.

[12] In 2007, ISS was acquired by RiskMetrics Group.

[13] For instance, on its Web site, RiskMetrics advertises "engagement with appropriate company officials, top institutional holders and other parties to gain insight and make informed vote recommendations." http://www.riskmetrics.com/proxy_advisory/benefits. Accessed July 27, 2009.

Table 6
Average management-friendliness of funds holding a firm.
The dependent variable is the average management-friendliness of mutual funds holding shares in a firm. A fund's management-friendliness is calculated as the average vote of a fund in the previous calendar year on firms other than the firm under observation. The industry return is the value-weighted return of the firm's two-digit SIC industry. The governance index is the governance index from Gompers, Ishii, and Metrick (2003). The omitted category from Outside director and Outside related director is an Inside director. Data sources: SEC Edgar (N-PX filings), CRSP, Compustat, IRRC governance database, Board Analyst directors database.

	(1) Average management-friendliness	(2) Average management-friendliness	(3) Average management-friendliness	(4) Average management friendliness
Last year return		−0.002		−0.002
		[0.001]***		[0.001]
ROA				−0.014
				[0.022]
Industry return		0.041		0.038
		[0.002]***		[0.002]***
Return below industry quartile				0.002
				[0.001]
Log assets	0.003	0.003	0.003	0.005
	[0.000]***	[0.000]***	[0.000]***	[0.000]***
Q				−0.001
				[0.001]**
Book-to-market				−0.004
				[0.002]**
Leverage				−0.007
				[0.003]***
Cash flow to assets				0 015
				[0.023]
Capex-to-assets				−0.009
				[0.015]
S&P 500	0.02	0.021	0.02	0.016
	[0.001]***	[0.001]***	[0.001]***	[0.001]***
Governance index			0	0
			[0.000]*	[0.000]**
Constant	0.868	0.867	0.866	0.859
	[0.003]***	[0.003]***	[0.004]***	[0.004]***
Observations	2,348	2,324	2,185	1,926
R^2	0.21	0.34	0.22	0.38

Robust standard errors clustered on fund-year in brackets.
* Significant at 10%; ** significant at 5%; *** significant at 1%.

funds, although none of them are statistically significant in the full specification. Combined, these results do not support the view that unfriendly funds hold shares in bad companies. Instead, mutual fund friendliness is correlated with the book size of a firm's assets, its leverage, book-to-market, membership in the S&P 500, and the industry return. These variables are highly correlated with the determinants of mutual funds' management styles as in Goetzmann and Brown (1997). In other words, the correlation of average mutual fund friendliness and firms' observable characteristics is consistent with the standard determinants of fund style, but not with the hypothesis that unfriendly funds purchase lower-quality companies.

Another way to check whether fund friendliness is correlated with unobservable director quality in the fund's portfolio companies is the following. As we mentioned above, if unfriendly funds hold companies that are bad on an unobservable characteristic, then a fund's past voting record is not only proxying for the fund's friendliness, but also for the firms' unobservable quality. Suppose that is indeed the case. Then, to predict the quality of a firm, one has to look at both its observable characteristics and at which funds hold the firm. If the funds holding the firm frequently voted against other firms in their portfolio in the past, then this firm is also a part of a portfolio of bad firms and is therefore, on average, worse than one would predict from its observable characteristics. A fund's past voting record in other firms then contains information both about the fund's actual friendliness and about the quality of the firm in question. When we predict a fund's voting behavior using its past voting record, as we did in Table 4, column 2, controlling for observable firm and director characteristics, the fund's past voting record is potentially correlated with its current vote for two different reasons. First, a high past voting record in other firms is correlated with a fund's vote because the fund is management-friendly. Second, the past voting record in other firms is correlated with a fund's vote in the firm under consideration because all firms in the portfolio have similar unobserved quality. Now, if instead we run an alternative specification with an election fixed effect, that fixed effect should absorb all firm information that was up to this point contained in a fund's past voting record. Hence, if a fund's past voting record in other companies were proxying for unobserved firm quality, then its effect on a fund's vote should be diminished after the inclusion of the fixed effect. Therefore, one would expect the coefficient on the past voting record to disappear or at least to decrease substantially after the inclusion of director fixed effects. When we run this alternative specification, the size of the coefficient is barely affected (column 4 of Table 4). The coefficient changes from 0.551 in the specification with firm and director characteristics (column 2), to 0.542 with director election fixed effects (column 4). The standard error of the noisier coefficient is 0.04, and so the change of 0.009 is statistically indistinguishable from zero. Thus, all our evidence points to the strategic driver of the effect presented in the previous subsection, with funds incorporating their expectations about other funds' votes into their own decisions, rather than the alternative explanation that the past voting record of a fund in other companies proxies for an unobserved quality of the firm in question.

5. The model of strategic proxy voting

We now turn to the structural analysis of strategic proxy voting. We model voting as a simultaneous-move game.[14] There are n_i funds, $j \in \{1,\dots,n_i\}$, voting in electing director i to the board.[15] The director has a vector of characteristics $q_i=(q_{i1},\dots,q_{im})$, representing both director- and firm-specific characteristics. All characteristics are observed by all funds.

Each fund has a certain *management friendliness* parameter v_j. As mentioned above, funds differ in their approaches to voting. Friendliness v_j captures such systematic differences on a scale of how favorable these are to management. Formally, funds with a higher v_j, holding all else equal, have a higher relative payoff to voting "for" vs. "withhold" than less friendly funds. The fund's friendliness v_j is known to all funds.

The fund also privately observes an idiosyncratic director-specific shock ε_{ij}, which affects its payoff from voting.[16] This shock could arise, for example, if a fund manager finds it particularly costly to oppose a particular director due to a personal or business connection. These shocks are drawn independently from a zero-mean distribution $G(\varepsilon_{ij})$.

Funds simultaneously cast their votes on director i. We denote by $\omega_{ij} \in \{0,1\}$ the vote of fund j on director i, with 1 representing a "for" vote and 0 a "withhold" vote. The vector of all votes cast for director i is then $\omega_i=(\omega_{i1},\dots,\omega_{in})$; also, let $\omega_{i,-j}=(\omega_{i1},\dots,\omega_{i,j-1},\omega_{i,j+1},\dots,\omega_{in})$. After votes are cast, each fund realizes its payoff

$$U(q_i,v_j,\omega_{ij},\omega_{i,-j},\varepsilon_{ij}). \tag{1}$$

The payoff of the fund depends on director characteristics, the fund's management-friendliness, its own vote, the votes of other funds, and the fund's director-specific shock. Note that we assume that only the fund's own friendliness enters the payoff function of a fund directly. The fund cares about other funds' management-friendliness only to the extent that it affects other funds' votes. This assumption formalizes our exclusion restriction behind the reduced-form estimates. We also make several additional assumptions, discussed below.

