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Activist arbitrage: A study of open-ending attempts of closed-end funds ☆

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ABSTRACT

This paper documents frequent attempts by activist arbitrageurs to open-end discounted closed-end funds, particularly after the 1992 proxy reform which reduced the costs of communication among shareholders. Open-ending attempts have a substantial effect on discounts, reducing them, on average, to half of their original level. The size of the discount is a major determinant of whether a fund gets attacked. Other important factors include the costs of communication among shareholders and the governance structure of the targeted fund. Our study contributes to the understanding of the actions undertaken by arbitrageurs in financial markets beyond just pure trading.

1. Introduction

Closed-end funds (CEFs) are among the most interesting assets in financial markets. Trading at substantial discounts from their net asset values (NAVs), closed-end funds constantly attract arbitrageurs who take positions and wait for the eventual convergence of the CEF share price to its NAV.[1]

A phenomenon that has not received much attention in the literature is *activist arbitrage*. Unlike the traditional *pure-trading arbitrage*, activist arbitrageurs do not simply wait for convergence, but rather take actions to open-end

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[1] The profitability of arbitrage strategies in the CEF market has been studied by Thompson (1978), Brauer (1988), and Pontiff (1995). Lee, Shleifer, and Thaler (1991), Pontiff (1996), and Gemmill and Thomas (2002) provide evidence on the limits to this arbitrage. For a survey of the CEF literature, see Dimson and Minio-Kozerski (1999).

the target fund, knowing that upon open-ending the price of the fund's shares will be forced to converge to its NAV.

We conduct a comprehensive empirical study of the attempts of activist arbitrageurs to open-end closed-end funds in the U.S. We show that this form of arbitrage has become quite common since the mid-1990s. We study the extent to which activist arbitrage activities can eliminate or reduce CEF discounts, and analyze the factors that determine which funds are targeted by activist arbitrageurs. Overall, our study contributes to the understanding of the full spectrum of activities taken by arbitrageurs attempting to eliminate deviations of market prices from intrinsic values.

Our analysis is based on a unique hand-collected data set consisting of all activist arbitrageurs' activities in U.S.-based CEFs between 1988 and 2003. Activist arbitrage in closed-end funds was quite rare until the early 1990s. However since the mid-1990s—shortly after the Securities and Exchange Commission (SEC) significantly relaxed constraints on communication among shareholders of public corporations—this type of arbitrage has become very common. Several arbitrageurs—hedge funds, endowment funds, banks, and financial arms of corporations—have become quite active in initiating proxy contests and proposals targeted at open-ending discounted CEFs. In the peak years of 1999 and 2002, about 30% of the funds in our sample were targets of such attacks.

We find that activist arbitrage has substantial impact on CEF discounts. While most of the open-ending attempts in our sample were met with resistance from the funds' managements, quite a few led to successful open-endings despite such resistance. In addition, activists' activities were sufficiently credible in many instances to induce fund managers to take actions themselves to reduce the size of the discount. We show that open-ending attempts reduce the discount of the targeted funds by more than 10 percentage points on average (considering both successful and unsuccessful attempts). This is substantial, given that discounts of targeted CEFs are around 20% of NAV in the years before an open-ending attempt. We show that this effect of activist arbitrage is above and beyond the mean reversion in discounts that has been shown in previous literature.

A key variable that guides activist arbitrageurs in choosing which fund to target is the fund's discount from its NAV. Our empirical results suggest that a one percentage point increase in the discount is associated with a 0.66 percentage point increase in the probability of an attack in a given year. This correlation is the result of a dual relation between CEF discounts and open-ending attempts. While the probability that a fund will be attacked by activists should increase with the size of the discount because of the increased profit opportunity, forward-looking discounts should decrease in anticipation of future attacks. Using an instrumental-variables approach and an econometric technique that allows us to estimate a simultaneous system of an endogenous dummy variable and an endogenous continuous variable (based on the work of Rivers and Vuong, 1988), we disentangle the two effects and show that a one percentage point increase in the discount leads to a 1.07 percentage point increase in the probability of an open-ending attempt in a given year. The increase is substantial given that the unconditional probability of an open-ending attempt in our sample is about 13% in a given year.

The fact that discounts shrink in anticipation of future attacks suggests that activist arbitrage affects CEF discounts not only via the direct effect on the targeted funds, but also via an indirect anticipation effect. That is, some funds' discounts may decrease without any noticeable attacks, simply because such attacks are anticipated in the future.[2] Hence, the above effect of activist arbitrage on discounts should be considered a lower bound.

Another important determinant of activist arbitrage is the ease of communication and coordination among shareholders. Shareholder communication is crucial because in order to open-end a fund, an activist needs to communicate with many other shareholders and convince them to support his plan of action. Indeed, one of the main activists in our sample, Phillip Goldstein, notes that: "The first thing you have to do as an activist is to form a good network. You have to be able to call up institutional investors and ask, 'What would you think about this?'"[3] The fact that open-ending attempts became so common after the SEC's 1992 proxy reform that relaxed constraints on shareholder communication highlights the importance of communication in the process of activist arbitrage. To investigate the role of communication further, we conduct tests using cross-sectional measures of the costs of communication in different funds.

We use three proxies for the ease of communication among the stockholders of a particular fund. The first is turnover, which measures the frequency at which the shares of the CEF change hands. A high turnover rate indicates greater costs of communication because frequent changes of shareholders make it difficult to locate and inform them of an activist's intent. The second variable is the average size of trade in the fund's shares. Larger trades indicate that, on average, shareholders hold bigger positions in the fund, and thus, the fund has fewer shareholders which are easier to communicate with. The third variable is the percentage of institutional ownership in the fund. Institutional investors typically hold larger positions, are more informed, and are more likely to cast votes for shareholder proposals and proxy contests than retail investors (who are often blamed for apathy). Due to regulatory disclosure requirements (such as the quarterly 13F filings of holdings), they are also easier to locate and notify regarding an activist's intent. The results of our empirical tests are consistent with the hypothesis that smaller costs of communication enhance activist arbitrage. Interestingly, the effects of the above proxies are present only after the legal reform of 1992. Our results suggest that before the 1992 reform, communication

[2] Despite this strong effect, however, discounts have not decreased after 1992, when attacks became much more common, compared to their levels during 1988–1992. This suggests that other forces that generate discounts became stronger in the late 1990s. After 2000, discounts have been declining overall.

[3] See: Harvard Business School Case N9-208-097: "Opportunity Partners", by Robin Greenwood and James Quinn.

among shareholders was so severely restricted by the SEC that cross-sectional differences in the shareholder base did not matter much for activist arbitrageurs.

Finally, the governance of funds also plays an important role in determining the probability of an open-ending attempt. Funds that have pro-manager governance structures (i.e., staggered boards, supermajority voting, and ability of the board to call a special meeting) are more likely to be targets for activism after the legal reform of 1992, but not before. This is likely because communication among shareholders is particularly important when managers have more power. While managerial entrenchment attracts more attacks after 1992, we find that it lengthens the time needed to implement a successful open-ending. This result is related to the study by Del Guercio, Dann, and Partch (2003) on governance in closed-end funds. They find that board characteristics regarding the funds' governance structure affect the implementation of restructuring proposals.

The literature on closed-end funds has evolved along two major strands. Studies by Barclay, Holderness, and Pontiff (1993), Ross (2002), Berk and Stanton (2007), and Cherkes, Sagi, and Stanton (2009) emphasize the agency problem between outside shareholders and managers and insiders as the source of CEF discounts. Studies by Lee, Shleifer, and Thaler (1991), Pontiff (1996), and Gemmill and Thomas (2002) emphasize the limits to (pure-trading) arbitrage in explaining CEF discounts.[4] Our study speaks to both strands of the literature. On the one hand, the fact that open-ending attempts are affected by a fund's governance structure suggests that agency problems play at least some role in the existence of CEF discounts. Further evidence of agency problems in CEFs is our finding that discounts shrink after corrective actions (such as an increase in dividends, the initiation of a share buyback program, or a reduction in fees) taken by fund management in response to activist arbitrageurs' activities. On the other hand, our work also shows that costly shareholder communications due to ownership structure or legal constraints are additional limits to arbitrage that prevent the convergence of CEF share prices to NAVs.

As mentioned above, prior research on closed-end funds (conducted mostly before the 1992 reform) largely ignores the possibility of activist arbitrage, arguing that such a strategy is very costly and difficult to execute (Lee, Shleifer, and Thaler, 1991) and is likely to fail due to resistance of managers and blockholders (Barclay, Holderness, and Pontiff, 1993). Two studies from that period—Brauer (1984) and Brickley and Schallheim (1985)—analyze the return realized by shareholders upon actual open-ending of CEFs. Unlike our analysis, however, they do not look at the full array of open-ending attempts to analyze their determinants and consequences. Moreover, since their analysis is conducted in a period where open-ending attempts were quite rare, they study a much smaller sample than we do in this study. Our paper is also related to the literature on shareholder activism in public corporations in general, which was recently surveyed by Gillan and Starks (2007), although the focus of the analysis in our paper is very different from that literature.

The remainder of this paper is organized as follows. In Section 2, we describe the history of the SEC regulations of the proxy process and especially the legal reform of 1992. We also describe key institutional details of activist arbitrage in closed-end funds. Section 3 describes the unique data set used for our empirical analysis. In Section 4, we develop the methodology used in our empirical analysis and present our empirical results on the determinants and consequences of activist arbitrage and its relation with CEF discounts. Section 5 offers some concluding remarks.

2. Background

2.1. SEC regulation of the proxy process and the 1992 reform

Dissident shareholders have two main avenues by which they can impose changes in a corporation (including a closed-end fund). They can initiate a proxy contest and put forward an alternative slate of directors to replace the firm's current board and achieve ultimate control over the corporation, or they can put forth a shareholder proposal to improve the firm's governance structure, its investment strategy, or its overall operations.[5] The issues raised by dissidents in proxy contests and shareholder proposals are resolved by shareholders' voting. In the voting process, also called the proxy process, the dissident shareholders try to get the proxies of other shareholders to cast their votes in support of the changes they wish to make.[6]

The rules governing the proxy process were first established by the Securities and Exchange Commission (SEC) in 1935 under the authority granted by Section 14(a) of the Securities Exchange Act of 1934. One of the first rules enacted by the SEC required any party soliciting proxies (requesting votes) from other shareholders to register and disclose certain information prior to contacting shareholders. The proxy solicitation documents were reviewed by the SEC. This often led to significant negotiations between the SEC and the soliciting party before approval was granted to the activists to communicate with shareholders.

[4] Attempts to explain the discounts by arguing that the methods used to calculate NAVs overstate the value of the assets due to tax liabilities or illiquidity have been shown long ago to be unpersuasive (see Malkiel, 1977).

