Another Option for Determining the Value of Corporate Votes *

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Abstract

This paper proposes a new method using option prices to measure the value of the voting right attached to a stock. The method consists of synthesizing a non-voting share using put-call parity, and comparing its price to that of the underlying stock. Empirically, I find this measure of the value of a voting right to increase around shareholder meetings, particularly for those which are contested. The measure is also more frequently positive for activist hedge fund targets. I estimate the mean (median) annualized value of a voting right to be 1.23% (0.86%) of the underlying stock price.

JEL Classification. G13, G34

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Estimating the value of the voting rights attached to a stock is important to our understanding of corporate control[1]. Two main methods have been used. First, one can compare the prices of different classes of shares of the same firm with different voting rights. Second, one can consider sales of controlling blocks in publicly traded companies and compare the price paid per share of the block with the prevailing stock price[2]. Both approaches have advantages but also their problems. For instance, the former requires that at least two types of shares be publicly traded. However, only six percent of US publicly traded companies are dual-class firms and their shares with superior voting rights are usually not publicly traded (Gompers, Ishii, and Metrick (2009)). Moreover, even if both classes of shares are traded, one might be less liquid than the other. More importantly, generalization may be a concern since firms with dual-class shares are likely to be those for which control is most valuable (DeAngelo and DeAngelo (1985) and Smart and Zutter (2003)). With the latter, finding reliable data is more difficult. Moreover measuring the value of control is possible only when there is a transfer of a controlling block. This might prevent estimating the value of control when there is no control contest, or in the case of failed takeover attempts or shareholder activism.

In this paper, I propose a method using option prices to measure the value of the voting rights attached to a stock. The main idea is as follows. For dispersed shares, the value of a voting right ought to be negligible outside important control-related events (e.g., takeovers, proxy fights). In those events, however, voting rights may be valuable, and are akin to a dividend (voting right dividend) paid to voting shares. Given this interpretation, the value of a voting right can be obtained from the put-call parity relation. Indeed, the value of a voting right is the difference between the dividend value as inferred from put-call parity and the present value of actual dividends until the option’s maturity.

The method may alternatively be described as synthesizing a temporarily non-voting share. Indeed, the cash flows of a stock can be replicated by a portfolio of same-maturity and -strike European put, call and bond. However, this portfolio has no voting right until the options’ maturity. Therefore if holding the voting right before maturity is valuable, this should be reflected in the price wedge between the stock and the portfolio.

The method can be used for both single- and dual-class companies. It also helps solve the data problems in both dual-class and controlling block sales studies. In principle, one

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1See Adams and Ferreira (2008) and Burkart and Lee (2008) for surveys of empirical and theoretical work.

can estimate the value of the voting right attached to a stock at any time, as long as the 
stock has call and put option pairs of same maturity and strike price traded. A complicating 
issue is that the put-call parity relation holds as an equality only for European options, while 
exchange-traded stock options are American options. Therefore, the put-call parity bounds 
for American options provide a lower bound for the value of voting rights. For conciseness, I 
call “the value of the voting right” the lower bound for the value of holding the voting right 
before the options mature.

Using this measure, I document empirically the value of voting rights. To do this, I focus 
on two instances when voting rights would be expected to increase in value: shareholder 
meetings and episodes of hedge fund activism.

In the first part of my empirical analysis, I measure the value of a voting right for 2,735 
publicly traded US companies for the period 2000-2007 around shareholder meetings. For 
comparison across time and companies, I measure the value of a voting right on a given day 
as a percentage of the closing stock price. I expect the value of the voting right to increase 
around the meeting’s record date, and the actual meeting date[^9] I also expect meetings 
involving fiercer control contests to lead to larger increases in the value of voting rights.

I focus my analysis around the record date and compute the lower bound for the value 
of a voting right daily for every option pair. The first observation is that the lower bound is 
negative for 88% of the option pairs. This is not surprising as the value of voting rights should 
be negligible outside important control-related events. For these cases, I infer the value of 
voting right to be zero as it cannot be negative. Focusing on cases with non-negative lower 
bounds (12% of the option pairs), I find that the value of a voting right increases as the time 
to maturity of the option pairs used increases. This is expected as the method synthesizes 
a share that is non-voting only until the options’ maturity and derives the value of holding 
voting rights only until this maturity. Hence the longer the time to maturity, the less valuable 
the synthetic temporarily non-voting stock.

To estimate the average value of a voting right over a year, I compute a hypothetical 
**voting right dividend yield** from the present value of voting rights. Assuming that this yield 
remains constant over a year, I estimate the mean (median) value of a voting right over a 
year to be 5.47% (4.71%) of the stock price around record dates for cases with non-negative 
lower bounds. Incorporating the cases where the lower bound is negative, I find that the[^3] 

[^9]: Investors holding voting shares on a meeting’s record date are eligible to vote at the meeting.
mean (median) annual value of a vote is 1.23% (0.86%). This is to be compared with the value of voting rights of 2 to 4% of the firm’s market capitalization estimated in studies using controlling block sales and with the voting premium of 5 to 10% of inferior-voting shares estimated for dual-class firms in the US.

Over time, the value of a voting right exhibits three spikes associated with special and annual shareholder meetings: around the record date, around the actual meeting date and about six months after the meeting date. The spikes at the record and meeting dates are in line with my hypotheses as they are the likely times of the control contest. One might speculate that the spike after the meeting date could be due to the realization of the control event (e.g., buying of shares during the takeover of a company).

The spikes are much bigger for special meetings than for annual meetings. This is also in line with my hypotheses insofar as the likelihood of a fierce control contest is higher at special meetings than at annual meetings. Other types of shareholder meetings provide interesting insights too. For instance, I find that the value of a voting right spikes up for proxy contests 3 to 6 months before the record date whereas it remains relatively stable for annual meetings. It is likely that the threat of a proxy fight increases the value of voting rights before the record date but that this type of activism tends not to develop into actual contests. This is in line with Klein and Zur (2009)’s finding that only 18 out of 151 activist campaigns result in actual proxy fights.

To test the impact of control contests on the value of voting rights, I estimate firm fixed-effect and tobit models. The dependent variable for the fixed-effect model is the value of voting rights averaged over six weeks around the record date minus their value averaged over six weeks ending a quarter before the record date. The dependent variable for the tobit model is the value of voting rights averaged over six weeks around the record date. In both models, I find that the value of a voting right increases significantly around the record date of special meetings. The value of voting rights also increases significantly if the proposal discussed in the meeting is about antitakeover, mergers & reorganizations, capitalization or maximizing value issues rather than about compensation, directors related, miscellaneous/routine, environmental/social and other issues. The value of votes is significantly higher for proposals that result in a close vote, as measured by the wedge between the percentage vote required for the proposal to pass and that actually cast in its favor, as well as for proposals where the

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4Note that this assumes a negligible bias in the value of a vote from possible measurement errors. This assumption is reasonable considering the filtering of the data (e.g., choosing highest volume, closest to ATM and shortest maturity option pairs) to minimize measurement error, as detailed in the paper.
ISS recommendation conflicts with that of management. These results are in line with the hypothesis that the fiercer the control contest, the higher the value of voting rights.

As a further analysis, I repeat the regressions with firm-fixed effects but by allowing negative vote values. The results are stronger. To facilitate comparability and economic interpretation, I also run the fixed-effect and tobit models with the annualized value of votes. Depending on the specification, I find that the value of a voting right is about 58-73 basis points higher if the meeting is special rather than annual. For the vote closeness variable, a 10% point deviation results in a reduction in the value of voting rights by about 4-5 basis points. Finally, a conflict between ISS and management recommendations implies about 22-42 basis points increase in the value of voting rights. These results are in contrast with Christoffersen, Geczy, Musto, and Reed (2007) who document an active market for votes around the record dates using data from equity-loan markets in US and UK, but find that the average vote sells for zero.

I compare my measure of the value of voting rights to the value of voting rights inferred from equity lending fees for a subsample of 170 firms. I find the two measures to be highly correlated and close to each other. This validates the lower bound for the value of voting rights in my method.

The second part of my empirical analysis focuses on hedge fund activism. Substantial hedge fund activism has been documented for the US and Europe in recent years. Moreover, the development of derivative and stock lending markets creates new, opaque and cheaper ways to decouple the cash-flow and voting rights in a common share. These techniques have been employed worldwide, especially by hedge funds. However, because of the secretive nature of the activities, mostly anecdotal evidence of this behavior exists.

I analyze 80 US public companies identified in the business press as activist hedge fund targets over 2002-2006 (Bratton (2007)). To each firm in this “target sample” I assign an industry- and size-matched control firm. My hypothesis is that the value of a firm’s voting rights increases when it is targeted by an activist hedge fund. Therefore disregarding the

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5Institutional Shareholder Services (ISS) -acquired by RiskMetrics Group in January 2007- and other private consulting firms examine the proposals once the proxy material is public and make recommendations to their clients about how to vote (Maug and Rydqvist (2009)).

6For example, Brav, Jiang, Partnoy, and Thomas (2008), Klein and Zur (2009), Becht, Franks, and Grant (2009).

7See Hu and Black (2006a), Hu and Black (2006b), Hu and Black (2007) for a more detailed discussion. See also Brav and Mathews (2009) for a theoretical analysis of the impact of empty voting (i.e., having voting power in excess of economic ownership) on the efficiency of corporate governance.
voting right dividends for targeted companies makes the lower bound of their put-call parity appear to be violated. The frequency of lower bound violations can also be interpreted as how frequently the value of voting rights is positive.

As a preliminary study, I conduct a case study of General Motors (GM), which was targeted by Tracinda Corp. in 2005. I find that the number and proportion of GM’s option pairs violating put-call parity increase after Tracinda engages in activism and that the demand for options increases during that period. Moreover, the fraction of lower bound violations jumps from 2-3% to 80% of all GM options traded on a given day. Finally, following the news about this engagement, I observe that the value of voting rights fluctuates widely over time and not necessarily only on certain meeting/voting days but also on days with a threat of control contest.

I next study the full target sample. For these firms, I find the average monthly percentage of lower bound violations of put-call parity among option pairs increase from about 14% pre-targeting, to about 29% post-targeting. The lower bound violations are 17% for the control sample before and remain around 15% after their matched firm is targeted.

I also estimate a logit model where the dependent variable is whether a call and put option pair of a firm on a given trading day violates the lower bound. I control for option volume, bid-ask-spread, the number of option pairs, time to maturity, moneyness, year-month and firm fixed effects. I find that the probability that a given option pair violates the lower bound more than doubles from about 10% to 26% after targeting by an activist hedge fund. The probability of lower bound violations goes up as the number of option pairs increases, and the increase in the average monthly number of option pairs is higher in the target sample than in the control sample.

Taken together, the results in this paper provide evidence that the value of voting rights increases around events when control would be expected to be contested, particularly for fiercer contests.