Assumption 1. Voting has increasing differences in director characteristics, i.e., for all k,

$$\frac{\partial(U(q_i,v_j,1,\omega_{i,-j},\varepsilon_{ij})-U(q_i,v_j,0,\omega_{i,-j},\varepsilon_{ij}))}{\partial q_{ik}} \geq 0. \tag{2}$$

That is, we assume that higher values of characteristics q_{ik} are viewed positively by the funds, and that all else being equal, the fund is more willing to vote for a director with higher values of these characteristics.

Assumption 2. Voting has increasing differences in management-friendliness and the idiosyncratic shock, i.e.,

$$\frac{\partial(U(q_i,v_j,1,\omega_{i,-j},\varepsilon_{ij})-U(q_i,v_j,0,\omega_{i,-j},\varepsilon_{ij}))}{\partial v_j} \geq 0, \tag{3}$$

$$\frac{\partial(U(q_i,v_j,1,\omega_{i,-j},\varepsilon_{ij})-U(q_i,v_j,0,\omega_{i,-j},\varepsilon_{ij}))}{\partial \varepsilon_{ij}} \geq 0. \tag{4}$$

This assumption formalizes the notion of the friendliness parameter and the role of the idiosyncratic shock: a more friendly fund has a higher incremental payoff of voting "for", holding director characteristics and votes of other funds fixed. It also states that a higher idiosyncratic shock increases the incremental return to voting with management.

Assumption 3. Voting has increasing differences in other funds' votes, i.e.,

$$\begin{aligned} &U(q_i,v_j,1,\omega_{i,-j},\varepsilon_{ij})-U(q_i,v_j,0,\omega_{i,-j},\varepsilon_{ij}) \\ &\quad \geq U(q_i,v_j,1,\omega'_{i,-j},\varepsilon_{ij})-U(q_i,v_j,0,\omega'_{i,-j},\varepsilon_{ij}) \end{aligned} \tag{5}$$

whenever, vote by vote, $\omega_{i,-j} \geq \omega'_{i,-j}$.

This assumption introduces a specific form of inter-fund externalities: voting "withhold" is more costly when few other funds also vote "withhold," for the reasons outlined in Section 1. The presence of these externalities, in turn, implies that in the voting game, funds will behave strategically: all else being equal, a fund is less likely to vote against a director if it expects few other funds to vote "withhold".

While this voting game can have multiple equilibria, Assumptions 1–3 above imply that they have a special structure: there exists a pure-strategy equilibrium most friendly to management, and a pure-strategy equilibrium most hostile to management. All other equilibria are contained between these two extremes. Proposition 1 states this result formally:

[14] We thus rule out the possibility that a fund observes the votes of others in a given election before making its own decision. We also, in effect, view each election in isolation, assuming away dynamic strategies that funds may play in the repeated game of voting in multiple elections over time.

[15] For notational convenience, we will sometimes omit index i.

[16] We interpret ε's as only influencing the private values of the funds from voting and not as private signals about underlying director qualities. The latter interpretation would imply a voting game with information transmission and interdependent valuations, similar to the model of Feddersen and Pesendorfer (1997).

Proposition 1. *There exist the lowest and the highest pure-strategy Bayesian Nash equilibria of the voting game specified above. (These equilibria may coincide.) In both equilibria, each fund's vote is weakly increasing in the fund's own friendliness parameter v_j, other funds' friendliness parameters v_k, $k \neq j$, and the vector of director qualities q_i.*

Proof. The game satisfies the assumptions of a monotone supermodular game in Van Zandt and Vives (2007):

- Condition 1 requires supermodularity and increasing differences in actions and parameters, which determine a fund's payoff $(q_{i1},\ldots,q_{im},v_j,\varepsilon_{ij})$, which are satisfied by Assumptions 1–3.
- Condition 2 requires that the beliefs of fund j about vectors $(q_{i1},\ldots,q_{im},v_k,\varepsilon_{ik})$ for all $k \neq j$ are first-order stochastically increasing given its own realization of $(q_{i1},\ldots,q_{im},v_j,\varepsilon_{ij})$. Given that the idiosyncratic shocks ε_{ij} are independent, management-friendliness of funds v is commonly known, and the characteristics q_i are common to all funds, this condition is trivially satisfied.

Proposition 1 now follows directly from Theorem 1 in Van Zandt and Vives (2007). □

Remark 1. In equilibrium, funds play threshold strategies in q_i,v_j, and ε_{ij}.

Remark 2. The best response function of a fund is increasing in q_i,v_j, ε_{ij}, and the expected vote of other funds.

Generally, best response functions in games are specified in terms of strategies of other players, which are not directly observable. Remark 1, however, allows us to express a fund's strategy as a cutoff strategy in ε_{ij}, conditional on commonly known director quality q_i and the fund's friendliness v_j. Therefore, there is a monotonic one-to-one relationship between a fund's strategy and its expected vote, conditional on q_i and v_j, and we can replace other funds' strategies with their expected votes when writing down a fund's best response function.

6. Estimation

We now turn to estimating fund voting behavior, i.e., in the framework of Section 5, a fund's best response function:

$$\omega^*_{ij} = \omega^*_{ij}(q_i,v_j,E_{\varepsilon_{i,-j}}\omega_{i,-j},\varepsilon_{ij}). \tag{6}$$

Best response ω^*_{ij} is an increasing function of director characteristics, fund characteristics, other funds' expected votes, and idiosyncratic fund-director shocks (see Remark 2). Ideally, to estimate the function, one would observe all variables that enter it. Then one would directly estimate all the parameters of the model, including the parameter on other funds' expected vote, to test for the presence of strategic interactions. The problem we encounter is that director characteristics observed by the funds, q_i, are only partially known to the researcher. This is the same issue as we encounter when we estimate peer effects in the reduced-form model of Section 4.2. We circumvent it using the same identification strategy: exploiting the heterogeneity in funds' management-friendliness.

If our best response function (6) were linear, our reduced-form approach from Section 4.2 would estimate its structural parameters. However, because our outcome variable is binary, our structural equation is inherently non-linear. Hence, the linear instrumental variables approach can only provide a rough approximation of the best response function. For our main estimation procedure, we use an approach based on the control function methodology (Imbens and Wooldridge, 2007; Navarro, 2008).