[5] Activism can also be pursued via takeovers. In such a case, the arbitrageur acquires control over the firm, and makes restructuring decisions without being dependent on the votes of other shareholders. The profit from such a strategy is the capital gain realized by the activist once the improved operating strategy is reflected in the share price. Interestingly, takeovers are virtually non-existent in the closed-end fund industry. A possible reason is the anti-pyramiding provision of the Investment Company Act of 1940 (Section 12(d)(1)), which prevents investment companies from holding more than 3% of the shares of other investment companies. This restriction prevents obvious potential activist arbitrageurs from attempting takeovers of closed-end funds.

[6] There is a fundamental difference between the voting on a proxy contest and the voting on a shareholder proposal, in that the outcome of the latter does not bind the management. In addition, proxy contests are more expensive.

The proxy rules in the U.S. have evolved significantly since 1935. The most significant amendments were enacted in 1956. These amendments created major deterrents to communication among shareholders throughout a proxy process. The central feature of the 1956 amendments was a change in the definition of a proxy solicitation. Under the new definition, a solicitation consisted of *any* communication under circumstances reasonably calculated to influence voting decisions. This liberal interpretation of solicitation dramatically expanded the power of the SEC to require registration and review all proxy materials before they were communicated to shareholders. In addition, public statements, analyses of voting issues, and any impromptu communications made through television, speeches, or on the radio were severely restricted. Finally, the new proxy rules placed restrictions on communications containing complex, sophisticated, or forward-looking language (such as predictions regarding future sales, earnings, etc.) and any criticisms regarding the competency of the firm's current management.

Clearly, these rules had a stifling effect on stockholder communication. Moreover, the impact of the regulations fell mostly on dissidents, who face significantly greater costs than the incumbent management in a proxy contest. These limitations on shareholder communication have been subject to wide criticism for their negative impact on the efficiency of the voting process. Pound (1991) provides an excellent summary of these criticisms.

In 1992, the SEC enacted major revisions in proxy rules. The new rules relaxed the prevailing definition of a proxy solicitation to exclude any communication by shareholders when not directly seeking the power to vote as proxy for other shareholders, as long as the shareholders' motive was only to gain pro rata with other shareholders. The 1992 amendments also specifically excluded shareholders' public statements of their voting intentions and/or voting rationale (including public speeches, press releases, newspaper advertisements, and internet communications) from the definition of a solicitation. These changes allowed independent shareholders to freely engage in communication without being monitored by the SEC.

2.2. Activism in the closed-end fund industry

There are only a handful of arbitrageurs who actively engage in attempts to liquidate or open-end CEFs. Consider, for example the following quotation from a *BusinessWeek* article:

> "Some institutions are more aggressive than others. A few groups are known for their activism: Newgate Management Associates, based in Greenwich, Conn., Harvard College, City of London Investment Management, Lazard Freres & Co., and Phillip Goldstein, who runs Opportunity Partners, a $40 million hedge fund that specializes in closed-end funds in Pleasantville, N.Y. Their stake in a closed-end fund does not guarantee an open-ending, but the odds are higher".[7]

[7] Source: Toddi Gutner, *When the lead comes off closed-end funds*, BusinessWeek, September 29, 1997.

Our review indicates that the arbitrageurs mentioned in the previous quote are, with minor exceptions, those that tend to dominate the activism in the CEFs market.[8]

Since the activists' activities on which we focus are relatively unexplored in the literature, we discuss in some detail the attempt by Phillip Goldstein to open-end the Emerging Germany Fund. This example reflects some commonalities in the behavior of dissident shareholders and the managements of CEFs. These include: (1) activists target deeply discounted funds; (2) the attacks are conducted by more than one arbitrageur, and communication plays a key role in the success of the attack; (3) the managements of CEFs often object to open-ending attempts and fight them over an extended period of time; and (4) the arbitrageurs use various tools to intervene in the operations of a CEF, including shareholder proposals and proxy contests. Fig. 1 provides an illustration of the evolution of this dissident attack and the resultant effect on the fund's discount.

In mid-March 1997 the Emerging Germany Fund submitted its proxy filing, which included a shareholder proposal filed by Phillip Goldstein "recommending that the board of directors expedite the process to ensure the Fund's shares can be purchased and/or sold at net asset value." (See Form DEF 14A filed March 18, 1997.[9]) The fund advised shareholders to oppose this proposal in the upcoming shareholder meeting in April. At that meeting the proposal was defeated (2.7 million for, 3.6 million against, and 1 million abstained). By the end of 1997 both Phillip Goldstein and another prominent dissident, Ron Olin, jointly held 14% of the fund's outstanding shares (see DFRN 14A filed January 11, 1999[10]). In addition, Bankgesellschaft Berlin, FMR Corp., and Lazard Freres & Co. were beneficial owners of 14%, 10%, and 10%, respectively, of the fund's outstanding shares (DEF 14A filed March 6th 1998).

In early 1998 the fund embarked on a program to distribute to its shareholders on a quarterly basis approximately 2.5% of NAV, for a total of at least 10% annually. The managed distribution policy was intended "to enhance shareholder value" (N-30D filed March 2, 1998[11]).

On March 27, 1998, Phillip Goldstein again submitted a letter to the fund's management advising them of his intention to attend the fund's annual shareholder meeting on April 27 and to nominate himself and three others for election as directors of the fund. He also revealed his intention to submit four proposals for consideration by the shareholders, including proposals that essentially would require open-ending the fund and firing the fund's investment advisers. During the course of this

[8] Other key players include Ron Olin, Bankgesellschaft Berlin AG, and Laxey Partners Limited.

[9] A Form DEF 14A is a document sent by publicly listed corporations to their shareholders providing material information on corporate matters subject to vote at the annual meeting.

[10] A Form DFRN 14A contains the definitive non-management proxy solicitation material.

[11] A Form N-30D is a semi-annual report that contains information on fund performance and other important information.

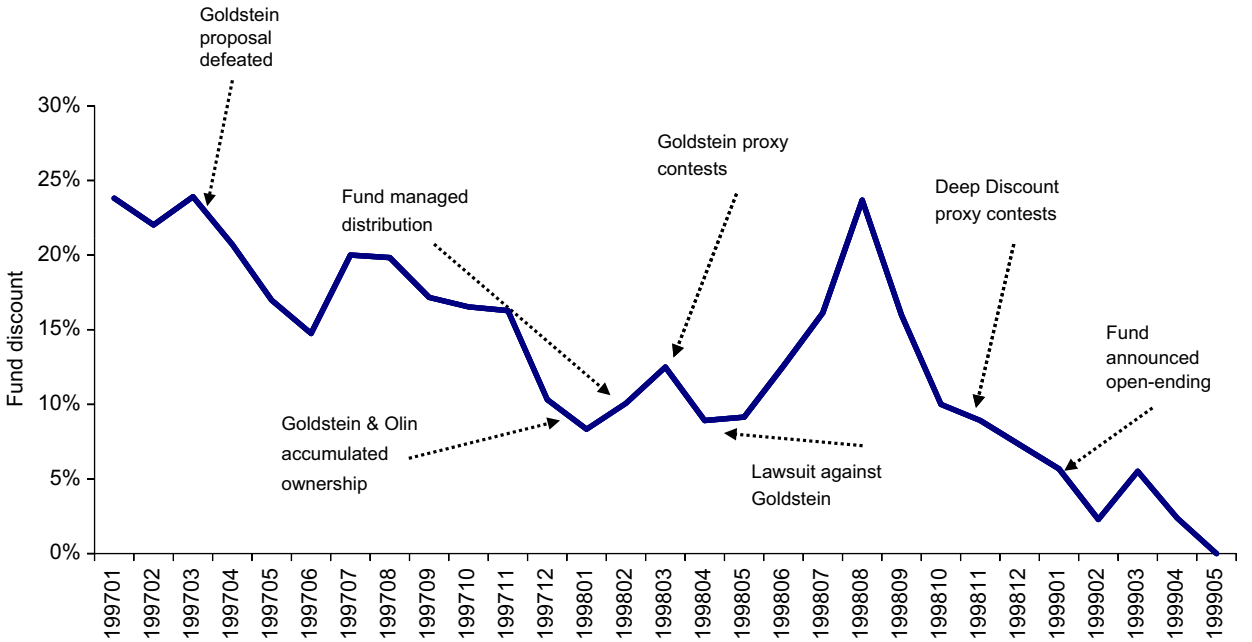

Fig. 1. Activist example: The Emerging Germany Fund (1997–1999). This chart plots the evolution of fund discount of the Emerging Germany Fund from early 1997 (when the fund came under an open-ending attempt) to May 1999 (when the fund was finally open-ended). Section 2.2. provides a detailed description of the case.

increasingly hostile battle, Mr. Goldstein was an active participant in electronic "discussions" on an internet discussion board and a number of the messages that he posted addressed the proposals that he wanted shareholders to consider at the annual shareholders' meeting. On April 8, 1998 the fund withdrew its notice of the April 27, 1998 meeting and commenced a lawsuit against both Mr. Goldstein and Mr. Olin, alleging violation of the proxy solicitation rules and beneficial ownership disclosure provisions of U.S. federal securities laws (PRE 14A filed April 8, 1998 and PRE 14A filed April 27, 1998[12]).

Throughout 1998 Deep Discount Advisors, Inc. and Ron Olin Investment Management Company continued to increase their holdings of the fund's shares. As of November 6, 1998 the combined beneficial holdings of the two entities represented approximately 14.5% of the fund's outstanding shares. In a letter to the fund's management dated November 6, 1998, Deep Discount Advisors Inc. requested that the board nominate Mr. Olin and three of his associates as directors of the fund for the next annual stockholders' meeting, which was scheduled for January 26, 1999. The letter made clear that if elected, this dissident slate of directors would take the necessary steps to open-end the fund.

Seeing the writing on the wall, in late 1998 the management of the fund made a package of proposals designed to open-end the fund (DEF 14A filed January 4, 1999). The package was accepted at the shareholder meeting held on January 26, 1999, and the fund announced that it would convert to an open-end, no-load mutual fund at the close of business on Monday, May 3, 1999. With the announcement, the fund's discount from its NAV virtually disappeared. Following the announced plan, the fund was later open-ended.

3. Data

From the Center for Research in Security Prices ("CRSP") database, we gathered information on all closed-end funds that were in existence at any time over the period 1988 through 2002.[13] We also collected information on these funds through 2005 to allow for post-event analyses. Based on information contained in various issues of *Barron's* and Morningstar's Principia database, as well as data obtained from Lipper, we then reduced this sample to funds managing either domestic or international equity, including specialized equity funds. Eliminated from the sample were closed-end funds investing in convertible bonds, preferred stocks, taxable bonds, real estate, private equity, and municipal bonds. We also excluded exchange-traded funds and funds incorporated outside the United States. Our selection criteria reflect the need to obtain accurate NAV information so that the key variable in our analysis, fund discounts, could be measured without error. The resulting

[12] A form PRE 14A is a preliminary proxy statement providing official notification to designated classes of shareholders of matters to be brought to a vote at a shareholders meeting.