This paper contributes to the literature on corporate control and governance by introducing a new method for measuring the value of voting rights. This study also contributes potentially to the option pricing literature as it proposes a possible explanation for the empirically documented put-call parity violations (e.g., Ofek, Richardson, and Whitelaw (2004) and Cremers and Weinbaum (2009)) or early exercise puzzles (e.g, Poteshman and Serbin (2003)).

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8 Ofek, Richardson, and Whitelaw (2004) find that deviations from put-call parity are asymmetric in the direction of short sale constraints. The increased value of voting rights during important control-related events
Indeed, this literature does not typically account for the value of voting rights. Whether such an explanation is empirically important remains to be tested and is beyond this paper’s scope.

The paper closest to mine is the contemporaneous work by Kalay and Pant (2009). They use a similar measure of the value of voting rights, and also find it to increase around special meetings. The main differences are as follows. First, I use the put-call parity bounds for American options to estimate a lower bound for the value of voting rights, whereas they try to convert American options into European options and back out the value of a vote from put-call parity. Second, my sample of shareholder meetings is more recent and richer, allowing me to run cross-sectional regressions based on the proposals and their voting outcomes. Finally, I also study hedge fund activism, whereas they also study M&A events. I compare my results to theirs where appropriate throughout the paper.

The paper proceeds as follows. Section 1 outlines the method. I present an empirical analysis of the value of voting rights around shareholder meetings in Section 2, and for activist hedge fund targets in Section 3. Section 4 concludes.

1 An Option-Based Method to Value Voting Rights

I present a new method to measure the value of voting rights attached to common stocks. For European options with dividend-paying underlying stocks, put-call parity is expressed as:

\[ c + K e^{-rT} + D = p + S_0 \]  

where \( c \) and \( p \) are the prices of European call and put options; \( K \) is their common strike price; \( T \) their common time to maturity; \( r \) the risk-free rate; \( S_0 \) the current stock price; and \( D \) is the present value of dividends paid before the options mature (Hull (2002)).

This expression is correct when the value of voting rights is negligible. However, if voting rights are valuable (e.g., during a takeover contest), a voting right is akin to a dividend right.
In this case, Equation (1) remains valid, but \( D \) is the sum of the present value of this \textit{voting right dividend} \((D_V)\) and of that of real dividends \((D_R)\). Hence, the present value of the voting right dividend can be computed as \( D - D_R \), i.e.

\[
D_V = p + S_0 - c - Ke^{-rT} - D_R.
\]  

(2)

Note that the method measures the value of owning the voting right only until the options mature.

Alternatively, the method may be described as synthesizing a temporarily non-voting share. Indeed the cash flows of a stock can be replicated by a portfolio of put, call and bond. However, this portfolio has no voting right until the options’ common maturity. Therefore if owning the vote before the options’ maturity is valuable, its value should be equal to the price difference between the underlying stock and the portfolio.

An issue is that exchange-traded stock options are American not European options. To overcome this problem, I use put-call parity bounds for American options (Hull (2002)): \[10\]

\[
S_0 - D - K \leq C - P \leq S_0 - Ke^{-rT}
\]  

(3)

where \( C \) and \( P \) are the prices of American call and put options with the same underlying stock, strike price \( K \) and time to maturity \( T \). The first inequality can then be written as a lower bound for the value of a voting right:

\[
D_V \geq S_0 - K - C + P - D_R.
\]  

(4)

2 Shareholder Meetings

In this section, I apply the method to estimate (a lower bound for) the value of voting rights for US public companies. I focus on shareholder meetings as these are times when the value of voting rights is likely to increase.

\[10\] Alternatively, one could convert American options into synthetic European options and then apply the method, or use index options which are of European type. There are some difficulties with these alternatives. For instance, for the former, converting American options into synthetic European options is not straightforward. During the conversion, one should take the omitted voting right dividend into account recursively, which complicates the analysis. Moreover, this approach is model-dependent in the estimation of early exercise premiums of the options. For the latter, finding important corporate events that would simultaneously affect the index companies is challenging. See Appendix B for a more detailed discussion.
2.1 Data, Methodology and Hypotheses

2.1.1 Data

I use the Ivy DB OptionMetrics database for the January 1996 to June 2007 period. This database provides end-of-day bid and ask quotes, open interest, trading volume and option-specific data (e.g., implied volatility, maturity, strike price, etc.) for all American call and put options on stocks traded on US exchanges. It also provides the stock price and dividends of the underlying stocks and zero-coupon interest rates. See Appendix A for details on the database and steps for preparing the data.

I use RiskMetrics’ Voting Analytics database for shareholder meetings’ voting records and details of proposals.\textsuperscript{11} It covers the shareholder meetings of the Russell 3000 companies over 2000-2007. For each shareholder meeting, it provides the meeting’s type (e.g., annual, special), a description of the proposals, the proponent of the proposals (e.g., shareholders, management), the meeting’s record date, the meeting date, the voting requirement (e.g., majority, supramajority), the vote’s outcome (e.g., percentage of votes for, against, abstained, withheld), the ISS recommendation and the management recommendation.\textsuperscript{12}

2.1.2 Methodology

Using Condition (4), I estimate a lower bound for the value of a voting right for every company on every trading day. I focus mostly on the shareholder meeting’s record date which is the date set typically by the board as the deadline for shareholders to register and be eligible to vote in the upcoming meeting. I limit the analysis to trading days in the year preceding and that following the record date. This is to alleviate possible contamination by other events. For comparability across firms and time, I normalize the value of the voting right by dividing it by the underlying stock’s closing price on the corresponding day.

One important issue is the treatment of negative lower bounds. On the one hand, one might argue that such cases are uninformative as the value of a voting right cannot be negative. With this in mind I take the value of the vote to be zero when the lower bound is negative. On the other hand, one might argue that a negative lower bound is informative as one might expect the value of the vote to be smaller as the lower bound gets smaller. Therefore, I repeat the analysis allowing for negative lower bounds (Section 2.3.2).

\textsuperscript{11}Formerly known as the IRRC database.
\textsuperscript{12}See Maug and Rydqvist (2009) for a detailed description of the database.
To analyze the shareholder meetings, I first classify each proposal according to its content (e.g., antitakeover-related, directors related). Second, I rank its agenda according to the possibility of a control event (the higher the possibility, the higher the ranking). For instance, antitakeover-related proposals have the highest ranking (rank=1) whereas the proposals about environmental and social issues have the lowest ranking (rank=5). Table 1 reports the classification categories and their rankings. Since usually several proposals are considered in a given meeting, I classify the meeting according to the highest-ranking proposal.

2.1.3 Hypotheses

The first hypothesis is that the value of voting rights increases around the record date. As a meeting’s record date is the deadline for shareholders registering to be eligible to vote in that meeting, I hypothesize that the demand for voting rights should increase before and up to that date.\footnote{Christoffersen, Geczy, Musto, and Reed (2007) find support for this hypothesis in that the volume of equity lending spikes up on the record date.}

I also hypothesize the value of voting rights to increase towards the meeting date. Even though the statute is silent on what happens to voting rights of shares sold after the record date, the general consensus is that, unless otherwise contracted, purchasers do not have the right to vote (Brown (2007)). Therefore, on the one hand, one might conclude that the value of voting rights should drop after the record date. On the other hand, buying shares after the record date might still improve the purchaser’s effective voting power. First, he might contract with the record owners, who are the shareholders owning the right to vote on the record date, for them to vote for his preferred proposal. Second, he might prevent the record owner from voting (against him). Even if contracting is not possible for the purchaser, the evidence suggests that the voting turnout is negatively affected by the shares traded after the record date probably due to reduced economic interest of record owners in the company control (Bethel and Gillan (2002)). In meetings that are (potentially) contested, a lower turnout might benefit one of the competing parties.\footnote{For example, the leading party may buy shares to reduce the uncertainty about voting outcomes.} Therefore investors might have incentives to buy shares after the record dates. This demand would increase the price of the share and also the value of the voting rights. Therefore I expect the value of voting rights to increase before the meeting
date as well.

I also hypothesize the value of a voting right to increase more in case of a control contest. Possible cases are special (as opposed to regular) shareholder meetings, meetings that have high-ranking proposals (e.g., antitakeover-related), meetings with conflicts among different parties (e.g., ISS and management recommendations conflict) and meetings with close votes. I measure the closeness of a vote with the absolute value of the difference between the percentage vote required for the proposal to be accepted and that actually cast in its favor.\footnote{Using a dummy variable taking the value 1 if the closeness measure is less than 5% and 0 otherwise, as in Christoffersen, Geczy, Musto, and Reed (2007), yields similar results.}

To test these hypotheses, I estimate firm fixed-effect and tobit models where the dependent variables are the (change in the) value of a voting right and the independent variables are proxies for the probability and fierceness of a control contest.

\section{Results}

\subsection{General Properties}

In this section, I present some general properties of the measure of the value of voting rights. I find that the value of a voting right increases with the time to maturity of the option pair (Table \ref{table:time_maturity}).\footnote{Here I regress only the non-negative lower bounds for the value of voting rights. Results are qualitatively the same if I restrict the sample to options with maturity less than 12, 6 or 3 months.} This is expected as the method synthesizes a share that is non-voting until the maturity of the option pair and infers the value of voting rights only until this maturity. Therefore the longer the time to maturity, the less valuable the synthetic stock. Figure \ref{fig:time_maturity} graphs the relation between the value of a voting right and time to maturity for options with maturities below six months.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{time_maturity.png}
\caption{Relation between the value of a voting right and time to maturity for options with maturities below six months.}
\end{figure}

To examine the relation between the value of a voting right and the moneyness (defined as $\ln(S_0/K)$) of the option pairs, I divide the options into 42 groups based on their moneyness. Options with moneyness below -1 are in group 1, options with moneyness above 1 in group 42, and options with moneyness between -1 and 1 are evenly allocated to groups 2 to 41. The (lower bound for the) value of voting rights is a U-shaped function of moneyness, with the lowest point around group 21, which corresponds to the at-the-money (ATM) options (Figure \ref{fig:moneyness}).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{moneyness.png}
\caption{Relation between the value of a voting right and moneyness for options with maturities below six months.}
\end{figure}
Plotting the value of the voting right averaged across firms against the time to the record date for special and annual meetings, I find that the value of the voting rights spikes up around the record date (Figure 3). The spikes are much higher for special meetings than for annual meetings. This is consistent with my hypothesis as votes tend to be less fiercely contested, if contested at all, at annual meetings than at special meetings.

Similarly, the value of the voting rights spikes up just before the meeting date (Figure 4). This is also as expected. Note that the spike is higher for the meeting date than for the record date. Interestingly, the value of the voting right also spikes up about six months after the meeting date. This might be due to the realization of the control event (e.g., completion of a takeover).

Plotting graphs similar to Figure 3 for different types of meetings yields interesting results. For instance comparing proxy contests with annual meetings one observes that the spikes in the value of a voting right happens mostly before the record date (Figure 5). One interpretation is that the threat of the proxy contest may be more important than the realization of the threat, consistent with the literature on activism (e.g., Klein and Zur (2009)). Written consents, which are documents on mostly routine and formality issues and are executed instead of formal meetings, do not seem to have much impact on the value of voting rights (Figure 6).