We start by making several specific functional-form assumptions about the funds' payoff function $U(q_i,v_j,\omega_{ij},\omega_{i,-j},\varepsilon_{ij})$. First, we assume that the votes of other funds enter the utility function in a particular way: a fund cares about the fraction of other funds voting "for," i.e., since each vote can take the value of either one or zero, each fund cares about the average vote of other funds, $\overline{\omega}_{i,-j} = (1/(n_i-1))\sum_{k\neq j}\omega_{ik}$, where n_i is the total number of funds voting on director i. In other words,

$$U(q_i,v_j,\omega_{ij},\omega_{i,-j},\varepsilon_{ij}) = U(q_i,v_j,\omega_{ij},\overline{\omega}_{i,-j},\varepsilon_{ij}). \tag{7}$$

Second, we divide the vector of director characteristics q_i into a vector of characteristics observable by both the researcher and the funds, x_i, and a scalar representing unobserved director quality, ζ_i, which is known to the funds, but not to the econometrician:

$$U = U(x_i,\zeta_i,v_j,\omega_{ij},\overline{\omega}_{i,-j},\varepsilon_{ij}). \tag{8}$$

Third, we normalize a fund's utility from voting "withhold" to zero:

$$U(x_i,\zeta_i,v_j,0,\overline{\omega}_{i,-j},\varepsilon_{ij}) = 0. \tag{9}$$

Finally, we assume that the utility from voting "for" is linear:

$$U(x_i,\zeta_i,v_j,1,\overline{\omega}_{i,-j},\varepsilon_{ij}) = \alpha + \beta_1 v_j + \beta_2\overline{\omega}_{i,-j} + \beta_3\zeta_i + \Gamma x_i + \varepsilon_{ij}. \tag{10}$$

This assumption precludes non-linear interactions between various parameters of interest. It is, however, a common restriction in the literature on estimating discrete choice models and discrete games, which makes the estimation problem computationally tractable (see e.g., Ackerberg, Benkard, Berry, and Pakes, 2007). Also, in an earlier version of the paper, we have estimated several more flexible specifications, in which we included quadratic and cubic terms of parameters and their interactions. Our results are robust to those specifications and, if anything, are stronger economically and statistically; details are available upon request.

When fund j casts its vote, it does not know how the other funds will vote. Those funds' votes depend on the realizations of their idiosyncratic shocks ε_{ik}, $k \neq j$. Let $\varepsilon_{i,-j}$ denote the random vector of these idiosyncratic shocks. Fund j maximizes its expected utility $E_{\varepsilon_{i,-j}}U(x_i,\zeta_i,v_j,\omega_{i,j},\overline{\omega}_{i,-j},\varepsilon_{ij})$. If it votes "withhold," its utility is zero:

$$E_{\varepsilon_{i,-j}}U(x_i,\zeta_i,v_j,0,\overline{\omega}_{i,-j},\varepsilon_{ij}) = 0. \tag{11}$$

If instead it votes "for", its expected utility is equal to

$$E_{\varepsilon_{i,-j}}U(x_i,\zeta_i,v_j,1,\overline{\omega}_{i,-j},\varepsilon_{ij}) = E_{\varepsilon_{i,-j}}[\alpha+\beta_1 v_j+\beta_2\overline{\omega}_{i,-j}+\beta_3\zeta_i + \Gamma x_i+\varepsilon_{ij}] = \alpha+\beta_1 v_j+\beta_2(E_{\varepsilon_{i,-j}}\overline{\omega}_{i,-j})+\beta_3\zeta_i+\Gamma x_i+\varepsilon_{ij}. \tag{12}$$

Let $\overline{\omega}^e_{i,-j}$ denote the average expected vote of other funds, $E_{\varepsilon_{i,-j}}\overline{\omega}_{i,-j}$. Note that this expectation is conditional on the information of fund j, i.e., funds' friendliness parameters v and director i's characteristics x_i and ζ_i. Eqs. (11) and (12) imply that the best response function of fund j, $\omega^*_{i,j}$, takes the form

$$\omega^*_{ij} = \begin{Bmatrix} 1 & \text{if } \alpha+\beta_1 v_j+\beta_2\overline{\omega}^e_{i,-j}+\beta_3\zeta_i+\Gamma x_i+\varepsilon_{ij}\geq 0 \\ 0 & \text{if } \alpha+\beta_1 v_j+\beta_2\overline{\omega}^e_{i,-j}+\beta_3\zeta_i+\Gamma x_i+\varepsilon_{ij}< 0 \end{Bmatrix}. \tag{13}$$

The vote of fund j on director i, ω^*_{ij}, is determined by the fund's own management friendliness v_j, other funds' expected average vote $\overline{\omega}^e_{i,-j}$, director i's observed characteristics x_i and unobserved quality ζ_i, and fund-director random shock ε_{ij}. Variables ζ_i (unobserved director quality) and $\overline{\omega}^e_{i,-j}$ (expected vote of other funds) are not observed by the researcher, and so we cannot estimate the coefficients in Eq. (13) directly. Instead, we first estimate these two variables, and then in the second stage estimate the parameters of interest. To separately identify these two variables, we use instruments that affect $\overline{\omega}^e_{i,-j}$ but not ζ_i. The key assumption behind our estimation approach is that other funds' friendliness parameters do not directly enter a fund's best response function (13). Therefore, we can use management-friendliness parameters of funds other than j, $v_{i,-j}$, to instrument for their votes. We can then use variation in $v_{i,-j}$ to identify the strategic interaction parameter β_2 and other coefficients in Eq. (13).

6.1. First stage

Fix the equilibrium. The average expected vote of other funds, $\overline{\omega}^e_{i,-j}$, is then a function of funds' friendliness parameters, v, and director i's observable and unobservable characteristics x_i and ζ_i, i.e., $\overline{\omega}^e_{i,-j} = \overline{\omega}^e_{i,-j}(v_1,\dots,v_n,x_i,\zeta_i)$.[17] In principle, we could have derived the shape of this function for various values of parameters from equilibrium considerations and then applied a moment- or likelihood-based procedure to estimate the parameters of interest by maximizing the likelihood or minimizing the deviations from moment conditions of the observed voting behavior. This, however, would be very demanding computationally, and so we instead use several alternative parametric approximations of function $\overline{\omega}^e_{i,-j}(\cdot)$ and subsequently verify that our results are robust to the choice of the functional form of the approximation. In the basic approximation that we use, the function is linear and the vector of friendliness parameters of other funds is summarized by their average, $\overline{v}_{i,-j} = \sum_{k\neq j} v_k$.

$$\overline{\omega}^e_{i,-j} = \delta+\gamma_1 v_{ij}+\gamma_2\overline{v}_{i,-j}+\Gamma_1 x_i+\gamma_3\zeta_i. \tag{14}$$

[17] Generally, $\overline{\omega}^e_{i,-j}$ could also depend on which equilibrium is played by the funds, in the case of multiple equilibria. We do not investigate the issue of equilibrium selection here; instead, we assume that the same equilibrium is played in all elections, e.g., the most or the least management-friendly one.