[13] In order to identify closed-end funds in the CRSP database, we used the 'share code' variable. We included all shares for which the code is 14 (ordinary common share of a closed-end fund).

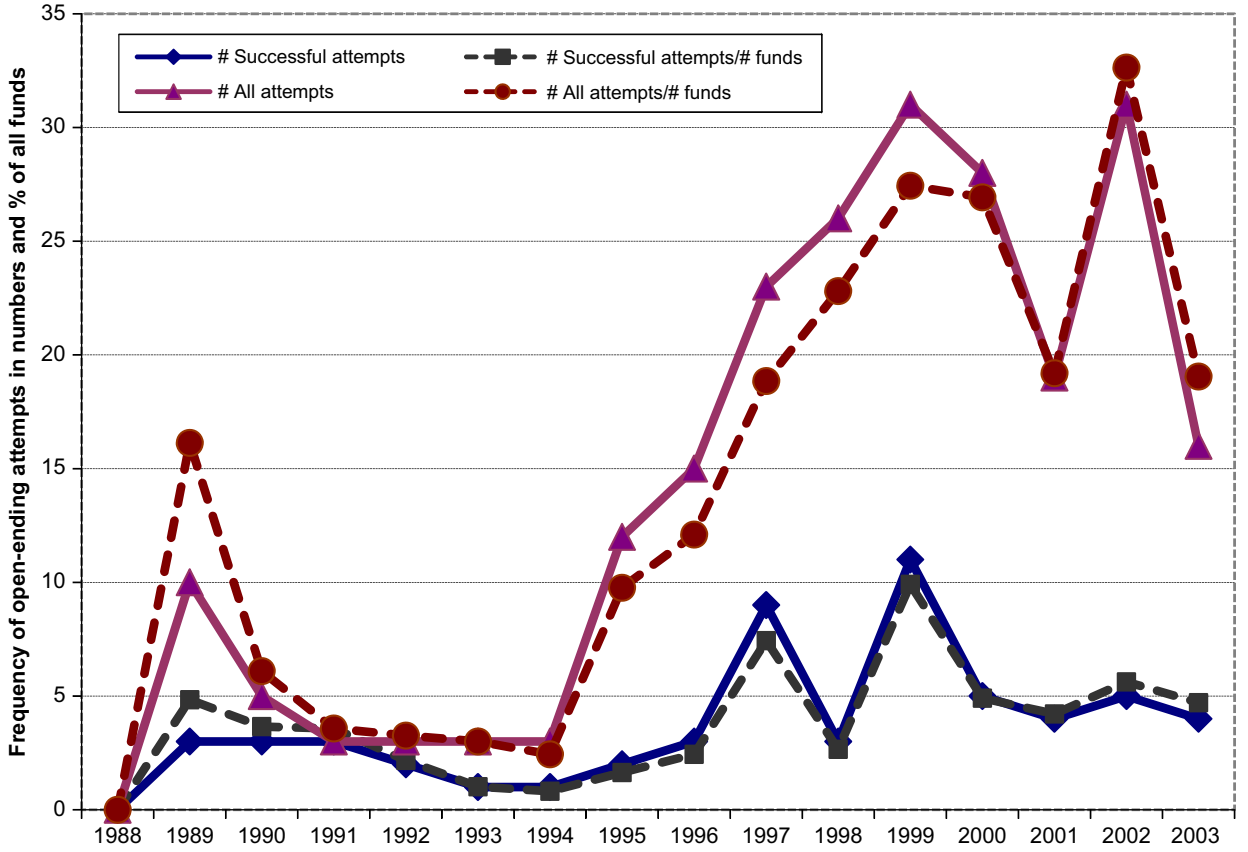

Fig. 2. Attempted and Successful Open-Endings of Close-End Funds (1988–2003). This chart plots the following time series for the period 1988–2003: (1) Successful open-ending cases in each year; (2) Successful open-ending cases as a proportion of the total number of funds in each year; (3) Attempted (including successful) open-ending cases in each year; (4) Attempted (including successful) open-ending cases as a proportion of the total number of funds in each year.

sample includes 142 closed-end funds that were traded sometime over the period 1988–2002.

For each fund in our sample, we collected information on all events that might potentially be related to activist arbitrage during 1988–2003. These events include any attempt of open-ending, merger, or liquidation, as well as funds' decisions to repurchase shares, make managed distributions, and conduct rights offerings. This information was collected from various sources. First, we hand-collected all reports filed with the SEC through SEC's Web site EDGAR during 1988–2003. Since the EDGAR database is incomplete prior to the mid-1990s, we examined Lexis-Nexis for filings in earlier years. We retrieved registration statements, proxy related materials, and annual reports from the SEC database. Second, we collected news stories using databases such as Factiva (formerly Dow Jones Interactive), Proquest, Lexis-Nexis, as well as articles published on the internet. Third, we acquired various monthly publications from Thomas Herzfeld Advisors. These publications provide a thorough description of the full universe of closed-end funds' corporate activities ranging from liquidations and mergers that have already been consummated to outstanding and unresolved activities.

Based on these data, we constructed two fund activity indicators, one denoted "Open-Ending Attempts" and the other "Open-Endings." For "Open-Endings" the indicator variable is assigned the value of one if an open-ending, merger, or liquidation occurred in a given year, and zero otherwise. The variable "Open-Ending Attempts" is given the value of one if an attempt had been made to open-end or liquidate the fund in a given year, and zero otherwise.

Three technical points on the construction of these variables should be noted. First, attempts include both shareholder proposals and proxy contests. While almost all the attempts involve shareholder proposals, proxy contests are used in 56.5% of the cases. Second, our main analysis includes eight open-ending cases that were initiated by managers after a condition of a lifeboat provision—a commitment contained in the fund's Bylaws or Articles of Incorporation to take actions to reduce the discount under certain specified circumstances—had been met. Managers can always (and often do) object to open-ending when a lifeboat provision is being met. Thus, we interpret a "voluntary" open-ending as an equilibrium decision that managers make after assessing the pressure from outside investors. Third, some funds were the targets

of open-ending attempts over multiple years. Attempts in later years are counted as new events only if they represent a distinctly new round of attacks.

Fig. 2 plots the time trends of open-ending attempts and actual open-endings, liquidations, and mergers into open-end funds from 1988 to 2003. As can be seen from the graphs, there is a clear upward trend in open-ending attempts after the 1992 reform, especially after 1994. In the early 1990s, only 3–4% of the funds were subject to activists' attacks. In the peak years of 1999 and 2002, the percentage rose to around 30% of the sample funds. The number of actual open-endings, however, did not change significantly following the legal reform.

Table 1 Panel A reports the summary statistics of the major fund characteristics that we employ in our analysis. We acquired monthly NAV and price data from Securities Data Corporation (SDC). In a few cases, we obtained the NAV and price data from Herzfeld Advisors. Following the literature, fund discounts are calculated as (NAV-Price)/NAV. In most years, about 80–90% of the CEFs traded at a discount, similar to the numbers reported in prior research. Institutional holdings are taken from Thomson Financial's Spectrum Data, and insider holdings are taken from Thomson Financial's Lancer Analytics.[14] To ensure that we are not capturing the holdings of the activists themselves with these two variables, we exclude holdings by activists who ever attacked the fund during our sample period. We obtained information on price, volume, return, dividend, market capitalization, and turnover rate from CRSP. Fund age is the number of years since the fund was first listed on CRSP. The annual dividend yield is calculated as the difference between the funds' annual buy-and-hold return with dividends and the buy-and-hold return without dividends.

Table 1 Panel B lists the summary statistics of the fund policy variables for the full sample period and subperiods. We collected information on the existence of a staggered board, supermajority, special meeting, and confidential voting by examining the funds' filings with the SEC.[15] Information on lifeboat provisions was obtained from SEC filings and from a special Herzfeld publication dedicated to a survey of lifeboat provisions among closed-end funds. A fund is coded as having a lifeboat if it states explicitly that open-ending is a possible outcome to be considered by the management, or if it indicates a commitment to making a tender offer or share repurchase in cases of a persistent discount. Finally, information on management fees was obtained from SDC. To disentangle time trends from composition effects, we separately report the summary statistics in each period for old and new funds, depending on whether the fund is in our sample for more than three years.

[14] The Thomson Financial's Lancer Analytics database reports the updated number of shares held for all the insiders reported to the SEC. The measure of total insider holdings, used in our analysis, is then calculated as the sum over all insiders of their most recent reported holdings before the fiscal year-end.

[15] We do not present statistics on confidential voting since there is little cross-sectional variation in this variable.

4. Empirical results

4.1. Determinants of CEF discounts

CEF discounts provide the motivation for activist arbitrage. The core of our analysis, presented in Section 4.2.2, consists of estimating a system of equations where the discount and activist arbitrage activities are simultaneously determined. An important first step is to understand the determinants of CEF discounts. We now provide a brief overview of the key cross-sectional determinants of CEF discounts that have been documented in the literature. Table 2 presents regression results in which the dependent variable is *DISCOUNT*, defined as (NAV-Price)/NAV. The first column presents results based on a pooled regression with year fixed effects, and the second column presents results based on Fama-MacBeth type regressions.

CEF discounts are often attributed to mispricing. Pontiff (1996), followed by Gemmill and Thomas (2002), studied the relation between deviations of CEF share prices from NAVs and variables that proxy for the costs of pure-trading arbitrage and thus proxy for the difficulty of eliminating mispricing. We adopt his suggested variables in our regressions. First, we use the market capitalization (*MV*) of CEFs and the market price (*P*) of CEF shares to proxy for transaction costs, which make arbitrage more costly. The rationale for the inclusion of market price is that bid-ask spreads tend to be relatively fixed at low prices. Second, we use the residual standard deviation of a fund's NAV return (*STDNAV*) as a proxy for the difficulty in replicating the fund's underlying portfolio.[16] On the one hand, the more difficult it is to replicate the fund's underlying portfolio, the more costly are arbitrage activities, and the more likely it is that price will deviate from NAV. This can lead to a higher discount. On the other hand, a CEF might be created precisely because investors are willing to pay a premium for the hard-to-replicate fund's assets, which could lead to a higher premium or a lower discount. Third, we include the dividend yield (*DIV*). Pontiff (1996, 2006) argues that it should be easier to execute a pure-trading arbitrage on a fund with a higher dividend yield since the higher payout reduces the expected holding cost.