Kalay and Pant (2009) also find a positive relation between the value of a voting right and options’ time to maturity, and a higher value of a voting right at the record and meeting dates of special meetings in their sample. However, their methodology is different: They try to estimate the value of voting rights by first converting the American options to European and then backing out the value from the put-call parity. Interestingly, the relationship between the value of a voting right and options’ moneyness is different in Kalay and Pant (2009). They find that the estimated value of vote decreases monotonically with moneyness. This might be due to our different methodologies.

The figure is based on data for ±215 trading days around the meeting date as beyond that period the sample becomes very small.

For example, approval of standard loan terms offered by a bank. See Mancuso (2007) for a detailed discussion of written consents.
2.2.2 Regressions

To test the hypotheses that the value of a voting right increases around the record date and is higher the fiercer the control contest, I estimate firm fixed-effect and tobit models. For the fixed-effect model, the dependent variable is the value of a voting right of a firm averaged for each shareholder meetings over six weeks around the record date (more precisely over (-16,16) trading days) minus the value of a voting right averaged over the six-week period ending a quarter before the record date (more precisely over (-98,-66) trading days).\(^{21}\)

I drop the cases with fewer than 5 observations in the window to ensure that results are not driven by very few observations. For a given company, several option pairs are usually traded on a given day. I select the pair with the highest call volume, closest to the ATM and with the shortest time to maturity. The volume criterion alleviates the liquidity concerns. The moneyness and time to maturity criteria, following the findings in Section 2.2.1, ensure that I select the lowest value of the voting right (on average) among the available pairs. Therefore the inference of the measure as the lower bound for the value of voting rights is reliable. The overall results, however, are not sensitive to this particular data filtering. For instance, simply averaging the daily value of a voting right of a stock yields qualitatively similar results.

In the fixed-effect model, the value of a voting right before the record date constitutes a natural benchmark to analyze a firm’s value of a voting right around the record date. This benchmark is also useful for constructing the dependent variable since the value of the vote is non-negative and hence using it alone as a dependent variable in a regression requires special treatment. Taking the difference between the value around the record date and that before the record date allows me to use the standard regression framework as the dependent variable is no longer necessarily non-negative.

To proxy for the probability and fierceness of the control contest, I use “Meeting Dummy” which takes the value 1 if the meeting is a special meeting and 0 if it is an annual meeting; “Agenda Dummy” which takes the value 1 if the meeting has an agenda with rank 1 (e.g., antitakeover-related) and 0 otherwise;\(^{22}\) “Closeness” which is the absolute difference between

\(^{21}\)Results are not sensitive to the selection of the particular windows around the record date. Focusing only pre-record date (e.g., the (-16,0) window) also yields qualitatively similar results. However, as in the event studies, the selection of the window for the clean period (i.e., period before the record date) requires to be not very close to the event (record date) to prevent contamination. The clean period should not be very far from the event either, because of data availability and of the possible impact of previous events. Especially for small firms, the options are mostly traded around the event.

\(^{22}\)The majority of the cases are clustered at proposals with rank 1 or 2. Therefore, I create the agenda dummy and pool the proposals with ranking less than or equal to 2.
the percentage vote required to accept the proposal and that actually cast in its favor and “ISS-Management Conflict Dummy” which takes value 1 if the ISS recommendation for the proposal conflicts with management’s.

[ Insert Table 3 about here ]

Table 3 reports the results of the firm fixed-effect regression. Regressions 1-5 are for the sample of companies where the option data is available both around and before the record date. The results suggest that the value of voting rights increases towards the record date of special meetings and if the proposal discussed has (ex-post) close votes. The coefficients of other variables also have the correct sign but are not significant.

One concern with Regressions 1-5 is that the sample does not include companies with observations only around the record date or before. This could be biasing the results as options are more likely to be traded when control is valuable, especially for small companies. To address this concern, in Regressions 6-12, the sample also includes the companies with missing option data either around or before the record date. For those companies, the missing value of the vote is assumed to be zero. The results in these regressions confirm the previous findings. Additionally, the results suggest that for meetings with a high-ranking agenda and with conflicting proposals, the value of voting rights increases around the record date.

One issue with the independent variables is that they are correlated. For instance, the meeting’s agenda likely affects the closeness of the vote. Therefore when put together in the regression, some of these variables lose significance. In this framework, meeting type and closeness of the votes seem to be the strongest independent variables.

Fixed-effect regressions use the value of voting rights before the record date as a benchmark. However, as mentioned before, for 88% of the option pairs, the lower bound is not violated and the inferred value of the voting right is zero. Therefore one might also argue that in general outside important control events, the value of voting rights is similar across firms and is very close to zero. According to this argument, I run a tobit model where the dependent variable is the value of the vote averaged over (-16,16). I choose a tobit framework because the value of the vote cannot be negative. Independent variables in tobit regressions are the same as for the fixed-effect regressions.

[ Insert Table 4 about here ]

23 Note that Closeness is a forward-looking measure.
24 In the regression, the average values of votes are winsorized at the 97.5% level.
Table 4 reports the estimates of the tobit regression. Overall, the results confirm those of the fixed-effect regression and are in fact stronger. I find that the value of a voting right is significantly higher around the record dates for special meetings than for annual meetings. The value of voting rights is also significantly higher if the meeting involves a high-ranking proposal with close votes or with conflict of recommendations by ISS and the management. All these results are in line with the hypothesis that the fiercer the control contest, the higher the value of voting rights. The coefficients of all these independent variables are significant when they enter the regressions independently. Once put all together, the agenda dummy loses its significance most probably due to its correlation with Closeness.

2.3 Further Analysis

In this section, I extend the analysis of the fixed-effect and tobit regressions and check the robustness of the findings. I also compare my measure of the value of voting rights to the other measures in the literature.

2.3.1 Annualized Vote Values

To better assess the economic significance of the results, I estimate the annualized value of voting rights. For this, I first calculate a hypothetical voting right dividend yield using the estimated value of the vote. Here I assume that this yield is constant until the maturity of the options as the expected maturity of the synthetic non-voting share is not known. This biases the estimated value of voting rights downwards. Then assuming this voting right dividend yield remains constant over a year, I estimate the annualized value of a voting right. Below are the details of the procedure:

In the analysis above, I normalize the value of a voting right with the underlying stock price (call $N_V = D_V/S_0$). Assuming a constant voting right dividend yield (denoted $d_y$) over the time to maturity ($T$) of the options, the value of a voting right can be expressed as:

$$D_V = S_0 - S_0 e^{-d_y T}.$$  \hskip 1cm \hbox{(5)}$$

Therefore the voting right dividend yield is:

$$d_y = -\frac{\ln(1 - N_V)}{T}.$$  \hskip 1cm \hbox{(6)}$$

$^{25}$In the regression, the average values of votes are winsorized at the 97.5% level.

$^{26}$I run the regression with the ranking dummies rather than the agenda dummy. In untabulated results, I find that the value of voting rights almost monotonically increases with the ranking of the meeting’s agenda.
I estimate the annualized normalized value of vote as following:

\[ AN_V = 1 - e^{-d \cdot \frac{365}{T}} = 1 - e^{\ln(1 - N_V) \cdot \frac{365}{T}} = 1 - (1 - N_V)^{\frac{365}{T}}. \]  (7)

Using this method and the options with the highest volume, closest to ATM and with the smallest \( T \), I estimate the mean (median) value of voting rights in my sample (focusing on \( \pm 1 \) year around the record date) to be 1.23% (0.86%). For US companies, the average value of control is estimated to be about 2 to 4% of the firm value using the block sales method and 5 to 10% of the inferior-voting shares using dual-class firms.\(^{27}\)

I also apply the method to the regression analyses. Table 5 replicates the regressions of Table 3 with annualized value of votes, and reports similar results.

[ Insert Table 5 about here ]

They imply that on average the increase in the annualized (lower bound for the) value of voting rights around the record date is about 30-35 basis points (b.p.) higher if the meeting is special rather than annual. Also a 10% point deviation between the vote required for a proposal to pass and that cast in its favor decreases the change in the value of the voting right by about 0.8-1.4 b.p., depending on the specification.

Similarly, Table 6 replicates Table 4 with annualized voting right values.

[ Insert Table 6 about here ]

The results are qualitatively the same as in Table 4. The annualized (lower bound for the) value of a voting right around the record date is about 48 b.p. for annual meetings assuming that the Closeness is at its average value (0.65) and there is no conflict between ISS and management recommendations (Regression 9). The value of the voting right is 59.4 b.p. higher if the meeting is special rather than annual. If the recommendations of ISS and management conflict, the value of the voting right is 21.9 b.p. higher. Finally, a 10% point deviation between the fraction of votes required for a proposal to pass and that cast in its favor reduces the value of the voting right by about 3.9 b.p. These figures are in contrast with Christoffersen, Geczy, Musto, and Reed (2007) who find that the average vote sells for

\(^{27}\)For the results from former method, see, e.g., Barclay and Holderness (1989), Dyck and Zingales (2004), and Nenova (2003). For the results from latter method, see, e.g., Lease, McConnell, and Mikkelson (1983), Lease, McConnell, and Mikkelson (1984), and Zingales (1995). Kalay and Pant (2009) estimate the value of voting rights in a year as 5.4%. Again this might be due to our different samples and methodologies.
almost zero (0.64 b.p. in specialness) even though there is a market for votes through the equity lending market.

### 2.3.2 Negative Vote Values

So far the value of voting rights has been assumed to be zero when the lower bound is negative. For robustness, I relax this assumption and allow for negative values. Table 7 replicates the regressions in Table 3 allowing for negative value of voting rights.

The results confirm the main findings and are in fact stronger. This is probably because the regression fits better due to not treating all the negative votes the same (i.e. as zero).

Running the same (unreported) regression with annualized values, I find the value of the voting right to increase around the record date by about 49-58 b.p. higher on average if the meeting is special rather than annual. Also a 10% point deviation between the fraction of votes required for a proposal to pass and that cast in its favor decreases the change in the value of the voting right by about 2.8-3.4 b.p., depending on the specification.

### 2.3.3 Dual-Class Firms

The voting premium calculated from dual-class firms is (conceptually) closest to the value of voting rights I measure. Indeed, my method can be interpreted as synthesizing an inferior voting share. There are, however, three important differences between the two measures. First, the time to maturity is finite in my method, whereas it is infinite in dual-class firms. Therefore, the value of voting rights would be expected to be higher in the latter method. Second, my measure is a lower bound for the value of voting rights whereas the voting premium from dual-class is the actual value of voting rights. Therefore, again, one would expect higher value of voting rights from dual-class method compared to mine. Third, my method generates a synthetic non-voting share as the inferior voting share whereas in dual-class firms the inferior voting shares usually have some voting rights. I address this issue by adjusting the voting premium using the relative voting rights of different class of shares following Zingales (1995).