The actual, observed average vote of other funds is equal to the expected vote plus noise (due to idiosyncratic shocks in the preferences of other funds),

$$\overline{\omega}^*_{i,-j} = \overline{\omega}^e_{i,-j}+\eta_{ij}. \tag{15}$$

Unlike the funds, the researcher does not know the unobserved component of director quality, ζ_i, and hence, from his point of view, the expected vote of other funds is equal to

$$\overline{\omega}^r_{i,-j} = \delta+\gamma_1 v_{ij}+\gamma_2\overline{v}_{i,-j}+\Gamma_1 x_i. \tag{16}$$

We can now rewrite the actual average vote of other funds as

$$\overline{\omega}^*_{i,-j} = \overline{\omega}^e_{i,-j}+\eta_{ij} \tag{17}$$

$$= \delta+\gamma_1 v_{ij}+\gamma_2\overline{v}_{i,-j}+\Gamma_1 x_i+\gamma_3\zeta_i+\eta_{ij} \tag{18}$$

$$= (\delta+\gamma_1 v_{ij}+\gamma_2\overline{v}_{i,-j}+\Gamma_1 x_i)+(\gamma_3\zeta_i+\eta_{ij}) \tag{19}$$

$$= \overline{\omega}^r_{i,-j}+r_{ij}, \tag{20}$$

where $r_{ij} = \gamma_3\zeta_i+\eta_{ij}$ is orthogonal to v and x_i by construction. Hence, the researcher's expectation $\overline{\omega}^r_{i,-j}$ and parameters δ, γ_1, γ_2, and Γ_1 can be consistently estimated by regressing the realized average vote of other funds, $\overline{\omega}^*_{i,-j}$, on v and x_i. The estimate of the researcher's expectation that we obtain from this regression is $\hat{\overline{\omega}}^r_{i,-j} = \hat{\delta}+\hat{\gamma}_1 v_{ij}+\hat{\gamma}_2\overline{v}_{i,-j}+\hat{\Gamma}_1 x_i$.

Next, we can also obtain an estimate of unobserved director quality. Namely, we can rewrite the above equations as

$$\gamma_3\zeta_i = \overline{\omega}^*_{i,-j}-\overline{\omega}^r_{i,-j}-\eta_{ij}, \tag{21}$$

and then form the estimate of the unobserved component of director quality as

$$\hat{\zeta}_i = \frac{1}{n_i}\sum_{k\neq j}(\overline{\omega}^*_{i,-k}-\hat{\overline{\omega}}^r_{i,-k}). \tag{22}$$

Three comments about our estimate $\hat{\zeta}_i$ are in order. First, since ζ_i is only defined up to a re-scaling factor, we need to pick a unit of measurement for it. We do so by explicitly setting $\gamma_3 = 1$. Second, in our data, we have a median of 107 funds voting on a director, and so our estimates of unobserved director quality are quite precise: they differ from actual qualities by $(1/n)\sum_{k\neq j}\eta_{ik}$, which becomes small as n becomes large. Finally, the averaging of the residuals is a departure from the standard control function approach. We average the residuals because the unobserved director quality is not specific to every observation; rather, it is specific to a director.[18]

6.2. Second stage

We now get back to estimating the parameters of a fund's best response function,

$$\omega^*_{ij} = \begin{Bmatrix} 1 & \text{if } \alpha+\beta_1 v_j+\beta_2\overline{\omega}^e_{i,-j}+\beta_3\zeta_i+\Gamma x_i+\varepsilon_{ij}\geq 0 \\ 0 & \text{if } \alpha+\beta_1 v_j+\beta_2\overline{\omega}^e_{i,-j}+\beta_3\zeta_i+\Gamma x_i+\varepsilon_{ij}< 0 \end{Bmatrix}. \tag{23}$$

[18] Cooley (2010) uses a similar modification of the first stage.

Note that since we set the scale for ζ_i by setting $\gamma_3=1$, we have $\overline{\varpi}^e_{i,-j}=\overline{\varpi}^r_{i,-j}+\zeta_i$. Hence, we can rewrite the above equation as

$$\omega^*_{ij}=\begin{Bmatrix} 1 & \text{if } \alpha+\beta_1 v_j+\beta_2\overline{\varpi}^r_{i,-j}+(\beta_2+\beta_3)\zeta_i+\Gamma x_i+\varepsilon_{ij}\geq 0 \\ 0 & \text{if } \alpha+\beta_1 v_j+\beta_2\overline{\varpi}^r_{i,-j}+(\beta_2+\beta_3)\zeta_i+\Gamma x_i+\varepsilon_{ij}<0 \end{Bmatrix}. \quad (24)$$

In the last step of our estimation procedure, we replace variables $\overline{\varpi}^r_{i,-j}$ and ζ_i in Eq. (24) with their first-stage estimates $\hat{\overline{\varpi}}^r_{i,-j}$ and $\hat{\zeta}_i$ and run a logistic regression implied by the resulting equation (votes ω^*_{ij} on the left-hand side and variables v_j, $\hat{\overline{\varpi}}^r_{i,-j}$, $\hat{\zeta}_i$, and x_i on the right-hand side) to estimate coefficients α, β_1, β_2, β_3, and Γ in that equation. Note that Eq. (24) makes explicit the two channels through which unobserved director quality impacts the vote of fund i: directly, by changing its utility from voting for a director (measured by coefficient β_3) and indirectly, by changing the expected votes of other funds (measured by coefficient β_2), which in turn impacts fund i's incentives.

Like the first stage, the second stage of our estimation procedure also departs from the standard control function approach: we use the expected votes of other funds rather than the actual votes. This is a consequence of modeling voting as a game of private information, in which each fund chooses its action based on the expectation of other funds' behavior rather than the actual realization, which is unknown to the fund when it makes its decision.

7. Results

We can now estimate the model of voting presented in Section 5. The object we are estimating is the fund's best response function. In other words, we are estimating how, in equilibrium, a fund's vote changes in response to changes in the expectation of the other funds' votes, the type of director that is being voted on, and the fund's own management-friendliness.

7.1. First stage

In the basic specification of the first stage, we regress the average vote of other funds in the election, $\overline{\omega}^*_{i,-j}$, on a fund's own management-friendliness, v_{ij}, other funds' average management-friendliness, $\overline{v}_{i,-j}$, and firm and director controls, x_i (Eq. (19)).[19] The results are reported in columns 1 (without firm and director controls) and 2 (with controls) of Table 7. In the alternative specification, we also include three higher moments of the distribution of other funds' friendliness. The results for this specification are in columns 3 and 4.

The average past voting record of funds voting on the director is strongly correlated with their vote both when included alone and with other moments of the distribution. For example, in the basic specification with firm and director controls (column 2), the coefficient is 0.77, and it increases to 1.32 when higher moments are included (column 4). It is highly statistically significant at 1% across all specifications. From columns 3 and 4 we can see that the standard deviation, skewness, and kurtosis of other funds' friendliness all contain information about the equilibrium vote of other funds, which is not contained in the mean.

To uncover the unobserved director quality, we take the residual from the regression above and average it over the funds voting on a director, as in Eq. (22). A high residual from the first stage tells us that the director obtained a higher vote than predicted by her characteristics and the characteristics of the funds which voted on her.

7.2. Second stage: estimating the parameters of the model

We now have all determinants of a fund's vote from our model. Following Eq. (24), we estimate it using a logistic regression where the dependent variable is the fund vote. The explanatory variables are the fund's own friendliness, the expected average vote of the other funds, the estimate of director unobserved quality, and firm and director controls.