We find that a lower share price is indeed associated with a higher discount. Market capitalization, however, does not impact the magnitude of the discounts when other characteristics are included. We complement these measures of transaction costs with another common measure of liquidity: share turnover (*TO*). This variable is calculated as the yearly share volume scaled by the number of shares outstanding. As expected, this measure is negatively related to the discount.[17] We also find that

[16] The residual is calculated from a regression of a fund's NAV return, in excess of the risk-free rate, on the Fama-French three-factor model plus an additional momentum factor. To these factors we add two MSCI international indexes, representing the European and the Far East markets.

[17] We consider alternative measures of liquidity based on Lesmond, Ogden, and Trzcinka (1999) and Pastor and Stambaugh (2003). For both measures, higher illiquidity is indeed associated with higher fund discounts although only the second measure is marginally significant.

Table 1
Summary statistics.

Panel A: Fund characteristics over 1988–2002

This panel reports summary statistics for 142 closed-end funds over the sample period 1988–2002. The first four rows provide the number of funds in operation in each year, the percentage of funds that trade at a discount, and funds under attack as percentage of all funds, and that as percentage of the total market capitalization. Each of the next three-row blocks provides the sample mean, median, and standard deviation, respectively, of the indicated fund characteristic variable. Fund discount is defined as (NAV-P)/NAV. Market capitalization is the product of fund share price and number of shares outstanding. Annual turnover is the ratio of fund shares traded to total shares outstanding. Dividend yield is the ratio of dividend payout to fund share price. Insider ownership is the proportion of fund shares owned by insiders. Institutional ownership is the proportion of fund shares owned by institutions, excluding stakes by activists. Fund age is number of years since the first listing date on CRSP. Average trade size is the number of shares traded in a single transaction averaged over all trades in a given year. Standard deviations of monthly returns in a given year are calculated for both the underlying assets (NAV) and the fund shares. NAV return is defined as the percentage change in NAV values plus dividend paid, scaled by the beginning-of-period NAV.

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Number of funds	53	62	82	84	92	99	123	122	123	121	113	111	102	95	89
% Trading at a discount	81	79	83	79	68	55	71	78	86	83	82	89	92	86	88
% Funds under attack	0.0	16.1	6.1	3.6	3.3	3.0	2.4	9.8	12.1	18.9	22.8	27.4	26.9	19.2	32.6
% Market cap of funds under attack	0.0	7.2	3.5	2.4	7.5	5.6	2.2	16.2	11.6	25.6	26.0	13.0	15.1	13.1	17.7
Fund discount (%)	14.0	9.7	10.2	8.0	5.6	1.8	6.0	11.2	13.0	13.5	13.6	16.3	23.0	15.4	13.3
	20.2	12.5	11.5	8.8	5.8	1.8	6.3	12.8	15.2	15.9	18.1	19.1	23.6	17.4	14.2
	17.7	17.7	11.6	12.3	10.4	11.7	11.0	12.2	11.3	12.2	16.1	15.9	16.1	14.4	15.4
Market capitalization ($Million)	159	177	155	170	177	194	220	212	229	255	239	248	267	247	222
	69	88	85	93	98	111	133	121	125	136	105	101	123	101	102
	228	234	210	245	270	276	271	277	303	349	401	448	453	435	376
Annual turnover (%)	60	116	95	76	80	110	102	87	87	102	96	84	78	54	50
	49	57	67	59	64	92	86	79	85	96	92	80	69	48	44
	50	171	73	77	57	108	65	47	38	56	49	45	44	28	31
Dividend yield (%)	3.1	4.0	3.5	4.0	3.1	2.1	2.0	1.8	2.3	2.4	3.4	2.9	3.4	3.4	2.9
	2.6	3.3	2.4	2.7	1.8	0.8	0.9	0.6	1.2	0.9	1.0	0.9	1.1	1.3	1.3
	3.3	3.6	3.7	3.8	3.5	3.0	2.8	2.9	3.0	3.8	5.3	4.1	5.1	4.8	4.5
Insider ownership (%)	1.0	1.7	1.7	4.5	2.3	2.6	1.6	3.9	2.5	2.9	1.6	6.8	4.3	7.6	7.6
	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.0	0.7	0.4
	1.8	3.2	4.8	12.5	6.5	9.2	7.7	15.4	9.5	10.5	4.0	11.9	9.5	12.5	14.7
Institution ownership (%) (excluding activists' stake)	12.1	13.4	11.0	13.3	12.8	12.8	10.8	12.2	13.1	12.1	12.5	13.6	14.3	16.1	18.3
	6.6	8.0	6.5	8.6	9.1	9.9	8.7	10.5	10.5	10.5	11.1	10.9	12.4	14.3	16.0
	12.3	13.1	11.3	14.7	12.6	10.8	9.7	8.9	9.7	12.3	13.9	12.8	14.3	14.8	14.8
Fund age (years)	7	7	6	6	6	7	6	7	8	9	10	11	12	14	15
	2	2	3	3	3	4	4	5	6	7	8	9	10	11	12
	13	12	11	11	11	10	10	10	10	10	10	10	11	11	11
Average trade size (1,000 shares)	1.4	1.6	1.8	1.3	1.0	1.1	1.2	1.1	1.3	1.3	1.3	1.4	1.4	1.4	1.1
	1.1	1.4	1.3	1.1	0.9	1.0	0.9	1.0	1.2	1.2	1.2	1.3	1.3	1.2	1.0
	1.0	0.9	1.7	0.8	0.5	0.8	0.8	0.5	0.6	0.6	0.7	0.8	0.7	0.8	0.7
Standard deviation of monthly fund NAV (in %)	4.3	3.3	3.2	3.3	3.7	3.8	4.0	4.2	4.3	4.4	5.0	5.8	6.2	5.7	4.8
	3.1	2.4	2.4	2.6	2.8	3.1	3.1	3.2	3.8	3.6	4.4	5.2	5.7	5.3	4.3
	2.6	2.3	2.6	2.6	2.6	2.5	2.7	2.9	2.7	2.4	2.7	3.1	3.4	3.1	2.6
Standard deviation of monthly fund return (in %)	4.9	5.4	6.4	6.2	6.2	5.9	6.5	5.9	5.8	5.8	6.2	6.2	6.7	6.6	6.4
	4.2	4.5	4.7	4.8	5.0	5.4	5.9	5.2	5.4	5.3	5.9	6.0	6.3	6.1	6.0
	2.7	2.8	3.7	3.4	3.1	3.0	3.1	2.7	2.5	2.5	2.6	2.7	3.0	3.1	2.9

NAV return (in %)	7.8	20.3	−14.2	18.6	−2.1	29.2	−9.1	4.7	8.4	−2.4	−5.4	38.2	−19.5	−12.4	−14.0
	4.3	16.2	−11.2	11.3	−2.7	24.9	−7.3	3.4	9.9	2.4	−4.8	29.5	−19.8	−14.2	−14.3
	10.3	20.3	14.7	26.6	17.1	31.1	18.3	23.6	18.3	28.7	32.7	49.8	21.7	17.3	19.8

Panel B: Fund policies

This panel reports the mean values of the policy variables over different subperiods and separately for old and new funds. All of the variables except management fees are dummy variables equal to one if the provision exists. A staggered board is one in which directors are classified into different classes and serve overlapping terms. Supermajority requires supermajority votes out of outstanding shares for open-ending. Special meeting means that the management has the right to call special meetings to discuss/vote on dissidents' proposals. Lifeboat is a provision for remedial actions, including converting to an open-end fund, when discount persists beyond certain threshold for certain length of period. Management fees are calculated as fees over total net asset values. Standard deviations are reported in parentheses. A fund is counted as an Old (New) fund if it has existed in our sample for more than (less than or equal to) three years in the year of calculation.

	1988–2002	1988–1992		1993–1998		1999–2002	
	All funds	Old funds	New funds	Old funds	New funds	Old funds	New funds
Staggered board	0.38	0.09	0.03	0.42	0.30	0.67	0.47
Supermajority	0.14	0.09	0.20	0.17	0.08	0.14	0.00
Special meeting	0.60	0.70	0.56	0.63	0.52	0.58	0.67
Lifeboat	0.53	0.44	0.57	0.54	0.54	0.52	0.60
Management fees	1.79	1.45	2.01	1.62	2.03	1.90	2.22
	(0.90)	(0.58)	(0.61)	(0.86)	(0.71)	(1.06)	(0.49)

Table 2

Cross-sectional determinants of closed-end fund discounts.

The dependent variable is fund discount (DISCOUNT) in percentage points by firm-year observations. The first column reports estimates from a pooled regression with year fixed effects; the second column reports the results from a Fama-MacBeth regression, and the third column reports the results of a pooled regression without year fixed effects. MV is log market capitalization. P is log market price. STDNAV is the residual standard deviation from a regression of monthly NAV returns on the Fama-French three factors, the momentum factor, and two international index factors. AGE is fund age in years. TO is the annual turnover rate (in percentage points) of a fund's shares. DIV is the annualized dividend yield in percentage points. FEES is the management fees as percentage of net asset values. INSIDER is the ownership share of insiders in percentage points. LIFEBOAT is a dummy variable for the existence of a lifeboat provision (see definition in Table 1 Panel B). SMB is the Fama-French small-minus-big annual returns. Bold fonts represent statistical significance at less than the 5% level. In pooled regressions, standard errors adjust for autocorrelation using the Newey-West method with half-window width of four years. In Fama-MacBeth regressions, standard errors adjust for autocorrelation of all orders assuming an AR(1) process of the time-series coefficient estimates. The number of observations is 1,477, and the sample covers the period 1988–2002. * and ** indicate significance at the 10% and 5% levels.

	(1) Year fixed effects	(2) Fama-MacBeth	(3) Pooled
MV	**0.828**	0.404	0.814
	(1.08)	(0.49)	(1.06)
P	−**2.962****	−**3.561****	−**4.041****
	(−2.49)	(−1.97)	(−3.37)
STDNAV	−**0.760****	−**0.637****	**0.494**
	(−2.80)	(−2.35)	(0.39)
AGE	−**0.094***	−**0.055**	−**0.011**
	(−1.74)	(−0.45)	(−0.23)
TO	−**0.021****	−**0.005**	−**0.037****
	(−2.65)	(−0.54)	(−4.96)
DIV	−**0.499****	−**0.422****	−**0.323****
	(−3.53)	(−2.64)	(−2.46)
FEES	**0.735**	0.714	0.590
	(0.52)	(0.97)	(0.40)
INSIDER	**0.101***	**0.110****	**0.092**
	(1.71)	(4.61)	(1.56)
LIFEBOAT	−**1.843**	−**1.394****	−**1.702**
	(−1.59)	(−2.96)	(−1.36)
SMB	–	–	−**0.107****
	–	–	(−2.85)
CNST	**17.515***	20.281*	14.749
	(1.81)	(1.88)	(1.50)
*R*sqr	0.182	–	0.070

the relation between *STDNAV* and the discount is negative and significant. This result, which reflects the sum of two opposite effects, is consistent with the result in Table 2 of Pontiff (1996). Finally, we find that dividend yields are negatively related to discounts.