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28 In the regression, average values of votes are winsorized at the 2.5% and 97.5% level. I do not replicate regressions with single observations as the voting right value to substitute for the missing cases is not straightforward.
To compare the two measures, I intersect the dual-class firms compiled by Gompers, Ishii, and Metrick (2009) with my sample. 21 firms (13 matched through their inferior voting shares and 8 matched through their superior voting shares) are in both samples. Out of these 21 firms only 10 (7 inferior voting shares and 3 superior voting shares) have time series data longer than a quarter. For those 10 companies I calculate the voting premium as follows (Zingales (1995)):

\[ VP_Z \equiv \frac{P_S - P_I}{P_I - rP_S} \]  \hspace{1cm} (8)

where \( P_S \) and \( P_I \) are the prices of superior and inferior voting shares; and \( r \) is the relative number of votes of an inferior voting share versus a superior voting one. I set negative voting premiums to zero to be consistent with my measure of the value of voting rights.

My measure of the annual normalized voting rights can be thought in line with the voting premium calculation where \( P_S \) is the underlying stock, \( P_I \) is the synthetically generated non-voting share and hence \( r \) is zero. However, as I normalize the value of voting rights by dividing it with the price of the underlying stock, the denominator in my measure is the superior voting share rather than the inferior one as in Zingales (1995). Therefore, to make my measure comparable to the voting premium calculated above, I apply the following transformation:

\[ VP_O \equiv \frac{1}{1 - AN_v} - 1 \]  \hspace{1cm} (9)

I find the average \( VP_Z \) to be 4.47%, whereas the average \( VP_O \) is 2.37%.\(^{29}\) As expected, \( VP_Z \) is greater than \( VP_O \).

The simple coefficient of correlation between these two different measures of value of voting rights is significantly positive (0.29 at p=0.000), as expected. Regressing \( VP_O \) on \( VP_Z \) with firm fixed effects and firm clustered errors (untabulated), I again find that \( VP_O \) is positively correlated with \( VP_Z \). The coefficient for the \( VP_Z \) is 0.30 (significant at p=0.028). The regression coefficient implies that the maximum horizon for the voting premium is about 3.3 years for dual-class firms in my sample.

2.3.4 Equity Lending

Equity lending has been used for vote trading as illustrated by Christoffersen, Geczy, Musto, and Reed (2007). Therefore, one can infer the value of voting rights from equity lending fees and compare it to my measure of the value of voting rights.\(^{30}\) For this comparison, I obtain

\(^{29}\) The values of voting rights from both methods are winsorized at the 97.5% level.

\(^{30}\) See, e.g., Saffi and Sigurdsson (2009) for a detailed description of cross-country equity lending data.
equity lending data (value- and equal-weighted equity lending fee, total value of lendable share supply and total value of shares lent) for a subsample of firms from Data Explorers, which is a global information company tracking all securities financing related information. The data cover a year around the record dates (about three quarters before and one quarter after the record dates).

I construct the subsample by first selecting the 100 stocks with the highest and 100 stocks with the lowest values of voting rights inferred from option prices around the record dates (specifically, (-16,16) trading days). Since the equity lending data is available from 2005 onwards, I choose among the stocks with record dates after mid-2005. Of these 200 stocks, 170 have the needed equity lending data and out of these, 85 are among the 100 with the highest values of voting rights (“high value sample”) and 85 are among the 100 with the lowest value of voting rights (“low value sample”).

The average equity lending fee is 0.11% (5.31%) per year for the low (high) value sample. The corresponding annualized value of voting rights measured with my method is 0.10% (4.67%) for low (high) value sample. This suggests that the lower bound for the value of voting rights in my method is not very loose.

The simple correlation between these two measures is significantly positive (0.49 at p=0.000), and is mostly driven by the high value sample. The frequency of the equity lending data is weekly before 2007, and daily from 2007 onwards. However, my measure of the value of voting rights is computed on a daily basis for the whole period. This causes non-synchronicity of the two measures during 2005 and 2006 and biases the correlation downwards.

Figures 7 and 8 illustrate the average equity lending fee and the value of voting rights inferred from options 20 weeks around the record dates for the high and low value samples. Figures also graph the loan utilization rates (shares lent divided by lending supply).

For the high value sample, both measures increase as the record date approaches (Figure 7). The two measures are clearly highly correlated. The utilization also increases at the record date, which is consistent with increasing fees. The amount of shares lent increases about 34%

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31 I would like to thank Pedro Saffi for helping me with the equity lending data.
32 All equity lending fees reported are value-weighted figures. Results are similar for equal-weighted fees.
33 For example, week 0 refers to the (-3,3) trading day window around the record date (day 0).
34 Non-synchronous data before 2007 may cause the lags (or leads) between the two measures.
from week -1 to week 0, and about 84% from week -1 to week 2 (not graphed). For the low value sample, both measures of the value of voting rights and the utilization rate are quite flat around record date. This is not surprising as for the low value sample the votes do not matter much.

The increase in the amount of shares lent (and also in utilization rate) around record dates for the high value sample implies that the lending market hosts a vote market when votes matter. This is in line with Christoffersen, Geczy, Musto, and Reed (2007) who find that loan volumes spike around record dates. However, the increase in the value of voting rights around the record date for the high value sample is in contrast with Christoffersen, Geczy, Musto, and Reed (2007) who find that average vote sells for zero. A possible explanation for our different findings might be that the subsample in which voting rights are valuable is likely relatively small, so that the effect may be diluted out by the rest of the sample.\footnote{Similarly, mixing the relatively few Special meetings with the more numerous Annual meetings would reduce the observed increase in the value of voting rights around shareholder meetings’ record date in previous sections.}

The concurrent behavior of the value of voting rights measured from option prices and equity lending fees is in line with previous studies finding put-call parity violations associated with short sale constraints (e.g., Ofek, Richardson, and Whitelaw (2004), Evans, Geczy, Musto, and Reed (2009)). I argue that the increase in the value of voting rights around record dates is the reason for put-call parity deviations in my sample. I find that at these times shorting is more difficult and expensive, and, indeed, the shorting costs is closely linked to the value of voting rights, as expected. This may also constitute a possible explanation for some of the empirically documented put-call parity violations and associated shorting frictions in the literature. Whether such an explanation is empirically important remains to be tested and is beyond the scope of this paper.

### 2.3.5 Cumulative Abnormal Returns

I show that the value of voting rights peaks around the record dates of shareholder meetings, especially for special meetings. This implies that actual stock prices should decrease after the record dates (similar to the ex-dividend day behavior of the stock prices) and that the decrease should be greater for special meetings. To test these predictions, I calculate cumulative abnormal returns around record dates using a standard event study methodology. I find that the average abnormal return in the week following the record date is -30 b.p. per week (t-statistic -4.14). Moreover the average abnormal return in the week following the record date
is -26 b.p. (t-statistic -3.59) for annual meetings and -132 b.p. (t-statistic -2.72) for special meetings. This confirms the predictions.\textsuperscript{36}

These results are consistent with previous work documenting negative abnormal returns for stocks with relatively expensive put options (e.g., Ofek, Richardson, and Whitelaw (2004), Cremers and Weinbaum (2009)). Cremers and Weinbaum (2009), for instance, find an abnormal return of -26 b.p. per week for a portfolio of stocks with relatively expensive put options in the week following the portfolio formation. Again, the increase in the value of voting rights might explain some of these findings.

2.3.6 Dividends

Proper measurement of the present value of real dividends is critical in the estimation of the value of voting rights. Any mismeasurement of real dividends would bias the measured value of voting rights. Similarly, taxes on real dividends may impact the ex-date share prices and hence bias the measured value of voting rights. To address these concerns, I re-run all tests focusing on the non-dividend-paying stocks in my sample. The results are qualitatively the same, albeit slightly less significant in certain specifications as about two-thirds of the sample drop (untabulated).

2.3.7 Shareholder Proposals

In my sample, about 6\% of the annual meetings have a shareholder proposal as their highest-ranking agenda.\textsuperscript{37} Shareholder proposals are important mechanisms for shareholder activism (see, e.g., Gillan and Starks (2007)). Therefore one might expect the value of voting rights to increase for those meetings with such proposals. I conduct a regression analysis similar to that of Section 2.2.2. In some specifications the value of voting rights is slightly higher for meetings with shareholder proposals, but these results are not robust (untabulated). In general, the value of voting rights is similar for meetings with management and shareholder proposals. This seems to be in line with the literature finding small (if any) and mixed effects of shareholder activism (see, e.g., Karpoff (2001) and Bebchuk (2007)), with the exception of recent hedge fund activism, which I examine in the next section.

\textsuperscript{36}Results are not sensitive to the selection of the particular windows around record dates.

\textsuperscript{37}None of the special meetings have a shareholder proposal as the highest-ranking item on the agenda.
3 Activist Hedge Fund Targeting

In this section, I study the value of voting rights in firms targeted by activist hedge funds. Compared to traditional investors, hedge funds use more sophisticated financial products (e.g., options, equity swaps, etc.) and more aggressive tactics (see Agarwal and Naik (2005)’s survey). Klein and Zur (2009) find that activist hedge funds achieve their goals by posing a credible threat of engaging the target into a proxy solicitation contest. For this reason, hedge fund activism provides an ideal setting to study the value of voting rights.

3.1 Data, Methodology and Hypothesis

3.1.1 Data

I use Bratton (2007)’s sample of 114 US firms identified in the business press as activist hedge fund targets between 2002 and the first half of 2006. He searched the keywords “hedge fund”, “shareholder”, and “activist” in the news-search engines Factiva and Lexis-Nexis to identify the companies. For each target, the dataset includes the year of first press report or, if earlier, the year of investment; the first hedge fund reported to have taken an active investment position; and the maximum percentage of shares held by the hedge fund during its period of ownership or through December 31, 2006 for continuing investments (see Bratton (2007) for more details).

Of the 114 sample firms, 86 have the needed options data in the OptionMetrics database. After merging with the CRSP data, 6 more firms drop out due to not having market capitalization value. The final treatment sample (“target sample”) consists of 80 firms.

I construct a control sample by matching each target firm with a non-target control firm in the intersection of the CRSP and OptionMetrics databases having the same three-digit Standard Industrial Classification (SIC) Code and with market capitalization closest (in absolute terms) to that of the target firm at the end of 2000. If matching in 2000 is not possible, it is


39The 114 firms constitute the governance intervention sample in Bratton (2007)’s paper. On top of these firms, 25 firms (9 overlapping with the governance intervention sample) experience hedge funds intervention limited to a single merger transaction. For this study, I focus on the former since the control effect can easily be measured. I leave analyzing the mergers and acquisitions, which requires more detailed work to disentangle control effect from other effects around mergers (e.g. effect of demand due to speculation), to further research.