7.2.1. Strategic complementarity

The expected average vote of other funds is a strong determinant of fund voting: the strategic effect is highly statistically significant across specifications. Results are presented in Table 8. Once we control for firm or director characteristics in these specifications, the coefficient is 1.84 in the specification using only the mean friendliness of other funds as an instrument and 3.54 for the specification using the moments of other funds' friendliness as instruments.

The expectation of the average vote of other funds is determined in equilibrium and is therefore endogenous to the model. To shed some light on the economic magnitude of this coefficient, one has to consider an out-of-equilibrium shock to the expectation of other funds' average vote. Consider the following experiment: how would a fund's vote change if it made a mistake and overestimated the expected average vote of other funds. First, consider the higher coefficient, 3.54. If a fund's expectation of the average vote of other funds increases by 10%, the log odds of a "for" vote increase by 0.354. Consider a fund which withheld its vote on a director with a 20% probability. Suppose that in equilibrium the fund expected all other funds to withhold their votes with a 20% probability as well. If this fund instead made a mistake and expected all other funds to withhold their votes with only a 10% probability, its own probability of voting "withhold" would decrease by 5.1% to 14.9%. Alternatively, if the coefficient is 1.84, then the same 10% change in the expectation of other funds' average vote would cause a fund to change its probability of withholding by 2.8%, to 17.2%.

An alternative way of interpreting the coefficients is a back-of-the-envelope calculation of the corresponding social multiplier. Suppose the direct effect of changing a

[19] Recall from Section 4.1 that we compute a fund's management-friendliness as the average vote of that fund in firms other than the firm under observation in the previous year.

Table 7
First stage: equilibrium projection.

The dependent variable is the average vote of other funds voting on the director in the shareholder meeting, where the "for" vote takes the value of one and zero otherwise. "Moments of other funds' management-friendliness" are the moments of management-friendliness of funds voting on the director in the shareholder meeting. Own management-friendliness is calculated as the average vote of a fund in the previous calendar year on firms other than the firm under observation. Data sources: SEC Edgar (N-PX filings), CRSP, Compustat, IRRC governance database, Board Analyst directors database.

	(1) Other funds' avg. vote "for"	(2) Other funds' avg. vote "for"	(3) Other funds' avg. vote "for"	(4) Other funds' avg. vote "for"
Moments of other funds' management-friendliness				
Average	1.067	0.766	1.426	1.32
	[0.066]***	[0.101]***	[0.156]***	[0.203]***
Standard deviation			0.431	0.489
			[0.102]***	[0.129]***
Skewness			0.005	0.011
			[0.006]	[0.006]*
Kurtosis			0.001	0.001
			[0.001]*	[0.001]**
Own management-friendliness	0.002	0	0.005	0.004
	[0.001]***	[0.001]	[0.001]***	[0.001]***
Firm and director characteristics		Y		Y
Constant	−0.047	0.249	−0.431	−0.292
	[0.060]	[0.091]***	[0.145]***	[0.188]
Observations	1,766,982	1,493,621	1,766,982	1,493,621
R^2	0.02	0.09	0.03	0.09

Robust standard errors clustered by director election in brackets.
* Significant at 10%; ** significant at 5%; *** significant at 1%.

director characteristic decreases all funds' probability of voting "withhold" from 20% to 10%. In addition to that response, each fund now knows that all other funds will lower their vote by 10%. If the coefficient is 3.54, each fund's best response is to decrease its log odds of a "withhold" vote further by 3.54∗10% = 0.354, shifting the probability of a "withhold" vote from 10% to 7.2%. But then all funds know that as well, so they have an incentive to reduce their vote even further: an additional iteration decreases the log odds by (10–7.2%)∗3.54 = 0.10, decreasing the probability of funds voting "withhold" from 7.2% to 6.60%. Due to the structure of the game, by repeating the iterations until convergence, we can compute a new equilibrium. In this equilibrium, each fund votes "withhold" with probability 6.43%. Thus, the 10% direct effect of changing director quality translates to a total effect of 13.6%: the social multiplier is 1.36, and the complete effect of changing a director characteristic is more than a third larger than it would be in the absence of funds' strategic interactions. Alternatively, with the estimated coefficient of strategic interaction equal to 1.84, the corresponding social multiplier would be equal to 1.18.

In Section 8, we provide additional insight into the economic significance of our estimates of strategic complementarity by analyzing its impact on equilibrium behavior of the funds.

7.2.2. Fund heterogeneity

In Section 4.1, we showed that a fund's voting record from the previous year is a good proxy for how friendly a fund is, and that this friendliness affects fund voting. To understand the magnitude of this effect, however, we have to jointly estimate all factors that determine a fund's vote.

Funds' friendliness remains a statistically and economically significant determinant of voting in the structural model. From Table 8, we can see that the coefficient on a fund's own friendliness is remarkably stable across different specifications of controls, ranging from 5.81 to 5.96. To interpret this effect, consider changing a fund's friendliness by two standard deviations of the fund friendliness distribution. This change increases a fund's log odds of a "for" vote by 1.86. To put this magnitude in perspective, suppose a fund at one-standard-deviation under the mean of friendliness were to "withhold" the vote with a 20% probability. If the fund were to change to a one-standard-deviation above the mean friendly fund, it would withhold with only 3.8% probability. Given the relevant range of voting outcomes, such a change in fund behavior is potentially very large. Furthermore, we have only considered the change in voting of a single fund, ignoring the equilibrium reinforcement that would take place were all funds to become more management-friendly at the same time.

As we will see below, heterogeneity in management-friendliness is at least as important in determining fund voting as firm performance and director and governance characteristics.

7.2.3. Firm and director characteristics

A change in firm or director characteristics has a direct and indirect effect. The coefficients of the best response function which we interpret in this section represent the magnitudes of the direct effect, which gives us a lower bound on the equilibrium size of the effect. Furthermore, all direct effects are reinforced by the same mechanism of

Table 8
Best response function.

The dependent variable is a vote cast by a fund in a board of directors election; it takes the value of one if the vote is "for" and zero otherwise. The predicted vote of other funds is the fitted value of the corresponding column in Table 7. Unobserved quality is the average residual from the specification of the corresponding column in Table 7, averaged within a director-meeting pair. Own management-friendliness is calculated as the average vote of a fund in the previous calendar year on firms other than the firm under observation. The industry return is the value-weighted return of the firm's two-digit SIC industry. The governance index is the governance index from Gompers, Ishii, and Metrick (2003). The omitted category from Inside director and Outside related director is an Outside director. Data sources: SEC Edgar (N-PX filings), CRSP, Compustat, IRRC governance database, Board Analyst directors database.