Other important variables that we employ reflect the potential agency costs between fund managers and shareholders, which are often cited as a cause for CEF discounts. Based on the literature, our proxies for agency costs are the expense ratio (*FEES*) and the proportion of a fund's shares held by insiders (*INSIDER*). We find that *FEES* does not explain discounts.[18] This finding has also been

[18] The result does not change significantly if *FEES* is replaced with the residual from a regression of *FEES* on fund characteristics that could affect expenses for non-agency related reasons.

Table 3
Closed-End Fund Discounts around Open-Ending Attacks: Event Study.

This table reports the average discount of all funds subject to open-ending attempts in the seven event-time years from three years before an attempt ($t-3$) to three years afterwards ($t+3$), standard errors for the average are also reported. In the left four columns (1, 2, 3, and 4, "All sample"), funds are counted as zero discount funds after they are open-ended. In the right four columns (5, 6, 7, and 8, "Surviving sample"), funds drop out of the sample after being open-ended. In "Unadjusted" columns (1 and 5), discounts are expressed in their raw levels. In "Adj. for year fixed effect" columns (2 and 6), discounts are demeaned from average discount of all funds in our sample (including funds not under attack) in the same year. In "Adj. for fund historical" columns (3 and 7), discounts are reported in excess of their own historical level measured as the in-sample average through event year $t-4$. In "Adj. for matched funds" columns (4 and 8), discounts are subtracted from the average discounts of matched funds, where the latter are those that experience no open-ending attempts during the $[t-3,t+3]$ window and have very similar levels of discounts in year t-2 (within 90% and 110% of the discounts of the event funds). The total number of events during the 1989–2003 period is 127.

	All sample				Surviving sample			
	(1) Unadjusted		(2) Adj. for year fixed effect		(5) Unadjusted		(6) Adj. fro year fixed effect	
Year	Avg	Std err	Avg	Std err	Avg	Std err	Avg	Std err
$t-3$	18.34	1.12	6.20	1.01	18.34	1.12	6.20	1.01
$t-2$	21.20	1.23	6.88	1.09	21.20	1.23	6.88	1.09
$t-1$	19.82	1.07	6.03	1.05	19.82	1.07	6.03	1.05
Attempt	14.46	1.15	0.27	1.14	14.46	1.15	0.27	1.14
$t+1$	8.42	1.00	−4.19	1.03	14.41	1.34	2.39	1.19
$t+2$	7.33	1.12	−3.30	0.99	12.58	1.69	2.18	1.37
$t+3$	5.61	0.92	−3.57	0.89	9.59	1.43	1.36	1.18
	(3) Adj. for fund historical		(4) Adj. for matched funds		(7) Adj. for fund historical		(8) Adj. for matched funds	
Year	Avg	Std err	Avg	Std err	Avg	Std err	Avg	Std err
$t-3$	7.78	1.11	4.27	0.66	7.78	1.11	4.27	0.66
$t-2$	10.80	1.27	0.04	0.07	10.80	1.27	0.04	0.07
$t-1$	8.87	1.23	−0.49	0.70	8.87	1.23	−0.49	0.70
Attempt	3.81	1.44	−5.27	0.93	3.81	1.44	−5.27	0.93
$t+1$	−1.86	1.32	−10.78	1.38	3.70	1.57	−3.36	1.34
$t+2$	−2.92	1.50	−8.99	1.41	1.80	2.14	−0.21	1.59
$t+3$	−4.38	1.27	−8.41	1.65	−0.72	1.85	2.07	1.92

shown by Malkiel (1977), Barclay, Holderness, and Pontiff (1993), Gemmill and Thomas (2002), and Del Guercio, Dann, and Partch (2003). On the other hand, higher insider ownership is overall significantly associated with higher discounts, consistent with Barclay, Holderness, and Pontiff (1993).

Lastly, we include fund age (*AGE*) and the presence of a lifeboat provision (*LIFEBOAT*). The literature has shown that CEFs tend to trade at a premium after their initial public offering, and over time start trading at a discount. Surprisingly, we find the age effect to be slightly negative, though overall insignificant. As expected, the existence of a *LIFEBOAT* appears to reduce discounts.

Our regressions also include year fixed effects. As a robustness check, column 3 of Table 2 considers a more parsimonious alternative to year dummies. Following Lee, Shleifer, and Thaler (1991), we use the difference between the return on small stocks and large stocks as a proxy for investor sentiment. The results show that the proxy for sentiment is significantly related to the discount in the predicted negative direction.

Overall, a handful of covariates are able to explain a reasonable portion of the cross-sectional variation in fund discounts: they jointly explain 18.2% of the total variation in *DISCOUNT* at the fund-year level with the inclusion of year dummies. We include these covariates as we proceed to analyze the relation between discounts and activist arbitrage.

4.2. Analysis of open-ending attempts

4.2.1. Closed-end fund discounts around open-ending attempts: overview

We begin our analysis of open-ending attempts and their relation to CEF discounts by exploring the behavior of fund discounts around an open-ending attempt. The left panel of Table 3 considers all funds that were attacked. Here, funds that are actually open-ended are treated as having a zero discount after the open-ending. Column 1 shows the average path of raw fund discounts around an open-ending attempt. It demonstrates the decline in discount following an attempt. On average, a closed-end fund's discount is greater than 20% of its NAV two years before an attack. The discount drops to about 5.6% of NAV three years after the attack.

In order to provide a more meaningful interpretation of the effects of an attack, we adjust for time trends in the CEF industry and for the histories of the attacked funds. Columns 2 and 3 present the changes in the discount of attacked funds in excess of the mean discount of all funds in the same year and in excess of a fund's own historical average, respectively. Historical averages are calculated as a fund's average discount from all years up to four years before the current attack (an observation would drop out of the calculation for column 3 if the historical discount is not available). The results indicate that funds that are subsequently attacked by activists tend to have high

discounts. The discount drops substantially after the attack, and drops further in the subsequent three years.

It is possible that the results discussed above are due to mean reversion. Indeed, previous literature has noted that CEF discounts exhibit a tendency for mean reversion. If arbitrageurs target deeply discounted funds, the above pattern could be obtained independently of the attacks themselves. Column 4 addresses this issue. For each fund i under attack in year t, we find all the funds that did not experience attacks between $t-3$ and $t+3$ and that had $t-2$ discounts that are between 90% and 110% of fund i's discount in $t-2$.[19] We then report the discount of event funds in excess of the matched funds in column 4.[20] We find that, on average, funds that are attacked in year t have a discount at $t+3$ that is more than 8 percentage points lower than that of funds that had similar discount at $t-2$ and were not attacked. Hence, discount patterns of attacked funds cannot be explained solely by mean reversion.

Finally, the right panel of Table 3 (columns 5–8) repeats the analysis of columns 1–4 but only for the surviving sample. That is, here, funds drop out of the sample after they are open-ended. The purpose of this analysis is to show that open-ending attempts affect the discounts of attacked funds even if they end up not being open-ended. This happens because fund managements typically adopt remedial actions to fight discounts after the fund is attacked. Hence, Greenwood and Schor's (2009) result that the value-added from activism is associated only with firms that disappear from the public market does not seem to apply in our sample of closed-end funds.

In detail, looking at the right panel, we can see a similar, albeit more moderate behavior, of the discounts of attacked funds that survived as we saw for the whole sample of attacked funds. Column 8 addresses the issue of whether this pattern can be attributed to mean reversion. The short answer is no: during the first two years of the attack, funds that survive realize a greater reduction in their discounts than funds that started with a similar discount and were not attacked. However, unlike the case for the whole sample (column 4), the result disappears two years after the attack. (The results for $t+2$ and $t+3$ in column 8 are statistically insignificant).

4.2.2. Determinants of open-ending attempts: dual relation between attempts and discounts

We now turn to a rigorous econometric analysis of the determinants of open-ending attempts. The most important determinant is, of course, the discount. Estimating the effect of discounts on open-ending attempts is a complicated task. While deeply discounted CEFs are expected to attract more attacks since they offer greater potential profit to arbitrageurs, a CEF discount should decrease if the market expects that the fund is susceptible to an attack. Thus, a simple reduced-form regression of observed attacks on observed discounts could underestimate the sensitivity of attacks to discounts and understate the rational-expectation's component in discounts. The structural model underlying our analysis reflects these effects:

$$
\begin{aligned}
&ATTEMPT^{*}_{i,t} = \beta DISCOUNT_{i,t-1} + \gamma X_{i,t-1} + \varepsilon_{i,t},\\
&ATTEMPT_{i,t} = I(ATTEMPT^{*}_{i,t} > 0),\\
&DISCOUNT_{i,t} = \mu_1 X_{i,t} + \mu_2 Z_{i,t} + \omega_{i,t},\ Z \neq \Theta,\\
&\rho = corr(\varepsilon_{i,t}, \omega_{i,t-1}) \leq 0. \qquad (1)
\end{aligned}
$$

In (1), subscripts i and t index for fund and year, respectively. $ATTEMPT^{*}_{i,t}$ is a latent variable for the propensity of fund i to be the target of an open-ending attempt in year t, and $ATTEMPT_{i,t}$ is the observed binary outcome summarizing whether an open-ending attempt occurred or not. (The construction of this variable was described in Section 3.) $DISCOUNT_{i,t}$ is defined as in Section 4.1. $X_{i,t}$ is a vector of variables that affect both the discount and the probability of an open-ending attack. $Z_{i,t}$ is a vector of instrumental variables that only affect discounts directly. The ways in which variables $X_{i,t}$ and $Z_{i,t}$ affect the discount were reviewed in Section 4.1. Residual errors, $\varepsilon_{i,t}$ and $\omega_{i,t-1}$, in (1) are jointly normally distributed.[21]

A key feature of the model is that the first and the third equations in (1) may be linked because the unobserved shock in *ATTEMPT* may negatively affect the residual discount (i.e., $\rho = corr(\varepsilon_{i,t}, \omega_{i,t-1}) \leq 0$). The point is that shocks to the likelihood of an open-ending attempt may be observed by market participants and be priced so as to affect the discount. An example of such a shock is the emergence of arbitrageurs that target CEFs of a particular type. Hence, identifying the system in (1) requires a set of instrumental variables.