40I arbitrarily choose the year 2000 as a cutoff to be able to match the firms with a control group before the hedge fund targeting.
done at the end of the earliest possible year after 2000. The matching algorithm also makes sure that the control firm has data available for the entire period the target firm covers. Out of 80 firms, 6 cannot be matched within the three-digit SIC code. For these firms, if they have other SIC code(s) in another year (3 such cases), the matching is done using one of the other SIC codes with the procedure described above. If the firms have no other SIC code in other years, I move to the closest neighboring three-digit SIC code where the matching by close size is possible.\footnote{For 3 out of these 6 cases, the matched companies are very close but not the closest by absolute market capitalization. The reason is that in these cases I also paid attention to the quality of the option data and the relevancy of the business using a Google search for the control sample. These are especially the cases where the size difference between treatment and control is already so large that it is not that crucial to choose the closest firm. All results presented below are robust to not including the 6 firms that cannot be matched within the three-digit SIC code.}

### 3.1.2 Methodology

An issue with using a sample of activist hedge fund targets is that a specific meeting or voting date may not exist. Indeed, a hedge funds’ threat of a proxy fight does not necessarily mean that a proxy fight actually happens.\footnote{Klein and Zur (2009) document that 28\% of the target firms in their sample are publicly threatened with a proxy fight by the hedge fund but only 12\% of those threatened are actually involved in a proxy fight.} Therefore there is not a clear event day. Additionally, the benchmark for lower bound violations is also not obvious. To overcome these difficulties, I construct an industry- and size-matched control group and compare the lower bound violations between the target and control samples. I also test for differences in the frequency of lower bound violations pre- and post-targeting.

To conduct the lower bound violation test, for each firm in the target and control samples, I construct daily option pairs by taking call and put options with the same strike price and maturity. The option prices are taken as the midpoints of the bid and ask quotes, which are the best closing prices across all exchanges on which the option trades. The present value of real dividends ($D_R$) is computed under the standard assumption that investors have perfect foresight about the dividends on the underlying stocks. Note that the construction of the control sample might bias against finding significant lower bound violation differences between samples since it is likely that control group firms also have important corporate events with control contest increasing their lower bound violations.
3.1.3 Hypothesis

My hypothesis is that the probability of a control contest at a firm targeted by an activist hedge fund is higher compared to a firm in the control sample. Since such a contest is likely to increase the value of voting rights, disregarding the voting right dividends makes the violation of the lower bound of the put-call parity more likely. Related to this, one might expect an increase in option trading due to demand by activist funds trying to hedge their economic exposure and/or to trade votes.

3.2 A Case Study: General Motors

I begin with a case study of General Motors (GM), one of the firms in the target sample.

[ Insert Figure 9 & 10 about here ]

Figure 9 illustrates the beginning of the year 2005 Tracinda Corp., an activist hedge fund fully owned by Mr. Kirk Kerkorian, targeted GM; monthly total number of option pairs and monthly percentage of bound violations for the GM options. The striking increase in both the magnitude and variance of the lower bound violations after the targeting is easily observed. More importantly, the violations coincide with news about events where the value of voting rights may be expected to increase.

Figure 10 reports the timeline of important news about GM and Mr. Kerkorian. On May 4, 2005, Tracinda announced a tender offer for GM shares. At that time, upon the completion of the offer, Mr. Kerkorian’s ownership would have risen from 3.89% to about 8.84% of outstanding shares. Note that coinciding with this event lower bound violations for May, 2005 reached about 83%, which is the first peak in lower bound violations after the targeting. There is also an increase in the number of option pairs traded roughly from 400 to 750 reflecting an increased demand for options.

Mr. Kerkorian’s tender offer fell short of the target amount of shares. On June 8, his stake was about 7.2% of outstanding shares. The percentage of violations dropped to 38% in June, 2005. Even though Mr. Kerkorian claimed that he would remain as a passive investor, analysts were not convinced especially due to his previous involvement with Chrysler where he invested as a passive investor in 1990 but attempted (unsuccessfully) a hostile takeover in 1995.
On September 1, Tracinda’s stake in GM increased to 9.53%. A couple of weeks later it was rumored that Mr. Kerkorian might seek board representation. Following an antitrust clearance, he increased his stake to 9.9% on October 12. Negotiations between GM and him resulted in the invitation of his representative, Jerome York, to GM’s board on December 7 and Mr. York joined the board on February 6, 2006. Meanwhile, the lower bound violations spiked up a second time to 79%, with the number of option pairs traded getting close to 1,000 in January, 2006. Kerkorian’s representative recommended a cut in dividends and the board followed this advice. This clearly shows that Mr. Kerkorian did not remain as a passive investor and had some control over the company.

On June 30, 2006, Mr. Kerkorian urged GM to form an alliance with Renault/Nissan and the lower bound violations reached a third spike of 50%. The board of GM first considered the possibility of a merger but the project did not progress much. Mr. Kerkorian made one more push announcing on September 28 that he was willing to buy more shares of GM (therefore exceeding the 10% threshold) but the board did not support him and on October 4, GM terminated the alliance talks. Two days later, Mr. Kerkorian’s representative quit the board and at the beginning of December, 2006 Mr. Kerkorian sold his entire GM stake. Note that after August, 2006 the lower bound violations dropped significantly to 2-3% and remained at that level thereafter. This is consistent with the argument that after the GM and Renault/Nissan alliance project failed, the value of voting rights decreased in GM. Confirming this story, Mr. Kerkorian closed his position by selling all his shares shortly thereafter.

GM’s case provides insights into the relation between the value of voting rights and violations of put-call parity. First of all, the number and frequency of violations increase when the value of the voting right increases, as predicted. Second, the demand for options increases during control contests, in line with Hu and Black (2007). Third, the activist hedge fund’s activity has tremendous impact on option and stock prices (e.g., the lower bound violations jump from 2-3% to 80% etc.). Fourth, one does not necessarily need a definite a meeting/voting date for violations to occur. Finally, control contests may last more than a year and the value of voting rights may fluctuate widely over that time.

3.3 Regression Analysis

In this section, I study the whole target sample in both univariate and multivariate settings.
3.3.1 Univariate Analysis

Bratton (2007) only reports the year of first press report of targeting or, if earlier, the year of investment for each target firm. Moreover the first report of targeting does not necessarily imply an immediate control contest. Sometimes it takes years for a fund to engage in a control contest. For instance, Mr. Kerkorian invested in Chrysler in 1990, but his (unsuccessful) takeover attempt occurred only in 1995. The exact timing of the targetings being unknown, I cannot conduct an event study. Even if the specific time of each targeting were known, the event study methodology might not be appropriate due to the effect of different and/or long time periods targetings take places. Instead, I employ an approach similar to the calendar-time portfolio method used in the studies of long-term stock performance.\textsuperscript{43} I calculate the average monthly percentage of lower bound violations for the target and control samples in each calendar month before and after the first engagement of the hedge fund. For the control firms, the year of engagement is that of their matched target firms. Since Bratton (2007) only reports the year of engagement by the hedge fund, I assume the engagement happens at the beginning of the year. This biases against finding an increase in violations following the targeting.

\[ \text{[ Insert Table 8 & 9 about here ]} \]

Tables 8 and 9 report the results of two-sample t-tests of monthly lower bound violations for hedge fund and the control sample with unequal variance assumption before and after the engagement of the hedge fund, respectively.

Before hedge fund targeting, the average monthly percentage of lower bound violations is about 14% for the target sample and 17% for the control sample. After targeting, the percentage of lower bound violations more than doubles to 29% for the target sample whereas it stays around 15% for the control sample, the difference between samples being significant at p=0.000. Note also that the increase in violations for the target sample from 14% to 29% is significant at p=0.000 while the decrease in violations for the control sample from 17% to 15% is only significant at p=0.066 (untabulated). Similarly, in unreported results, the difference-in-difference (comparison of difference of lower bound violations between the target and control samples before and after the hedge fund targeting) results are significant at p=0.000.

\textsuperscript{43}See, e.g., Mitchell and Stafford (2000) for a detailed discussion of the calendar-time portfolio and event study methodologies.
These results suggest that the percentage of lower bound violations increases substantially for the target sample after the engagement of activist hedge funds whereas it remains essentially the same for the control group.

3.3.2 Multivariate Analysis

To examine which factors affect the probability of lower bound violations, I run a logistic regression using the daily option pairs for both the target and control samples.

The dependent variable, Lower Bound Violation, is a dummy which takes the value 1 if on a given day a specific option violates the lower bound and 0 otherwise. Independent variables include: “Target Sample Dummy”, which takes the value 1 if the option pair is of a firm in the target sample and 0 otherwise; “After Targeting Dummy”, which takes the value 1 if the trading day of the option pair is after the beginning of the year of engagement by the activist hedge fund and 0 otherwise; “Target Sample D. x After Targeting D.”, which is the interaction term of the dummies above; “Volume”, which is the daily trading volume of call options in the option pairs; “Bid-Ask Spread”, which is the ratio of ask minus bid quotes to the mid-point of bid and ask quotes for call options in the option pairs; “Number of Option Pairs”, which is the number of option pairs traded in a trading day for a given company; “Time to Maturity”, which is the number of days to the expiration for option pairs; “Moneyness”, which is the ratio of closing price of the underlying stock to the strike price of the call options in option pairs; “YearMonth Dummy”, which takes the value 1 for each particular year and month in the sample (e.g., for 1999 January) and 0 otherwise; “Firm Dummy”, which takes the value 1 for each particular firm in the sample and 0 otherwise.

Table 10 provides descriptive statistics of the variables in the sample of option pairs for the multivariate analysis. Note that the univariate analysis is also based on this dataset.

Table 11 reports the estimates of the logistic regression. In line with the univariate results, I find that the probability that an option pair of a firm violates the lower bound increases after the firm is targeted by an activist hedge fund. The impact, as measured by the “Target Sample D. x After Targeting D.”, is both statistically and economically significant. Note that
the coefficients in the logistics regressions do not necessarily capture the marginal effects. To compute the marginal effects, I evaluate the expressions at the sample means (Table 12). I find that the probability that an option pair violates the lower bound more than doubles from about 10% to 26% (p=0.0143) after controlling for option volume, bid-ask spread (for liquidity concerns), number of option pairs, time to maturity, moneyness, year-month and firm fixed effects.

Among other independent variables, bid-ask spread has the strongest impact on lower bound violations. Consistent with the liquidity constraints, a higher spread (lower liquidity) is associated with more violations. The number of option pairs traded positively correlates with higher frequency of violations possibly implying a higher demand in period during which the lower bound is violated. Call option volume is insignificant and time to maturity is significantly negative. Finally, moneyness is positive and significant implying that in-the-money call options (and therefore out-of-the-money put options) violate lower bounds more often.