	(1) Vote "for"	(2) Vote "for"	(3) Vote "for"	(4) Vote "for"
Predicted vote of other funds	5.608	1.839	6.349	3.541
	[0.310]***	[0.650]***	[0.292]***	[0.539]***
Own management-friendliness	5.834	5.958	5.813	5.942
	[0.041]***	[0.047]***	[0.041]***	[0.047]***
Unobserved quality	7.824	7.85	7.817	7.849
	[0.032]***	[0.038]***	[0.032]***	[0.038]***
Firm characteristics				
ROA		3.207		2.867
		[0.423]***		[0.413]***
Last year return		−0.077		−0.066
		[0.020]***		[0.019]***
Industry return		0.077		0.055
		[0.045]*		[0.045]
Return below industry quartile		−0.058		−0.064
		[0.024]**		[0.024]***
Log assets		0.021		0.019
		[0.009]**		[0.009]**
Q		−0.026		−0.022
		[0.009]***		[0.009]**
Book-to-market		0.123		0.11
		[0.034]***		[0.034]***
Leverage		0.333		0.27
		[0.055]***		[0.053]***
Cash flow-to-assets		−1.753		−1.544
		[0.420]***		[0.414]***
Capex-to-assets		1.217		1.094
		[0.249]***		[0.245]***
S&P 500		0.212		0.153
		[0.034]***		[0.032]***
Governance index		0.011		0.009
		[0.004]***		[0.003]***
Director characteristics				
Inside director		−0.273		−0.177
		[0.053]***		[0.049]***
Outside related director		−0.653		−0.468
		[0.075]***		[0.063]***
CEO		0.157		0.116
		[0.049]***		[0.048]**
Chairman		0.036		0.008
		[0.039]		[0.039]
Founder		−0.066		−0.03
		[0.060]		[0.058]
Audit member		−0.107		−0.083
		[0.021]***		[0.021]***
Compensation chair		−0.02		−0.03
		[0.050]		[0.050]
Compensation member		−0.405		−0.353
		[0.029]***		[0.027]***
Executive chair		−0.043		−0.067
		[0.093]		[0.092]
Executive member		−0.071		−0.055
		[0.026]***		[0.026]**
Governance chair		0.23		0.201
		[0.119]*		[0.118]*
Governance member		−0.004		−0.011
		[0.034]		[0.034]
Nominating chair		−0.314		−0.288
		[0.113]***		[0.112]**
Nominating member		−0.084		−0.054
		[0.035]**		[0.034]

Table 8 (*continued*)

	(1) Vote "for"	(2) Vote "for"	(3) Vote "for"	(4) Vote "for"
Constant	−7.006	−3.922	−7.667	−5.436
	[0.282]***	[0.587]***	[0.268]***	[0.496]***
Observations	1,766,982	1,493,621	1,766,982	1,493,621

Robust standard errors clustered by director election in brackets.
* Significant at 10%; ** significant at 5%; *** significant at 1%.

strategic voting. Therefore, if the direct effect of a change in last year's return is economically greater than the direct effect of changing governance characteristics, then the overall effect of increasing last year returns on voting will also be larger than the overall effect of changing governance characteristics on voting.

The first group of effects we look into are measures of the firm's last year performance. The previous year return on assets seems to be the most robust performance measure that funds respond to: the coefficient of 2.867 in specification 4 (Table 8) implies that a two-standard-deviation move in the ROA increases the log odds ratio of a director obtaining a "for" vote by 0.58. Returning to our canonical example, this change in returns would decrease the likelihood of a "withhold" vote of a fund from 20% to 12.3%. We also examine whether funds consider firm performance relative to the industry when casting votes. If a firm manages to switch from the bottom return quartile of its two-digit SIC industry, the log odds of a "withhold" vote decrease by 0.06. In our example, this would reduce the probability of a "withhold" vote from 20% to 19.0%.

Directors of larger firms and firms that are members of the S&P 500 also obtain more favorable voting outcomes. There are several potential explanations for this effect: first, there is a larger free-rider problem among the shareholders in large firms, which decreases the benefit from voting "withhold." Second, business connections with larger firms may be more important for funds. Third, the management of large firms might also have more funds at their disposal to hire proxy solicitors and investor relations firms to help them manage the voting. A coefficient of 0.153 implies that membership in S&P 500 would reduce a director's probability of a "withhold" from 20% to 17.7% in our example. Similarly, the coefficient on log assets of 0.019 implies that a two-standard-deviation increase in firm assets decreases a director's probability of a "withhold" vote by 2.9% in our canonical example.

Next, we examine the effect of governance characteristics. Two outcomes are possible: funds could "withhold" their vote more frequently in firms with weaker shareholder rights to force the directors to increase shareholder rights. Alternatively, funds may "withhold" their vote more frequently in firms with stronger shareholder rights, where they may be able to exert more pressure on directors. The latter seems to be the case in the data. Funds are more likely to vote "for" a director in a more dictatorial firm, as measured by the Gompers-Ishii-Metrick (GIM) index (Gompers, Ishii, and Metrick, 2003). A two-standard-deviation (5-point) increase in the index increases the log odds of a "for" vote by 0.05. The direct effect is economically small: a two-standard-deviation increase in the GIM index decreases a fund's probability of a "withhold" vote from 20% to 19.3%. A similar phenomenon, where funds seem to vote against directors on whom they may be able to exert more pressure, can also be seen in voting on the CEO. The CEO, on average, realizes fewer "withhold" votes than other inside directors. If we compare a CEO to a similar inside director whose probability of a "withhold" vote is 20%, the CEO is 1.8% less likely to receive a "withhold" vote.

Funds frequently address a director's relationship with the firm as a reason to "withhold" the vote in their guidelines. Funds are least likely to "withhold" their vote on an outside director. Outside related directors, however, are more likely to obtain a "withhold" vote than inside directors. A potential explanation is that mutual funds understand that both outside related and inside directors are not free of conflicts of interests. Outside related directors have available substitutes in outside directors. The latter may not be good substitutes for inside directors, who have significantly more information on the company. An outside director's log odds ratio of a "for" vote is 0.18 higher than that of an inside director in the same firm. To put this coefficient in context, consider an inside director that receives a 20% "withhold" vote; the same director as an outsider would obtain a 17.3% "withhold" vote, leading to a 13% decrease in the probability of a withhold vote.

Funds' proxy guidelines also target committee members and specify that funds are to withhold votes if they are dissatisfied with the decisions or the composition of the committee. Compensation committee members receive, on average, the lowest "withhold" votes among committee members; a director whose withhold vote would otherwise be 20% receives 6.2% fewer votes if she is on the compensation committee. Similar in magnitude is the effect of being the chair of the nominating committee. We would like to caution that these results may be sensitive to the time period under consideration, due to the funds' changing focus on different governance characteristics over time. For example, an accounting scandal may lead to more attention to the members of audit committees, making them subject to more "withhold" votes in the future. A longer time series may shed more light on the robustness of these effects.

7.2.4. *Unobserved director quality*

Unobserved director quality plays an important role in determining fund voting. Note that the coefficient on unobserved director quality obtained from the logistic regression (Table 8) is not the structural coefficient.