We use three $Z_{i,t}$ variables that enter the *DISCOUNT* equation but not the *ATTEMPT* equation. First, we use *DIV*. High dividends are expected to reduce the discount as they lead to partial liquidation of the fund. The effect can be quite significant given that dividends are expected to be paid over the entire future horizon. For arbitrageurs who attack the fund, however, taking the discount as given, the effect of the dividend is very small, given that

[19] For nine cases, this range is widened to 80–120% due to data availability.

[20] Note that the excess discount in $t-2$ is very close to zero by construction. Our choice of $t-2$ as the matching year reflects a balance between being close enough to the event, but still far enough to be roughly free from the anticipation effect that causes a decrease in the discount of the attacked fund before the attack started.

[21] Note that we include in the estimation observations where the fund's discount is negative even though such funds must be immune to attacks. The reason we do not automatically exclude those observations is that there is no theoretical cutoff discount level above which attacks become likely. For example, a discount level of 0% is not a natural cutoff since funds with a 0.1% discount are probably as much immune to attacks as funds with a 0% discount. As a result, our empirical strategy is to rely on the maximum likelihood function to trace out the predicted probability at each level of discount. Fortunately, the parametric specification of the probit, which we use here, does not impose a linear relationship between the predicted probability and the covariates. Hence, if funds with a low discount (including negative discounts) are empirically not subject to attacks, then the probit likelihood function will fit the data such that the predicted probabilities of attacks on such funds are arbitrarily close to zero.

Table 4
Determinants of open-ending attempts.

This table reports results from estimating the first equation of system (1). The dependent variable is the occurrence of open-ending attempts at the fund-year level. All regressors are lagged for one year. *MV, STDNAV, AGE, TO, FEES*, and *INSIDER* are defined in Table 2. *DISCOUNT* is the fund discount in percentage points. *GOV* is the sum of three indicator variables: staggered board, supermajority vote, and special meetings as defined in Table 1 Panel B. *NAVRET* is the fund's NAV return as defined in Table 1 Panel A. Columns 1 and 3 report one-stage probit estimates without adjusting for the feedback effect. Columns 2, 4, 5, and 6 apply the two-stage estimation, with the additional exogeneity test reported below the regressions. Reported for each covariate are the unscaled probit coefficient (in bold fonts), the *t*-statistic (in parentheses), and the sample average incremental probability for a unit change in the covariate (in percentage points). In columns 2, 4, 5, and 6, the incremental probabilities also integrate out the variation of *RESIDUALDISC* (the residual from the second equation of (1)). In the exogeneity tests, reported are the θ estimate (the loading of *RESIDUALDISC* in the *ATTEMPT* equation), its *t*-statistics, and the implied ρ value (the correlation coefficient of the two error disturbances in (1)). The sample size is 1,445 for the full sample period 1989–2003. * and ** indicate significance at the 10% and 5% levels.

	Full sample				1989–1993	1994–2003
	1	2	3	4	5	6
DISCOUNT	**0.034****	**0.054****	**0.041****	**0.053****	**0.184****	**0.034****
	(9.53)	(7.03)	(9.15)	(5.55)	(3.53)	(3.45)
	0.66%	1.07%	0.77%	1.03%	2.43%	0.71%
LN(MV)	–	–	**−0.033**	**−0.025**	**0.785****	**−0.075**
	–	–	(−0.62)	(−0.48)	(3.25)	(−1.33)
	–	–	−0.61%	−0.49%	10.39%	−1.57%
STDNAV	–	–	**−0.001**	**0.000**	**−0.003**	**−0.003**
	–	–	(−0.06)	(−0.02)	(−0.03)	(−0.13)
	–	–	−0.02%	−0.01%	−0.03%	−0.06%
AGE	–	–	**0.027**	**0.020**	**−0.175**	**−0.042**
	–	–	(0.40)	(0.30)	(−1.00)	(−0.50)
	–	–	0.52%	0.39%	−2.32%	−0.89%
TO	–	–	**−0.002**	**−0.001**	**0.002**	**−0.003***
	–	–	(−1.44)	(−1.08)	(0.57)	(−1.83)
			−0.03%	−0.03%	0.03%	−0.06%
FEES	–	–	**−0.076**	**−0.085**	**0.169**	**−0.139***
	–	–	(−1.13)	(−1.25)	(0.60)	(−1.74)
	–	–	−1.44%	−1.65%	2.23%	−2.91%
GOV	–	–	**0.209****	**0.185****	**−0.831****	**0.241****
	–	–	(3.71)	(3.15)	(−3.03)	(3.90)
			3.95%	3.58%	−11.00%	5.06%
INSIDER	–	–	**0.006**	**0.005**	**−0.034**	**0.010****
	–	–	(1.32)	(1.16)	(−1.58)	(2.09)
	–	–	0.11%	0.10%	−0.45%	0.21%
NAVRET			**−0.002**	**−0.004***	**−0.016***	**−0.002**
			(−1.29)	(−1.74)	(−1.79)	(−0.68)
			−0.05%	−0.07%	−0.21%	−0.03%
Exogeneity test:						
$\hat{\theta}$	–	**−0.025****	–	**−0.015**	**−0.120****	**0.001**
	–	(−2.97)	–	(−1.47)	(−2.24)	(0.09)
Implied $\hat{\rho}$	–	**−0.312**	–	**−0.182**	**−0.689**	**0.012**
NOB	1445	1445	1445	1445	367	1078
Goodness of fit	0.096	0.104	0.132	0.134	0.206	0.141

they only plan to hold the shares for a short period of time. Second, we use *LIFEBOAT*. As explained previously, a lifeboat is a commitment by the fund to remedial actions designed at narrowing the discount. Discounts should fully reflect the potential effect(s) of lifeboats. Conditional on the discount, the existence of a lifeboat should not affect the probability of an attempt. Third, we use the Fama-French small-minus-big factor (*SMB*), which empirically comoves with the CEF discounts. This comovement has several explanations, both behavioral (Lee, Shleifer, and Thaler, 1991), and rational (Cherkes, Sagi, and Stanton, 2009, or Swaminathan, 1996). For our purpose, it only matters that activists care about the *SMB* factor solely for its effect on discounts.

The $X_{i,t}$ variables include the other determinants of the discount reviewed in Section 4.1. We add a governance variable that we expect affects the probability of an attack. *GOV* is an index (0–3) aggregated over the existence of a staggered board, supermajority voting, and the ability of the board to call a special meeting. The higher the index, the worse is the firm's governance structure (see Gompers, Ishii, and Metrick, 2003).[22] We also add a variable *NAVRET* that captures the raw return on the NAV of the fund. This is because many activists mention a poor return on the funds' assets as a trigger for an attack.

The model in (1) falls within the general class of probit models with an endogenous continuous variable. It differs from a linear simultaneous system in that *ATTEMPT** is an unobserved latent variable. As a result, the two endogenous observed variables—*ATTEMPT* and *DISCOUNT*—cannot be solved as linear functions of the exogenous variables, and the conventional instrumental variable method does

[22] According to Pound (1988), special meetings are used by managers to shorten the time for collecting proxies.

not apply. Two methods that have been used extensively in the labor economics literature are well-tailored for our model specification: a two-stage conditional maximum likelihood (2SCML) method introduced by Rivers and Vuong (1988), and a full-information maximum likelihood (FIML) method applied in Evans, Oates, and Schwab (1992). We have applied both methods and obtained similar results. We report those from the Rivers and Vuong (1988) method for its tractability and ease of interpretation.[23]

To begin the estimation procedure, we rewrite Eq. (1) as

$$ATTEMPT^{*}_{i,t} = \beta DISCOUNT_{i,t-1} + \gamma X_{i,t-1} + \theta\omega_{i,t-1} + \eta_{i,t}, \quad (2)$$

where $\varepsilon_{i,t} = \theta\omega_{i,t-1} + \eta_{i,t}$ is a linear projection of $\varepsilon_{i,t}$ onto $\omega_{i,t-1}$, and $\eta_{i,t}$ is orthogonal to all the other variables. Eq. (2) is estimated using a two-step procedure. First, we estimate the *DISCOUNT* equation in Eq. (1), as we did in Section 4.1, and retain the residuals $\hat{\omega}_{i,t-1}$. Second, we estimate Eq. (2) using the probit method, where $\omega_{i,t-1}$ is replaced with $\hat{\omega}_{i,t-1}$.[24]

Table 4 reports the results on the determinants of open-ending attempts. The dependent variable is a dummy for the occurrence of an open-ending attempt at the fund-year level. The mean of the dependent variable is 13.3% for all fund-year observations. Reported coefficients are the un-scaled probit estimates from Eq. (2) (and the associated *t*-statistics) and the change in the probability of an open-ending attempt for a unit change in the covariates (as derived in Eq. (5) in the Appendix A). Separately reported are $\hat{\theta}$ (the coefficient on the residual discount in Eq. (2)) and $\hat{\rho}$ (the implied correlation between the two error disturbances in Eq. (1)).

A simple regression of *ATTEMPT* on *DISCOUNT* shows that a one percentage point increase in the observed discount is associated with a 0.66 percentage point increase in the probability of an open-ending attempt in a given year (column 1). When accounting for the endogeneity of *DISCOUNT*—i.e., the effect of the possibility of future attempts on the residual discount—in column 2, the sensitivity of the probability to the discount increases substantially to 1.07% in a given year. Columns 3 and 4 add other covariates as controls. These additional explanatory variables do not significantly change the effect of the discount on open-ending activities. Columns 5 and 6 report results for the subsamples before and after the legal reform of 1992. Note that the sensitivity of open-ending activities to the discount is stronger before the legal reform. This is perhaps because open-ending attempts were difficult to launch before the reform, so only deeply discounted funds were targeted.

The negative sign of $\hat{\theta}$ reported at the bottom of Table 4 demonstrates that the discount shrinks in anticipation of the higher probability of open-ending activities. This creates a feedback loop between discounts and open-ending attempts. This negative feedback loop is significant in columns 2 and 5. Before the legal reform of 1992, there were fewer open-ending attempts, and hence, conditional on an attempt taking place, the probability of success was higher. This provides the rationale for why the feedback loop was strong enough to be statistically significant mostly before the legal reform (column 5).[25]

Interestingly, after controlling for the discount, the fund's past-year NAV return is only marginally significant in explaining activists' attempts. Hence, poor return seems to affect such attempts only (or mostly) to the extent that it is reflected in the discount. In robustness analysis, we constructed measures of NAV return that control for benchmark returns or market factors, but it turns out that they have even lower power in explaining the attempts.