All these results are consistent with activist hedge funds’ using options before/during their targetings. In other words, their demand for options might create the observed correlations. They might demand short maturity and at-the-money option pairs to increase their control of the company (e.g., going long calls and short puts) or for hedging their existing equity positions (e.g., going short calls and long puts) before targeting the company. After targeting by the fund, the increase in the value of voting rights due to a control contest might create lower bound violations and also increase the stock price which would make the at-the-money call options in-the-money. Under this scenario, one would observe a positive/negative/positive correlation between the number of option pairs traded/time to maturity/moneyness and the probability of lower bound violations, which is the case in my sample. All of these require further investigation of the hedge funds’ demand for options, which I leave for future research.

In sum, the results suggest that the frequency (probability) of lower bound violations increases substantially after an activist hedge fund targets a company. This is consistent with the hypothesis that such a targeting increases the value of voting rights. These results, taken together with those on shareholder activism, are also in line with the activism literature reporting a stronger impact of hedge fund activism compared to shareholder activism (Gillan and Starks (2007)).

44 This is similar to the results of Wagner, Ellis, and Dubofsky (1996) who run a tobit regression analysis to examine the determinants of put-call parity violations of S&P100 Index options. Different from this paper, they define volume as the total number of S&P100 puts and calls traded on the relevant day.
4 Conclusion

I propose a new method for measuring the value of the voting rights attached to a stock by using option prices. The method achieves this by synthesizing a (temporarily) non-voting share using put-call parity, and by comparing its price to that of the underlying stock. This approach avoids the data selection, generalization and availability problems of existing ones.

Empirically, I find this measure of the value of a voting right to increase around events in which control may be more valuable. First, the value of a voting right increases around shareholder meetings, particularly so for special meetings. Second, I find that lower bound put-call parity violations are more frequent for companies targeted by hedge funds.

The method can be used to study the determinants of the voting premium. Indeed, it can be applied to any study in the corporate finance/governance literature focusing on control. The method has also asset pricing implications. For instance, it provides a potential explanation to put-call parity violations and early exercise of call options.
References


Appendix A: Options Data

The options data come from OptionMetrics’ Ivy DB database. This is a comprehensive database of option prices and related data for the “entire” US listed index and equity options markets. It provides bid and ask quotes, open interest, trading volume, implied volatility data (under Option_Price File) which are compiled from raw end-of-day pricing information supplied by FT Interactive Data Corporation (Ivy DB File and Data Reference Manual v2.5.1). The database also provides stock price (under Security_Price File), dividend (under Distribution File) and zero-coupon interest rate information (under Zero_Curve file).

I use options data from January 4, 1996 to June 29, 2007. All options on individual stocks are of American type. I adopt the following steps to prepare the data for the analysis:

First, I apply the following initial filters to the dataset from Option_Price File: I eliminate options with zero trading volume, I eliminate options with zero bid and/or ask quote; I eliminate if the bid quote is greater than the ask quote; I clean the duplicate data.

Second, I eliminate the options which are not uniquely defined. OptionMetrics provides OptionID, which is in general a unique identifier for each option contract. However on some dates for some OptionIDs there is more than one price entry and therefore uniqueness is not guaranteed. This issue is also mentioned in the Documentation section of OptionMetrics at WRDS. There, it is suggested to use some combination of OptionID and the root and/or suffix of the option symbols. While this is an improvement, this unfortunately does not solve the uniqueness problem completely. Therefore I eliminate the contracts which do not have unique OptionID and root and/or suffix combination.

Third, I merge the data from OptionMetrics with the Compustat data using cusip identifier. Note that the OptionMetrics data is daily whereas the Compustat data is monthly. Therefore, I merge the month (t-1) data from Compustat to month (t) data for OptionMetrics.

Fourth, I merge the Security_Price File (for the underlying security prices) with the dataset constructed in the previous step using secid identifier and date.

Fifth, I merge the Distribution File (for the dividends) with the dataset constructed in the previous step. For each option, I merge all the dividend payments within that option’s expiration date. I also apply the following filters to the merged dataset: I eliminate firms that pay more than 150 dividends. This reduces the sample by 10 firms; I keep options whose

Note that this is a more strict filter compared to the one applied by Ofek, Richardson, and Whitelaw (2004) where they eliminates options with zero open interest.
underlying stock has regular, stock and/or special dividend distribution (distribution type is 1, 3 or 5, respectively) whereas I eliminate those with unknown or not yet classified, split, capital gain distribution, spin-off, new equity issue, rights offering or warrants issue (distribution type is 0, 2, 4, 6, 7, 8, 9, respectively) within the life span of the option; I eliminate options whose underlying stock has a cancelled distribution or for which a regular payment has been omitted (cancel flag is 1) within the life span of the option; I eliminate options whose underlying stock’s distribution is either a partial or total liquidating distribution (liquidation flag is 1) within the life span of the option.

Sixth, I merge the Zero_Curve file (for the interest rates) with the dataset constructed in the previous step. This is done by assigning the daily continuously compounded zero-coupon interest rates whose maturities match best (closest) to the options’ expiration dates. If for a given date there is no interest rate information, I eliminate the options.

Seventh, I eliminate call and put options that do not construct a pair in terms of same maturity and exercise price.

Eight, I apply the following filters to improve the quality of the data: I keep options with standard settlements (special settlement flag is 0), whereas I eliminate options with non-standard settlement (special settlement flag is 1) and/or with non-standard expiration date (special settlement flag is E); I eliminate options expiring at the market open of the last trading day (AM settlement flag is 1).

Appendix B: Alternative Approaches

While put-call parity holds as an equality for European type options, exchange-traded stock options are of American type. To overcome this difficulty, three approaches are offered. The first one is to use put-call parity bounds for American options. The other two are to convert American type options into European or to use index options which are of European type. The first approach has been employed in this paper. Below I discuss the other two.

Conversion from American to European

In theory, American type options can be converted into synthetic European type options by using the Black-Scholes implied volatilities. Implied volatility figures are provided by OptionMetrics where they are calculated using the Cox-Ross-Rubinstein (CRR) binomial tree
model to correct for early exercise and dividend payments using the midpoints of bid-ask spread. Broadie, Chernov, and Johannes (2007) provide evidence that approximation error using such a procedure is minimal in models with jumps and stochastic volatility. Dubinsky and Johannes (2005) also use a similar approach to convert American options to European ones but they only consider call options on stocks paying almost no dividends (to minimize the early exercise premium).

Once American options are converted into European options, one can apply put-call parity as in Equation (1) and check whether it is violated or not. Similarly the value of the voting right dividend can easily be inferred using Equation (2). If the time-series variations of put-call parity violations are studied and the violations during important corporate events are compared with other dates, any model misspecification will be immaterial unless it is correlated with these corporate events.

However the conversion method is not straightforward during times where voting right dividends become important. Indeed, one should take the omitted voting right dividend into account recursively. To illustrate the issue, consider the following conversion of options from American to European:

\[
C(d_1, IV_1) = C(d_2, IV_2) \rightarrow c(d_2, IV_2) \rightarrow c(d_1, IV_1) \rightarrow c'(d_1, IV_1) \tag{10}
\]

where \( C (c) \) is an American (European) call option with dividend \( d_i \), implied volatility \( IV_j \), and \( i, j \in \{1, 2\} \). Assume that \( d_2 < d_1 \) due to omitted voting right dividends.

Here \( C(d_1, IV_1) \) is the price of the American call option with the correct dividend \( d_1 \) (including the voting right dividend), and the correct implied volatility \( IV_1 \). If one omits the voting right dividend, the dividend \( d_2 \) would be less than the real dividend \( d_1 \) since voting right dividends cannot be negative. However, since the price of the option is observed, this would automatically bias the implied volatility downwards: \( IV_2 < IV_1 \). Therefore the first implication of omitting voting right dividends is that the implied volatilities of options would be biased.

Using \( C(d_2, IV_2) \), the price of a synthetic European call option, \( c(d_2, IV_2) \), can be calculated using the Black-Scholes formula. Let \( c' \) denote the price of the European option converted from American option with biased dividends ad hence biased implied volatilities. The last step is to convert this price into the European option price with correct dividends and implied volatilities.

\[\text{Note that Broadie, Chernov, and Johannes (2007) calculate implied volatilities rather than taking them from the database.}\]
volatility, \( c(d_1, IV_1) \). Let us call the price of this option as \( c \).

One can run a similar exercise for the put option. Note that in this case omitting the voting right dividends would bias the implied volatility upwards \( (IV_2 > IV_1) \).

\[
P(d_1, IV_1) = P(d_2, IV_2) \rightarrow p(d_2, IV_2) \rightarrow p(d_1, IV_1)
\]

where \( P (p) \) is the price of an American (European) put option with dividend \( d_i \), implied volatility \( IV_j \), and \( i, j \in 1, 2 \). Assume that \( d_2 < d_1 \) due to omitted voting right dividends.

If the biases in the prices of options are defined as \( B_c = c - c' \) and \( B_p = p - p' \), the put-call parity specification for only voting right dividend paying underlying can be written as:

\[
c - p = S_0 - Ke^{-rT} - D_v
\]

\[
\Rightarrow (c' + B_c) - (p' + B_p) = S_0 - Ke^{-rT} - D_v
\]

\[
\Rightarrow D_v + \frac{B_c - B_p}{+/-} = -c' + p' + S_0 - Ke^{-rT}
\]

As seen from Equation (14), the sign of cumulative biases is ambiguous. Moreover if it is negative, it might reduce/cancel the voting right dividend effect, which would make the inference very difficult. The link between dividends and implied volatility might be broken by trying to make some plausible assumptions and modeling the implied volatility process. I leave this to future research.

**Index Options**

Index options which are of European type could be used to measure the value of control at the aggregate level. However, finding important corporate events that simultaneously affect the companies forming the index is difficult. Increased investor sentiment, takeover waves and shareholder/hedge fund activism concentrated in certain periods of time might be candidates.
Figure 1: Value of Vote vs. Time to Maturity.

Figure 2: Value of Vote vs. Moneyness.
Figure 3: Value of Vote: Special vs. Annual Meetings (Record Date Centered).

Figure 4: Value of Vote: Special vs. Annual Meetings (Meeting Date Centered).
Figure 5: Value of Vote: Proxy Contest vs. Annual Meetings (Record Date Centered).

Figure 6: Value of Vote: Written Consent vs. Annual Meetings (Record Date Centered).
Figure 7: Value of Vote for High Value Sample: Option Method vs. Equity Lending (Record Date Centered).

![Graph showing the comparison between Option Method and Equity Lending for high value samples.]

Figure 8: Value of Vote for Low Value Sample: Option Method vs. Equity Lending (Record Date Centered).

![Graph showing the comparison between Option Method and Equity Lending for low value samples.]

[40]
Figure 9: Monthly Percentage of Bound Violations for GM Options.
Figure 10: Timeline of News for General Motors and Kirk Kerkorian: 2005-2007.