To compute the latter, we need to adjust the regression coefficient by subtracting from it the coefficient on expected vote of other funds (see Section 6 and Eq. (24) for details). The magnitude of the structural coefficient is economically important. For example, consider the estimates from specification 4. These estimates imply that a two-standard-deviation change in unobserved director quality increases log odds of a "for" vote by 1.36, which is twice as large as the change following a two-standard-deviation increase in the return on assets. This result demonstrates the importance of accounting for unobserved director heterogeneity in our estimation of strategic complementarities, which would otherwise be severely biased.

8. Equilibrium impact of strategic complementarity

We now use the estimated model to generate counterfactuals to examine the equilibrium consequences that changes in underlying parameters have on the voting outcome. Factors that directly affect fund voting are amplified in equilibrium. We briefly explored the magnitude of this multiplier in Section 7. In this section, we analyze it in more detail.

8.1. Constructing counterfactuals

To construct counterfactuals, we alter the inputs used in the model we estimated and find a Bayesian Nash equilibrium of the resulting game. Because of the supermodular structure of the game, an equilibrium exists, and there is a simple algorithm that finds the most and the least management-friendly equilibria.

We first specify funds' strategies and beliefs. Using Remark 1, we can specify a strategy of fund j, given its own type, director characteristics, and other funds' expected average vote, by a cutoff c_{ij}. For realizations of the idiosyncratic shock ε_{ij} below c_{ij}, the fund votes "withhold"; otherwise it votes "for." The cutoff for fund j can be obtained from our best response function (13) as $c_{ij} = -(\alpha+\beta_1 v_j+\beta_2\overline{\varpi}^e_{i,-j}+\beta_3\zeta_i+\Gamma x_i)$. The logistic specification of the best response function allows us to obtain a closed-form expression for the expected vote corresponding to the fund's strategy $\Pr(\omega_{ij}=1) = \exp(-c_{ij})/(1+\exp(-c_{ij}))$. Moreover, from (13) we know that the sufficient statistic for a fund's belief about other funds' strategies is the expected average vote of other funds $\overline{\varpi}^e_{i,-j} = (1/(n_i-1))\sum_{k\neq j}\Pr(\omega_{ik}=1) = (1/(n_i-1))\sum_{k\neq j}\exp(-c_{ik})/(1+\exp(-c_{ik}))$.

The highest equilibrium is obtained by iterating the best response function from the highest strategy profile. Let c^t_{ij} be the cutoff value for the strategy and $\Pr(\omega^t_{ij}=1)$ the expected vote of fund j after the tth iteration of the best response function. In tth iteration we calculate the strategy of every fund by calculating its cutoff, c^t_{ij}. The belief of each fund about other funds' strategies is the strategy of the other funds from the previous iteration, i.e., it is the expected vote of other funds fixed from iteration $t-1$, $\overline{\varpi}^{e,t-1}_{i,-j}$. Formally,

$$c^t_{ij} = -(\alpha+\beta_1 v_j+\beta_2\overline{\varpi}^{e,t-1}_{i,-j}+\beta_3\zeta_i+\Gamma x_i), \quad (25)$$

$$\overline{\varpi}^{e,t}_{i,-j} = \frac{1}{n_i-1}\sum_{k\neq j}\Pr(\omega^t_{ik}=1) = \frac{1}{n_i-1}\sum_{k\neq j}\frac{\exp(-c^t_{ik})}{1+\exp(-c^t_{ik})}. \quad (26)$$

We start by setting the belief of each fund about the strategies of other funds to $\overline{\varpi}^{e,0}_{i,-j}=1$ and iterate the following two equations until $\sum_{i,j}|\Pr(\omega^t_{ij}=1)-\Pr(\omega^{t-1}_{ij}=1)|$ is less than 0.001. We repeat the procedure by starting with $\overline{\varpi}^{e,0}_{i,-j}=0$ to obtain the lowest equilibrium.

8.2. Performance of the model

We begin by simulating equilibrium voting behavior under the estimated parameters, and compare it to the actual votes. The highest and lowest simulated equilibria are very close, and so we present the results only for the highest equilibrium. We calculate director support by averaging the probability of a "withhold" vote for all funds voting on a director.

Panel A of Table 9 describes the distribution of the percentage of funds supporting a director in an election for the actual data and the simulated equilibrium under two specifications. The model matches the qualitative features of the data. It also matches the quantitative features of vote distribution for directors who received support above the 10th percentile. The median director obtains "withhold" votes from 3.4% of funds in the actual data and 3.6% and 3.8% of funds in the simulated equilibria. The biggest difference between the realized vote and the predicted vote is in the level of support obtained by the 10% of directors with the highest level of opposition. In the data, the director at the 10th percentile of the distribution receives 26.4% "withhold" votes, while in our simulated equilibria he would receive such votes from 15.3% and 16.5% of funds. For the directors even further out in the tail, our model's quantitative performance deteriorates further, most likely as a consequence of the structural assumptions in our estimation, e.g., the lack of heterogeneity in strategic complementarities among funds. We have to keep this caveat in mind when interpreting the counterfactual results.

Our model does not replicate the empirical fact that many directors obtain no "withhold" votes. The reason is that we are comparing an actual realization of votes to the average probability of funds supporting a director. Using a logit model, no fund votes for a director with probability one; therefore, the mean expected support is lower than one by construction.

8.3. Social multiplier

Suppose the quality of a director increases for an exogenous reason. Then a fund will have an incentive to increase its vote on the director simply because she is a better director. This is the direct effect of increasing quality. Furthermore, the fund will have an additional incentive to increase its vote, because it knows that other

Table 9
Simulations.

Panel A compares the distribution of director votes in the sample to the distribution of director votes in the simulated equilibria based on parameter estimates in specifications 2 and 4 from Table 8. Director actual vote is the average "withhold" vote obtained by directors. Director simulated vote is the average probability of a "withhold" vote for a director computed using her actual attributes and estimated parameters from specifications 2 and 4 in Table 8, respectively. The sample is restricted to directors for whom we were able to obtain counterfactuals in all specifications. Panel B describes simulated equilibria for two different specifications of parameters on a subset of directors who were in the lowest quartile of unobservable director quality in that specification. The parameters for the simulation are taken from specifications 2 and 4 in Table 8. Director simulated vote is the average "withhold" vote for a director computed using her actual attributes. Direct impact vote is the director simulated vote increased by the odds difference implied by an increase in unobservable quality of 90–10 percentile range in unobservable quality. Equilibrium impact vote is the vote computed from our model using the director's actual attributes, but increasing her unobserved quality by the 90–10 percentile range in unobservable quality. Panel C presents the distribution of the multiplier for each specification, which is calculated as (Equilibrium impact vote–Director simulated vote)/(Direct impact vote–Director simulated vote). All simulated equilibria presented are the most management-friendly equilibria.