4.2.3. Determinants of open-ending attempts: communication and governance

We now turn to analyze other determinants of open-ending attempts. As we discussed before, the 1992 reform seems to have had a large effect on the volume of open-ending attempts. Columns 5 and 6 of Table 4 break the sample into two subperiods (all regressors are lagged by one year): 1989–1993 (pre-reform) and 1994–2003 (post-reform). Other things equal, there is an 8.48 percentage point increase in the probability of open-ending attempts during the second period (*t*-statistic=3.58). Since the reform was designed to lift barriers on communication among shareholders, the time-series pattern suggests that one important determinant of attacks is the ease of communication.

Clearly, the time-series pattern does not uniquely identify the effect of communication. The observed pattern could also result from other changes that occurred around 1993. One possibility is the increase in the number of hedge funds engaged in open-ending activities after 1993.[26] To further investigate the role of communication, Table 5 presents results using cross-sectional measures of communication costs.

The first variable we consider is share turnover. High turnover makes communication and coordination more difficult for two reasons (see Pound, 1988). First, given the time lag at which account names become available to activists, the latter may not get up-to-date shareholder contacts at high turnover funds. Second, there is a gap of 10–60 days between the record date (which qualifies a shareholder to vote) and the actual vote date. Investors

[23] See Rivers and Vuong (1988) for a discussion of their test in comparison with Heckman's (1978) generalized two-stage simultaneous probit (G2SP) method. Rivers and Vuong (1988) indicate that the two methods have similar asymptotic properties, but their method is easier to implement, and fares more favorably in limited samples.

[24] Additional technical details regarding the estimation methods are discussed in the Appendix A.

[25] The test of the feedback loop has low power because the residual discount also contains some exogenous components of *DISCOUNT* that are positively associated with *ATTEMPT*. Therefore, finding a significantly negative sign for $\hat{\theta}$ is strong evidence for a feedback loop.

[26] The attempt to attribute the surge in open-ending activities solely to the increasing presence of hedge funds faces two main problems. First, both the number of hedge funds and their assets saw smooth growth during our sample period, with no visible structural break at any point, including years around 1993. (Information is obtained from Hedge Fund Research, Chicago.) Second, open-ending activities are highly concentrated among a handful of players, even in the latter part of our sample.

Table 5
Effects of shareholder communication.

The dependent variable is the occurrence of an open-ending attempt at the fund-year level. All regressors are the same as in Table 4 columns 5 and 6 except that each column uses a different proxy for shareholder communication (*COMMUNICATION*). The default measure is turnover in column 1 (repeated from columns 5 and 6 in Table 4). Columns 2 and 3 use the average trade size (in 1,000 shares) and the proportion of trades that are more than 2,000 shares (in percentage points). Column 4 uses the dummy variable equal to one if the institutional ownership exceeds 15% for the fund-year. All regressors in Table 4 enter as controls but only coefficients on *DISCOUNT* and *COMMUNICATION* are reported (other coefficients are repetitively similar from those in Table 4 and are thus omitted). Reported for each covariate are the unscaled probit coefficient (in bold fonts), the *t*-statistics (in parentheses), and the sample average incremental probability for a unit change in the covariate (in percentage points). Reported below *COMMUNICATION* are the *t*-statistics for the difference between the coefficients from the two subsamples. The sample size is 367 for the 1989–1993 subsample, and 1,078 for the 1994–2003 subsample. * and ** indicate significance at the 10% and 5% levels.

	Turnover		Avg trade size (1,000)		%(Trade > 2,000)		(%Institution > 15%)	
	1989–1993	1994–2003	1989–1993	1994–2003	1989–1993	1994–2003	1989–1993	1994–2003
	1		2		3		4	
DISCOUNT	**0.184****	**0.034****	**0.146****	**0.031****	**0.139****	**0.030****	**0.155****	**0.028****
	(3.53)	(3.45)	(3.45)	(3.28)	(3.37)	(3.11)	(3.57)	(2.81)
	2.43%	0.71%	1.96%	0.64%	1.86%	0.63%	2.07%	0.59%
COMMUNICATION	**0.002**	**−0.003***	**−0.126**	**0.269****	**−0.050**	**0.030****	**−0.595**	**0.361****
	(0.57)	(−1.83)	(−0.77)	(3.47)	(−1.56)	(3.17)	(−1.37)	(2.53)
	0.03%	−0.06%	−1.41%	5.56%	−0.36%	0.61%	−5.91%	7.50%
(*t*-statistics for two-sample comparison)	(−0.213)		(2.07)**		(1.49)		(3.49)**	
NOB	367	1078	367	1078	367	1078	367	1078
Goodness of fit	0.206	0.141	0.185	0.151	0.187	0.149	0.209	0.152

with short holding periods (corresponding to high turnover) may cease to be shareholders by the voting date or expect to exit the fund soon, and thus, lack the incentive to cast a careful vote. Column 1 shows that after 1993, a 100 percentage point increase in the annual turnover rate is associated with a 6 percentage point lower probability of an attack, significant at the 10% level. While this result identifies high turnover as an impediment to activism, it is commonly believed that this variable enhances market efficiency. This is because high turnover improves liquidity, and can contribute to lower discount (see Table 2). This ambivalent effect of liquidity is consistent with the models of Kahn and Winton (1998) and Bolton and von Thadden (1998).

The second variable we use proxies for the average shareholder account size. Holding the market value of a fund constant, the smaller the average holding per account, the more shareholders an arbitrageur needs to persuade to have enough support. Accessing many shareholders and motivating them to act is logistically difficult. Direct information about individual account size is not readily available. However, it is reasonable to assume that the size of a typical trade by an investor in a fund is a good proxy for his total holdings in the fund (see Battalio and Mendenhall, 2005). Using the Trade and Quote (TAQ) and The Institute for the Study of Security Markets (ISSM) databases, we obtain the average trade size (in 1,000 shares) of a fund-year, and the proportion of trades that are more than 2,000 and 5,000 shares. Columns 2 and 3 of Table 5 show the effect of trading size on open-ending attempts. In the post-1993 period, every 1,000 share increase in the average trading size (the mean and standard deviation are 1,260 and 710 shares, respectively) is associated with a 5.6 percentage point increase in the probability of an attack. Using the proportion of trades above 2,000 shares (or 5,000, not tabulated) yields similar results. These results are significant at less than 5%.

The last variable we entertain is the percentage of the fund's shares that are owned by institutional investors. It is easier to locate and coordinate with institutional shareholders since they are bigger and are required to disclose their quarterly ownership. We construct a dummy variable for institutional shares being greater than 15%.[27] To ensure that we are not capturing the holdings of the activists themselves with this variable, we exclude holdings by institutions that ever attacked the fund during our sample period. Column 4 shows that the effect on the probability of an open-ending attempt after 1993 is 7.5 percentage points, significant at the 5% level. Using the level of total institutional ownership (not reported) yields similar results.

Overall, the evidence suggests that the ease of communication among shareholders is an important factor in generating activist attacks against CEFs. An important aspect of our results is that our measures explain open-ending attempts only after the 1992 reform. Table 5 shows that the effect of the communication variables is insignificant in the pre-reform subsample. We conjecture that before the 1992 reform, communication was so severely constrained by law that characteristics of the shareholder base did not matter much for activist arbitrageurs. These characteristics became significant only after the reform allowed various forms of communication. The bottom of Table 5 reports the results of a test for whether the effect

[27] In a private interview, Phillip Goldstein said that he targets funds with more than 15% institutional ownership.

of communication is different between the two subsamples. The results indicate that the effect of communication is indeed greater after the reform than before the reform. The results, however, are only significant in two out of the four columns.[28]

There is a robustness issue in interpreting the results regarding the effect of communication costs because these variables are affected by the attacks. For example, institutions may know that a fund is being targeted and react by buying its shares. To reduce this concern, our analysis uses measures of communication that lag the attack by one year. We also conducted a robustness check using a lag of two years. The results are similar.

Another class of variables likely to affect activist arbitrageurs' attacks against closed-end funds is governance variables. Del Guercio, Dann, and Partch (2003) show that governance variables are important determinants for various decisions of CEF managements and boards. Using the *GOV* variable defined in Section 4.2.2, we find (in Table 4) that after 1993, the addition of one of the three provisions in *GOV* (which makes governance more pro-management) is associated with an increase of about 5.1 percentage points in the probability of an attempt (significant at the 5% level). Moreover, funds with higher insider ownership invite more attempts after 1993 (significant at the 5% level). Such relations were non-existent beforehand. Following Bebchuk, Coates, and Subramanian (2002) and Del Guercio, Dann, and Partch (2003), we also use a dummy variable for staggered board in place of *GOV*. This specification (not tabulated) yields even stronger results: the sample average incremental probability is 7.8% (significant at the 5% level).[29] This evidence echoes Choi's (2000) finding that after the 1992 reform, firms with stronger management entrenchment and more pro-manager governance became more frequent targets of shareholder proposals. Our explanation is that communication among shareholders is particularly important when managers have more power in opposing dissidents. Hence, activism against firms with pro-manager governance became more prominent after the 1992 reform. Interestingly, although high fees may also point to bad governance, we find that high-fee funds are overall less susceptible to attacks in the post-reform era (significant at the 10% level). We do not have a good explanation for why this variable behaves differently than the other governance variables.

4.2.4. Determinants of successes of open-ending attempts

We now turn to an analysis of the determinants of the success of open-ending attempts. Table 6 Panel A repeats the same analysis conducted in Table 4, except we replace the dependent variable with a dummy variable for actual open-endings. We find a strong dual relation between actual open-endings and fund discounts prior to the attempts. While a higher discount level is associated with higher likelihood that the fund will be open-ended, the prospects of open-ending shrink the discount. In equilibrium, a one percentage point increase in the discount is associated with a 0.11 percentage point increase in the probability of open-ending (column 1 of Panel A). After incorporating the feedback loop, this sensitivity increases to 0.29 percentage points (column 2 of Panel A). Compared to Table 4, the results in Panel A of Table 6 show a stronger effect of actual open-endings on discounts. This is intuitive as ex post successful attacks are probably ex ante more powerful and thus, have a stronger effect on market prices.

An interesting observation reflected in Panel A is that successful open-ending attempts are not easy to predict based on observables, especially during the post-reform period. Indeed, the goodness-of-fit measures are modest. This is consistent with an equilibrium where activists profit from their activities because the market cannot predict them (Maug, 1998).

Defining "success" as the eventual open-ending of a closed-end fund, while natural and intuitive, does not accurately characterize the complicated outcomes of open-ending attempts. First, while in some cases funds are open-ended within the same year of the attempt, in other cases open-ending takes much longer. Such cases are not as successful because the arbitrageurs need to commit more of their capital and time and hence, realize lower profits. Second, arbitrageurs can also profit from their open-ending attempts when the fund remains closed. This happens when the discount shrinks as a result of the attack, for example, if the fund management takes actions to suppress the discount. We address these features with a duration-to-success model.