<table>
<thead>
<tr>
<th>Flag</th>
<th>Date</th>
<th>News</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>04-May-05</td>
<td>Tracinda Announces Tender for General Motors Shares.</td>
<td>Business Wire</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot; Tracinda Corporation, of which Mr. Kirk Kerkorian is the sole shareholder, currently owns...3.89% of the outstanding shares. Upon completion of the offer, Tracinda would beneficially own... approximately 8.84% of the outstanding shares.</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td>08-Jun-05</td>
<td>Kerkorian stake in GM now at 7.2%.</td>
<td>AFX International Focus</td>
</tr>
<tr>
<td></td>
<td>10-Jun-05</td>
<td>Kerkorian a 'very passive investor' in GM.</td>
<td>Financial Times</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot; Kirk Kerkorian...claims to have no plans to try to influence the restructuring of the ailing automotive group. Many remember his 1990 passive investment in Chrysler. It turned into a hostile but unsuccessful takeover attempt in 1995.</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td>01-Sep-05</td>
<td>Tracinda Ups Stake In General Motors To 9.53%.</td>
<td>Dow Jones International News</td>
</tr>
<tr>
<td>B</td>
<td>25-Jan-06</td>
<td>Kerkorian's Tracinda Raises GM Stake Back To 9.9%.</td>
<td>Dow Jones Corporate Filings Alert</td>
</tr>
<tr>
<td></td>
<td>06-Feb-06</td>
<td>GM names Kerkorian's aide to board.</td>
<td>AFX International Focus</td>
</tr>
<tr>
<td></td>
<td>07-Feb-06</td>
<td>General Motors cuts dividend in half, reduces executive salaries.</td>
<td>Broadcast News</td>
</tr>
<tr>
<td>C</td>
<td>30-Jun-06</td>
<td>Kerkorian urges GM alliance with Renault/Nissan.</td>
<td>Agence France Presse</td>
</tr>
<tr>
<td></td>
<td>08-Jul-06</td>
<td>GM to consider alliance; Struggling automaker to talk with Nissan, Renault.</td>
<td>Chicago Tribune</td>
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<tr>
<td></td>
<td>21-Jul-06</td>
<td>Nissan: Capital Stake Consideration Not Part Of GM Talks.</td>
<td>Dow Jones International News</td>
</tr>
<tr>
<td></td>
<td>28-Sep-06</td>
<td>Kerkorian Eyes More GM Stock, Pushes Alliance.</td>
<td>Dow Jones News Service</td>
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<tr>
<td></td>
<td>04-Oct-06</td>
<td>GM, Renault-Nissan terminate alliance talks.</td>
<td>Agence France Presse</td>
</tr>
<tr>
<td></td>
<td>06-Oct-06</td>
<td>Kerkorian Done Buying GM, Ally York Quits Board.</td>
<td>Financial Wire</td>
</tr>
<tr>
<td></td>
<td>22-Nov-06</td>
<td>Kerkorian's Tracinda Corp Cuts GM Stake To 7.4%.</td>
<td>Dow Jones Corporate Filings Alert</td>
</tr>
<tr>
<td></td>
<td>30-Nov-06</td>
<td>Kerkorian To Cut General Motors Corporation Stake To 4.95%.</td>
<td>Reuters Significant Developments</td>
</tr>
<tr>
<td>D</td>
<td>04-Dec-06</td>
<td>Kirk Kerkorian sells remaining GM shares to Bank of America.</td>
<td>Automotive World</td>
</tr>
</tbody>
</table>

Note: News are searched with keywords "General Motors" and "Kirk Kerkorian" on 28 February 2008 using Factiva.
Table 1: Classification and Ranking of Proposals.

<table>
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<tr>
<th>Rank</th>
<th>Management Proposals</th>
<th>Shareholder Proposals</th>
</tr>
</thead>
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<tr>
<td>1</td>
<td>Antitakeover-Related</td>
<td>Antitakeover-Related</td>
</tr>
<tr>
<td></td>
<td>Mergers &amp; Reorganizations</td>
<td>Maximize Value</td>
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<tr>
<td></td>
<td>Capitalization</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Compensation</td>
<td>Executive Compensation</td>
</tr>
<tr>
<td></td>
<td>Directors Related</td>
<td>Directors Related</td>
</tr>
<tr>
<td>3</td>
<td>Routine/Miscellaneous</td>
<td>Miscellaneous</td>
</tr>
<tr>
<td>4</td>
<td>Other</td>
<td>Other</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Environmental &amp; Social</td>
</tr>
</tbody>
</table>

Table 2: Regression of Lower Bound of Value of a Vote on Time to Maturity.

<table>
<thead>
<tr>
<th>Dependent Var. : Lower Bound of Value of Vote</th>
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</thead>
<tbody>
<tr>
<td>Independent Var.</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>Intercept</td>
</tr>
<tr>
<td>Time to Maturity</td>
</tr>
</tbody>
</table>

Number of observations: 1,691,132
Adjusted R-sq: 0.1312
Prob > F: .0000
Table 3: Regression of Change in the Value of Vote around Record Date.

*Dependent Var.*: Average % Value of Vote over (−16, 16) minus Vote over (−98, −66) for Each Company Meeting†

<table>
<thead>
<tr>
<th></th>
<th>−6−</th>
<th>−7−</th>
<th>−8−</th>
<th>−9−</th>
<th>−10−</th>
<th>−11−</th>
<th>−12−</th>
<th>−1−</th>
<th>−2−</th>
<th>−3−</th>
<th>−4−</th>
<th>−5−</th>
</tr>
</thead>
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<td>Meeting Dummy</td>
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<td>.020</td>
<td>.018</td>
<td>.024</td>
<td>.021</td>
<td>.020</td>
<td>.017</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Special:1, Annual:0]</td>
<td>(2.22)</td>
<td>(2.19)</td>
<td>(1.89)</td>
<td>(2.55)</td>
<td>(2.22)</td>
<td>(2.19)</td>
<td>(1.86)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agenda Dummy</td>
<td>.004</td>
<td>.007</td>
<td></td>
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</tr>
<tr>
<td>[High Ranking:1, Low:0]</td>
<td>(2.55)</td>
<td>(2.22)</td>
<td>(1.89)</td>
<td>(2.55)</td>
<td>(2.22)</td>
<td>(2.19)</td>
<td>(1.86)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closeness</td>
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<td>-.006</td>
<td>-.011</td>
<td>-.008</td>
<td>-.009</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Vote Required-Vote Cast For]</td>
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<td>(-1.78)</td>
<td>(-3.07)</td>
<td>(-2.36)</td>
<td>(-2.12)</td>
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</tr>
<tr>
<td>ISS-Management Conflict Dummy</td>
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<td>.009</td>
<td>.010</td>
<td>.005</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Conflict:1, Agree:0]</td>
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<td>(1.85)</td>
<td>(2.18)</td>
<td>(2.19)</td>
<td>(1.85)</td>
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<td>-.002</td>
<td>-.002</td>
<td>-.002</td>
<td>-.002</td>
<td>.004</td>
<td>.004</td>
<td></td>
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<tr>
<td></td>
<td>(-16.20)</td>
<td>(-9.04)</td>
<td>(-9.94)</td>
<td>(-4.03)</td>
<td>(-4.03)</td>
<td>(-3.62)</td>
<td>(1.32)</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

| Obs              | 6,656| 6,656| 6,656| 6,656| 8,564| 8,564| 8,564| 8,025| 8,564| 8,025| 8,025| 8,025 |
| Special Meetings in Obs | 252 | 252 | 252 | 251 | 252 | 379 | 379 | 379 | 377 | 379 | 377 | 377 |
| Prob>F           | 0.033| 0.272| 0.016| 0.787| 0.017| 0.011| 0.065| 0.002| 0.030| 0.003| 0.006| 0.002 |
| Firm Dummy       | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firms with Single Obs‡ | No | No | No | No | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

†Record date is day 0 and the time intervals are defined in terms of trading days.
‡Value of vote is set to 0 for the missing observations.
T-statistics (from robust std. errors) are in parenthesis below the coefficients.
Short description of independent variables are in brackets below the variables.
Table 4: Tobit Regression of Value of Vote around Record Date.

Dependent Var.: Average % Value of Vote ± 3 Weeks (−16, 16) around Record Date for Each Company Meeting†

<table>
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<tr>
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<th>−3−</th>
<th>−4−</th>
<th>−5−</th>
<th>−6−</th>
<th>−7−</th>
<th>−8−</th>
<th>−9−</th>
<th>−10−</th>
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</thead>
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<td>.041</td>
<td>.051</td>
<td>.043</td>
<td>.042</td>
<td>.045</td>
<td></td>
<td></td>
<td></td>
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<td>(3.53)</td>
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<td>-.005</td>
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<td>-.031</td>
<td>-.033</td>
<td>-.027</td>
<td>-.031</td>
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<tr>
<td>[% Vote Required-Vote Cast For]</td>
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<td>(-8.13)</td>
<td>(-7.29)</td>
<td>(-6.02)</td>
<td>(-5.89)</td>
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<td>.020</td>
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<tr>
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<td>(18.86)</td>
<td>(21.80)</td>
<td>(15.07)</td>
<td>(13.45)</td>
<td>(11.84)</td>
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<td>7,266</td>
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<tr>
<td>Special Meetings in Obs</td>
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<td>1,750</td>
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<td>0.000</td>
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<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

†Record date is day 0 and the time intervals are defined in terms of trading days. T-statistics (from robust std. errors) are in parenthesis below the coefficients. Short description of independent variables are in brackets below the variables.
Table 5: Regression of Change in the Value of Vote around Record Date: Annualized Vote Values.

<table>
<thead>
<tr>
<th>Dependent Var.</th>
<th>Average Annualized % Value of Vote over ((-16, 16)) minus Value over ((-98, -66)) for Each Company Meeting(^\dagger)</th>
<th>Meeting Dummy [^*]</th>
<th>Agenda Dummy [^*]</th>
<th>Closeness</th>
<th>ISS-Management Conflict Dummy</th>
<th>Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.355 (3.30)</td>
<td>0.034 (0.76)</td>
<td>-0.083 (-1.70)</td>
<td>-0.075 (-1.70)</td>
<td>-0.121 (-13.66)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.342 (3.10)</td>
<td>0.075 (1.58)</td>
<td>-0.136 (-2.87)</td>
<td>-0.094 (-2.00)</td>
<td>-0.092 (-12.83)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.310 (2.78)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

T-statistics (from robust std. errors) are in parenthesis below the coefficients. Short description of independent variables are in brackets below the variables. Record date is day 0 and the time intervals are defined in terms of trading days.

TValue of vote is set to 0 for the missing observations.

FStatistical significance of coefficients is assessed using the F-test. Significance levels are provided in the last column.

Firms with Single Obs\(^\dagger\) indicates whether a single observation is used for the firm. Yes indicates the firm has a single observation, while No indicates the firm has multiple observations.

\[^*\]Record date is day 0 and the time intervals are defined in terms of trading days.

\[^\dagger\]Value of vote is set to 0 for the missing observations.

\[^\dagger\dagger\]T-statistics (from robust std. errors) are in parenthesis below the coefficients.

\[^\dagger\dagger\]Short description of independent variables are in brackets below the variables.
Table 6: Tobit Regression of Value of Vote around Record Date: Annualized Vote Values.