Variable	N	Mean	St. dev.	p10	p25	p50	p75	p90
Panel A: *Actual and simulated distributions of votes*								
Director actual vote	7,897	9.5%	16.7%	26.4%	7.9%	3.4%	1.4%	0.0%
Director simulated vote (Spec. 2)	7,897	9.9%	18.9%	16.5%	5.5%	3.8%	2.8%	2.2%
Director simulated vote (Spec. 4)	7,897	11.0%	22.7%	15.3%	5.3%	3.6%	2.7%	2.1%
Panel B: *Simulated equilibria for low-quality directors*								
Specification 2								
Director simulated vote	2,300	28.6%	31.0%	80.9%	56.6%	9.1%	4.4%	2.9%
Direct impact vote	2,300	13.3%	18.6%	43.9%	21.3%	2.5%	1.0%	0.6%
Equilibrium impact vote	2,300	8.3%	12.1%	24.0%	11.7%	2.2%	0.9%	0.6%
Specification 4								
Director simulated vote	2,302	33.9%	37.5%	92.2%	79.9%	8.7%	4.3%	2.9%
Direct impact vote	2,302	22.4%	29.6%	72.7%	48.8%	2.9%	1.3%	0.8%
Equilibrium impact vote	2,302	8.8%	14.7%	22.7%	10.4%	2.5%	1.1%	0.7%
Panel C: *Social multiplier for low-quality directors*								
Multiplier (Spec. 2)	2,300	1.16	0.21	1.01	1.02	1.03	1.26	1.53
Multiplier (Spec. 4)	2,302	1.64	0.92	1.02	1.04	1.07	2.13	3.33

funds are also more likely to vote for the director, amplifying the direct effect. In this section, we compare the direct effect to the full equilibrium effect. Our approach allows us to obtain director-specific multipliers, which incorporate director characteristics and the distribution of fund friendliness.

We take directors in the lowest quartile of unobserved quality. For each director, we increase her quality by the difference in unobserved quality between the 90th- and the 10th-percentile directors. We compare the direct effect of this change to the full effect. As a baseline, we use the votes obtained from the simulated equilibria described in the previous section. We use the simulated rather than the actual votes as a baseline, because we want to isolate the effects of the multipliers, and do not want to confound the effects with how well our model can replicate the voting distribution.

Panel B of Table 9 presents the distributions of simulated votes taking into account the direct effect and the full effect of increasing director quality.[20] The full effect is much stronger than the direct effect. For example, in specification 4, the mean "withhold" vote drops from 33.9% in the baseline to 22.4% due to the direct effect and to 8.8% under full equilibrium response. This implies an aggregate multiplier of 2.2.

The distributions of director-specific multipliers are presented in Panel C. The distributions are highly skewed. The median multipliers in our specifications are 1.03 and 1.07. The multipliers in the 75th percentiles are much higher, at 1.26 and 2.13. In an earlier version of this paper, we reported additional results using various more flexible specifications of the model, suggesting that the higher estimate is more robust. Hence, for many directors (at least those above the 75th percentile), the social multiplier is likely to be large—at least two. Thus, any analysis of policy changes or improvements in firm or director characteristics has to take into account the fact that peer effects have an important influence on voting outcomes and the resulting social multipliers differ widely across directors.

9. Conclusion

Voting in director elections is an important tool that shareholders have at their disposal. Prior empirical literature on boards of directors has used outcome variables such as board composition and director survival rates to understand this process. We explore shareholder voting using a novel, comprehensive data set which includes 2,058,788 mutual fund votes in director elections that took place between July 1, 2003 and June 30, 2005.

Looking at individual votes allows us to study the behavior of the funds and the interactions among them. We find substantial systematic heterogeneity in voting patterns, with some funds being consistently more management-friendly than others. This heterogeneity has a large effect on voting, on par with firm and director characteristics. Thus, who monitors directors can potentially be as important as the characteristics of the directors monitored.

We then estimate a model of voting in which mutual funds impose externalities on each other: the cost of opposing management decreases when other funds oppose it as well. To estimate the model, we exploit fund heterogeneity. Using this variation, we show that strategic interaction between funds is an economically and statistically significant factor in determining fund voting. It reinforces the direct effect that director characteristics have on the voting outcome. This social multiplier varies substantially across directors.

The large and persistent differences in voting patterns and the strategic interaction effects suggest that at least some funds take voting seriously and try to use it to influence management. Yet on its own, voting in director elections is essentially powerless, since under the plurality voting system implemented in most U.S. companies, it takes just one "for" vote to elect a director. The reason why votes nevertheless have power is that shareholders have other tools at their disposal that they can use to influence managers and directors, if voting outcomes are ignored. Investors can sell shares in the company. They also can, at considerable cost, propose an alternative slate of directors and launch a "proxy fight." A clear expression of dissatisfaction with the management coming from the shareholders in the form of low director support could also send a signal to outsiders that the company is an attractive takeover target (dissatisfied shareholders will be more willing to agree to a takeover offer and sell their shares instead of sticking with the current management). These examples suggest that votes play an important role as signals, and empirically studying this role and the interaction of voting and other tools of shareholder control is an important direction for future research. As more data on mutual fund voting become available,[21] it becomes feasible to study the dynamic interaction between shareholder voting behavior, management response to the voting outcomes, and the use of other tools of corporate governance.

Better understanding of the role of voting as part of the larger corporate governance mechanism will in turn make it possible to address important policy questions. For instance, instead of the plurality system, some U.S. companies have begun to adopt majority voting systems. Under majority voting, "withhold" votes have the weight of an "against" vote and a candidate gets elected only if more than half of the votes cast are "for." A number of shareholder advocates and policymakers have recently called for a broader use of the majority voting system by corporations or even a full elimination of plurality voting (ISS, 2005). Viewing voting in isolation, majority voting seems to give shareholders much more power. In the richer framework, however, the question of which

[20] Formally, if ω_{ij}^{e} is the initial probability of fund i voting for director j, $\Delta\zeta$ is the change in director quality, and $\hat{\beta}_3$ is the coefficient on unobserved quality from (13), then the new probability of voting "for" resulting from the direct effect is $\exp(\ln(\omega_{ij}^{e}/(1-\omega_{ij}^{e}))+\hat{\beta}_3\Delta\zeta)/(1+\exp(\ln(\omega_{ij}^{e}/(1-\omega_{ij}^{e}))+\hat{\beta}_3\Delta\zeta))$.

[21] As of August 31, 2009, six years of voting data are available from the SEC.

mechanism allows shareholders to exert more influence on directors and managers becomes more subtle. For moderate levels of dissatisfaction with directors, if shareholders simply want to signal that they would like the director or the management to improve their performance but do not want to fire the director, they may be willing to "withhold" support under the plurality system but not under the majority system, making the latter less effective. Therefore, determining which of the two mechanisms is more effective becomes an empirical question, requiring careful analysis and better understanding of the role of voting in director elections as part of the broader set of tools of shareholder control.

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