**Dependent Var. : Average % Value of Vote ± 3 Weeks (−16, 16) around Record Date for Each Company Meeting†**

<table>
<thead>
<tr>
<th></th>
<th>−1−</th>
<th>−2−</th>
<th>−3−</th>
<th>−4−</th>
<th>−5−</th>
<th>−6−</th>
<th>−7−</th>
<th>−8−</th>
<th>−9−</th>
<th>−10−</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meeting Dummy</td>
<td>.726</td>
<td>.598</td>
<td>.582</td>
<td>.720</td>
<td>.594</td>
<td>.594</td>
<td>.619</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Special:1, Annual:0]</td>
<td>(5.73)</td>
<td>(4.67)</td>
<td>(4.58)</td>
<td>(5.67)</td>
<td>(4.65)</td>
<td>(4.67)</td>
<td>(4.84)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agenda Dummy</td>
<td>.289</td>
<td>.177</td>
<td>-.023</td>
<td>-.049</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[High Ranking:1, Low:0]</td>
<td>(6.29)</td>
<td>(4.14)</td>
<td>(-0.46)</td>
<td>(-0.96)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closeness</td>
<td>-.500</td>
<td>-.431</td>
<td>-.444</td>
<td>-.394</td>
<td>-.423</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Vote Required-Vote Cast For]</td>
<td>(-10.74)</td>
<td>(-9.53)</td>
<td>(-8.30)</td>
<td>(-7.22)</td>
<td>(-6.73)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISS-Management Conflict Dummy</td>
<td>.423</td>
<td>.421</td>
<td>.219</td>
<td>.217</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Conflict:1, Agree:0]</td>
<td>(8.75)</td>
<td>(8.76)</td>
<td>(3.83)</td>
<td>(3.78)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>.507</td>
<td>.483</td>
<td>.858</td>
<td>.484</td>
<td>.480</td>
<td>.791</td>
<td>.455</td>
<td>.803</td>
<td>0.734</td>
<td>0.761</td>
</tr>
<tr>
<td></td>
<td>(36.86)</td>
<td>(31.29)</td>
<td>(25.79)</td>
<td>(33.49)</td>
<td>(31.08)</td>
<td>(23.88)</td>
<td>(30.15)</td>
<td>(18.74)</td>
<td>(17.43)</td>
<td>(14.80)</td>
</tr>
<tr>
<td>Obs</td>
<td>7,743</td>
<td>7,743</td>
<td>7,743</td>
<td>7,266</td>
<td>7,743</td>
<td>7,743</td>
<td>7,266</td>
<td>7,743</td>
<td>7,266</td>
<td>7,266</td>
</tr>
<tr>
<td>Special Meetings in Obs</td>
<td>311</td>
<td>311</td>
<td>311</td>
<td>310</td>
<td>311</td>
<td>311</td>
<td>310</td>
<td>311</td>
<td>310</td>
<td>310</td>
</tr>
<tr>
<td>Left-Censored Obs at Vote&lt;=0</td>
<td>1,751</td>
<td>1,751</td>
<td>1,751</td>
<td>1,643</td>
<td>1,751</td>
<td>1,751</td>
<td>1,643</td>
<td>1,751</td>
<td>1,643</td>
<td>1,643</td>
</tr>
<tr>
<td>Prob&gt;F</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

†Record date is day 0 and the time intervals are defined in terms of trading days.

T-statistics (from robust std. errors) are in parenthesis below the coefficients.

Short description of independent variables are in brackets below the variables.
Table 7: Regression of Change in the Value of Vote around Record Date: Negative Vote Values Allowed.

<table>
<thead>
<tr>
<th>Dependent Var.</th>
<th>Average % Value of Vote over ((-16, 16)) minus Vote over ((-98, -66)) for Each Company Meeting(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(-1)</td>
</tr>
<tr>
<td>Meeting Dummy</td>
<td>.091</td>
</tr>
<tr>
<td>[Special:1, Annual:0]</td>
<td>(2.37)</td>
</tr>
<tr>
<td>Agenda Dummy</td>
<td>.046</td>
</tr>
<tr>
<td>[High Ranking:1, Low:0]</td>
<td>(2.99)</td>
</tr>
<tr>
<td>Closeness</td>
<td></td>
</tr>
<tr>
<td>[Vote Required-Vote Cast For]</td>
<td>(-3.74)</td>
</tr>
<tr>
<td>ISS-Management Conflict Dummy</td>
<td></td>
</tr>
<tr>
<td>[Conflict:1, Agree:0]</td>
<td>(2.45)</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-31.96)</td>
</tr>
</tbody>
</table>

Obs | 6,656 | 6,656 | 6,656 | 6,259 | 6,656 | 6,656 | 6,259 | 6,656 | 6,259 | 6,259 |

Special Meetings in Obs | 252 | 252 | 252 | 251 | 252 | 252 | 251 | 252 | 251 | 251 |

Prob>F | 0.018 | 0.003 | 0.000 | 0.014 | 0.006 | 0.000 | 0.006 | 0.001 | 0.006 | 0.001 |

Firm Dummy | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Firms with Single Ob | No | No | No | No | No | No | No | No | No | No |

\(^1\)Record date is day 0 and the time intervals are defined in terms of trading days.
T-statistics (from robust std. errors) are in parenthesis below the coefficients.
Short description of independent variables are in brackets below the variables.
Table 8: Monthly Percentage of Lower Bound Violations for Target and Control Samples: Before the Engagement of the Hedge Fund.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Err.</th>
<th>Std. Dev.</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target</td>
<td>120</td>
<td>14.069</td>
<td>.479</td>
<td>5.248</td>
<td>13.120 - 15.017</td>
</tr>
<tr>
<td>Control</td>
<td>120</td>
<td>17.421</td>
<td>.638</td>
<td>6.984</td>
<td>16.159 - 18.684</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
<td>-3.353</td>
<td>.798</td>
<td>-4.924</td>
<td>-1.781</td>
</tr>
</tbody>
</table>

Difference = Mean(Target) - Mean(Control) \( t = -4.204 \)

Table 9: Monthly Percentage of Lower Bound Violations for Target and Control Samples: After the Engagement of the Hedge Fund.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Err.</th>
<th>Std. Dev.</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target</td>
<td>66</td>
<td>29.128</td>
<td>2.214</td>
<td>17.987</td>
<td>24.706 - 33.550</td>
</tr>
<tr>
<td>Control</td>
<td>66</td>
<td>14.992</td>
<td>1.142</td>
<td>9.279</td>
<td>12.711 - 17.273</td>
</tr>
<tr>
<td>Combined</td>
<td>132</td>
<td>22.060</td>
<td>1.386</td>
<td>15.924</td>
<td>19.318 - 24.802</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
<td>14.136</td>
<td>2.491</td>
<td>9.191</td>
<td>19.080</td>
</tr>
</tbody>
</table>

Difference = Mean(Target) - Mean(Control) \( t = 5.674 \)
Table 10: Sample Description for the Hedge Fund Activism Analysis.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>5(^{th}) pct</th>
<th>95(^{th}) pct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Bound Violation</td>
<td>0.153</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Target Sample Dummy</td>
<td>0.608</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>After Targeting Dummy</td>
<td>0.405</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Target Sample D. x After Targeting D.</td>
<td>0.224</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Volume</td>
<td>291.968</td>
<td>40</td>
<td>2</td>
<td>1,143</td>
</tr>
<tr>
<td>Bid-Ask Spread</td>
<td>0.130</td>
<td>0.071</td>
<td>0.017</td>
<td>0.476</td>
</tr>
<tr>
<td>Number of Option Pairs</td>
<td>13.457</td>
<td>9</td>
<td>1</td>
<td>43</td>
</tr>
<tr>
<td>Time to Maturity</td>
<td>124.969</td>
<td>64</td>
<td>10</td>
<td>493</td>
</tr>
<tr>
<td>Moneyness</td>
<td>1.022</td>
<td>1.001</td>
<td>0.763</td>
<td>1.318</td>
</tr>
</tbody>
</table>

The data span between January, 1996 and June, 2007
Total number of option pairs: 622,098
Table 11: Logistic Regression Analysis of Factors Affecting Lower Bound Violations of Put-Call Parity.

| Independent Var.                      | Coef. | R.Std.Err. | z    | P > | ||z|| | [95% Conf. Int.] |
|--------------------------------------|-------|------------|------|-----|------|------------------|
| Intercept                            | -.799 | .392       | -2.04| 0.041| -1.567 | -.031 |
| Target Sample Dummy                  | -.290 | .206       | -1.40| 0.161| -.694  | .115  |
| After Targeting Dummy                | -.433 | .315       | -1.38| 0.169| -1.050 | .184  |
| Target Sample D. x After Targeting D.| 1.288 | .416       | 3.10 | 0.002| .472   | 2.103 |
| Volume                               | .000  | .000       | 0.85 | 0.398| -.000  | .000  |
| Bid-Ask Spread                       | .883  | .136       | 6.50 | 0.000| .617   | 1.150 |
| Number of Option Pairs               | .017  | .009       | 1.83 | 0.068| -0.001 | .035  |
| Time to Maturity                     | -.006 | .002       | -2.69| 0.007| -.010  | -.002 |
| Moneyness                            | .993  | .383       | 2.59 | 0.009| .243   | 1.743 |
| YearMonth Dummy                      | Yes   |            |      |      |       |      |
| Firm Dummy                           | Yes   |            |      |      |       |      |

Number of observations: 622,063
Pseudo R2: 0.2025
Standard errors are clustered by firms.
Table 12: Marginal Effects After Logistic Regression Analysis of Factors Affecting Lower Bound Violations of Put-Call Parity.

\[ y = Pr(\text{Lower Bound Violation}) = .101 \]

| Independent Var.                  | dy/dx | Std. Err. | z    | P > |z|  | [95% Conf. Int.] | X  |
|-----------------------------------|-------|-----------|------|-----|---|-----------------|----|
| Target Sample Dummy*              | -.027 | .019      | -1.44| 0.151|  .064 | .010            | .608|
| After Targeting Dummy*            | -.038 | .028      | -1.38| 0.167|  .092 | .016            | .405|
| Target Sample D. x After Targeting D.* | .156  | .071      | 2.19 | 0.029|  .016 | .296            | .224|
| Volume                            | .000  | .000      | 0.86 | 0.391|  -.000| .000            | 291.982|
| Bid-Ask Spread                    | .080  | .016      | 4.99 | 0.000|  .049 | .112            | .130|
| Number of Option Pairs            | .002  | .001      | 1.69 | 0.090|  -.000| .003            | 13.458|
| Time to Maturity                  | -.001 | .000      | -3.52| 0.000|  -.001| -.000           | 124.973|
| Moneyness                          | .090  | .030      | 2.99 | 0.003|  .031 | .149            | 1.022|

(*) dy/dx is for discrete change of dummy variable from 0 to 1.