Using the language of a duration analysis, we say that a "spell" starts when an attack occurs. The initial conditions are the funds' characteristics just before the attack. If the attempt does not succeed by the end of our sample period (that is, by 2003), the duration of the spell is treated as being censored on the right end. Alternatively, if the attempt succeeds at a time within our sample period, the attempt-to-success duration is recorded without censoring. Combining both types of observations, we get the following log-likelihood function for duration:

$$\ln(L) = \sum_{\text{uncensored spells}} h(t|x) + \sum_{\text{all spells}} \ln S(t|x). \tag{3}$$

In Eq. (3), h is the baseline hazard function, where we adopt the most commonly used eibull distribution: $h = \exp(-x\beta)\theta[t \cdot \exp(-x\beta)]^{\theta-1}$; t is the time from the start of an attempt; S is the survival function: $S = \exp(-h \cdot t)$. All covariates x are measured at the time an attempt starts (the discount is measured at the end of the previous period). The coefficients $\hat{\beta}$ (vector) and $\hat{\theta}$ (scalar) are estimable using the maximum likelihood estimation method. We are interested in the effect of the x variables on the duration of attempts. A positive coefficient means that a higher value of the covariate is associated with

[28] The reason for the lower significance here is that the insignificance of the effect of communication on attacks in the pre-reform period is associated with high standard errors, which inflate the standard errors of the difference statistics. Hence, the significance of the difference statistics is lower than that of the post-reform coefficients.

[29] There might be an endogeneity problem as funds that anticipate higher probability of activist attacks are more likely to add governance provisions. To alleviate this concern, we conducted a robustness test, in which we included only the funds that did not change their governance in the analysis. The results remained qualitatively the same.

Table 6
Determinants of open-ending successes.

Panel A: Actual open-endings

This panel repeats the analysis of Table 4 by replacing the dependent variable with a dummy variable for the actual open-endings. The definitions of all covariates and sample coverage are the same as in Table 4. * and ** indicate significance at the 10% and 5% levels.

	Full sample				1989–1993	1994–2003
	1	2	3	4	5	6
DISCOUNT	**0.019****	**0.042****	**0.023****	**0.060****	**0.214****	**0.047****
	(3.09)	(3.28)	(3.25)	(3.57)	(2.32)	(2.60)
	0.11%	0.29%	0.12%	0.46%	1.92%	0.32%
LN(MV)	–	–	**−0.059**	**−0.035**	**0.757****	**−0.099**
	–	–	(−0.73)	(−0.43)	(2.07)	(−1.07)
	–	–	−0.32%	−0.27%	6.78%	−0.67%
STDNAV	–	–	**−0.032**	**−0.030**	**−0.601****	**−0.003**
	–	–	(−0.88)	(−0.79)	(−2.01)	(−0.07)
	–	–	−0.17%	−0.23%	−5.38%	−0.02%
AGE	–	–	**−0.129**	**−0.150**	**0.314**	**−0.265***
	–	–	(−1.23)	(−1.41)	(1.02)	(−1.85)
	–	–	−0.69%	−1.16%	2.81%	−1.78%
TO	–	–	**−0.003**	**−0.002**	**0.006**	**−0.003**
	–	–	(−1.52)	(−1.06)	(0.75)	(−1.18)
	–	–	−0.02%	−0.02%	0.05%	−0.02%
FEES	–	–	**−0.016**	**−0.028**	**0.611**	**−0.114**
	–	–	(−0.16)	(−0.27)	(1.40)	(−0.82)
	–	–	−0.09%	−0.22%	5.47%	−0.77%
GOV	–	–	**−0.109**	**−0.177***	**−1.419****	**−0.053**
	–	–	(−1.09)	(−1.72)	(−2.80)	(−0.48)
	–	–	−0.59%	−1.37%	−12.70%	−0.36%
INSIDER	–	–	**−0.004**	**−0.006**	**−0.052**	**0.001**
	–	–	(−0.42)	(−0.71)	(−1.30)	(0.12)
	–	–	−0.02%	−0.05%	−0.46%	0.01%
NAVRET	–	–	**0.000**	**−0.004**	**−0.029****	**−0.001**
	–	–	(−0.10)	(−1.00)	(−1.97)	(−0.28)
	–	–	0.00%	−0.03%	−0.26%	−0.01%
Exogeneity test:						
$\hat{\theta}$	–	**−0.030****		**−0.045****	**−0.209****	**−0.027**
	–	(−2.08)		(−2.51)	(−2.18)	(−1.37)
Implied $\hat{\rho}$	–	−0.340		−0.479	−0.731	−0.312
NOB	1445	1445	1445	1445	367	1078
Goodness of fit	0.031	0.043	0.064	0.083	0.307	0.078

Panel B: Duration of open-ending attempts

This panel reports results from estimating the hazard model specified in (3) at the fund level using the maximum likelihood estimation method with a Weibull-distribution baseline hazard. The dependent variable is the length of time between the start of an open-ending attempt in a fund and its success (if no success avails, the observation is treated as right-censored at the end of the sample period). In columns 1 and 2, success is narrowly defined as actual open-ending; in columns 3 and 4, it is broadly defined as either open-ending, or shrinkage of discount to below 5%. All covariates are the same as defined in Table 4. Reported coefficients are the marginal effect of the covariates on the log expected duration. *T*-statistics (associated with $\hat{\beta}$ in (3)) are reported below in parentheses. Also reported are the Weibull coefficient ($\hat{\theta}$) for each specification, the corresponding *t*-statistic is for $\hat{\theta}-1$, the measure of duration dependence (that is, if $\hat{\theta}-1>0$ ($\hat{\theta}-1<0$), the instantaneous hazard rate is increasing (decreasing) with time). The number of observations is 106, and the sample covers the period 1988-2003. * and ** indicate significance at the 10% and 5% levels.

	Open-ending		Open-ending & (discount >5%)	
	(1)	(2)	(3)	(4)
DISCOUNT	**0.008**	**0.008**	**0.000**	**0.000**
	(0.76)	(0.80)	(−0.05)	(−0.05)
LN(MV)	**−0.017**	**−0.013**	**0.008**	**0.008**
	(−0.39)	(−0.31)	(0.19)	(0.22)
STDNAV	**−0.011**	**−0.026**	**−0.027**	**−0.033**
	(−0.21)	(−0.51)	(−0.63)	(−0.77)
AGE	**0.497****	**0.531****	**0.454****	**0.468****
	(2.53)	(2.86)	(2.55)	(2.82)
TO	**0.001**	**0.001**	**0.000**	**0.000**
	(0.29)	(0.17)	(0.06)	(−0.01)
FEES	**0.112**	**0.129**	**0.183**	**0.188**
	(0.89)	(1.07)	(1.54)	(1.62)

Table 6 (*continued*)

Panel B: Duration of open-ending attempts
This panel reports results from estimating the hazard model specified in (3) at the fund level using the maximum likelihood estimation method with a Weibull-distribution baseline hazard. The dependent variable is the length of time between the start of an open-ending attempt in a fund and its success (if no success avails, the observation is treated as right-censored at the end of the sample period). In columns 1 and 2, success is narrowly defined as actual open-ending; in columns 3 and 4, it is broadly defined as either open-ending, or shrinkage of discount to below 5%. All covariates are the same as defined in Table 4. Reported coefficients are the marginal effect of the covariates on the log expected duration. *T*-statistics (associated with $\hat{\beta}$in (3)) are reported below in parentheses. Also reported are the Weibull coefficient ($\hat{\theta}$) for each specification, the corresponding *t*-statistic is for $\hat{\theta}-1$, the measure of duration dependence (that is, if $\hat{\theta}-1>0$ ($\hat{\theta}-1<0$), the instantaneous hazard rate is increasing (decreasing) with time). The number of observations is 106, and the sample covers the period 1988-2003. * and ** indicate significance at the 10% and 5% levels.

	Open-ending		Open-ending & (discount >5%)	
	(1)	(2)	(3)	(4)
GOV	**0.265***		**0.104**	
	(1.94)		(0.93)	
STAGBOARD		**0.513****		**0.230**
		(2.22)		(1.25)
INSIDER	**0.087****	**0.087****	**0.058****	**0.059****
	(2.74)	(2.77)	(2.50)	(2.55)
NAVRET	**−0.004**	**−0.003**	**−0.006***	**−0.006**
	(−0.82)	(−0.56)	(−1.64)	(−1.50)
Weibull coefficient ($\hat{\theta}$)	**0.838***	**0.834***	**0.820****	**0.817****
t-Statistic for ($\hat{\theta}-1$)	(−1.68)	(−1.73)	(−2.13)	(−2.18)

lower success rates for the activist attempt (as it takes longer to achieve the goal).

Panel B of Table 6 provides the results from estimating Eq. (3). The reported coefficients are $\hat{\theta}$ and $\hat{\beta}$. In columns 1 and 2, the measure of success is narrowly defined as actual open-endings. In columns 3 and 4, success is more broadly defined as either open-ending or near disappearance of the discount (i.e., the discount dropped to below 5%).

We find several results that demonstrate how entrenched management is better able to defend against activists' attacks. First, older, established funds take significantly longer to be open-ended.[30] Second, our *GOV* variable is a direct measure of managerial entrenchment. Column 1 indicates that high *GOV* is indeed associated with longer duration (*t*-statistic=1.94). Among the components of *GOV*, staggered board has the most intuitive effect on duration: in order to have absolute control of the board, activists need to win proxy fights in at least two annual elections if the fund has a staggered board. In Column 2, we replace *GOV* with a dummy variable for staggered board alone (*STAGBOARD*). The coefficient is now strengthened (*t*-statistic=2.22). Our calculations of the economic effect show that the presence of a staggered board increases the time to open-ending (starting from the occurrence of an attempt) by almost three years. Third, we see that *INSIDER*, which captures the management's voting power, is significantly positively related to duration.

Columns 3 and 4 broaden the definition of "successful attempt" to either open-ending, or shrinkage of the discount to below 5%. The reported results are overall consistent with those in the first two columns, but are noisier. This is not surprising given that a reduction in the discount could be due to events unrelated to activism.

Finally, note that the discount is slightly positively related to the time to success. It might seem paradoxical that a higher discount does not make it easier for arbitrageurs to succeed. Given our earlier discussion on the feedback effect, however, the correct interpretation is that the discount already reflects the prospect of a successful attempt.[31]

5. Concluding remarks

In this paper, we document strong and frequent attempts by activist arbitrageurs to open-end closed-end funds in the wake of the SEC's proxy reform in 1992. We find a dual relationship between activist arbitrageurs' activities and funds' discounts. On the one hand, activists tend to target deeply discounted funds. On the other hand, funds' discounts reflect such activity in a forward-looking way and shrink when an attack is expected. Following an attack, the discount shrinks further or completely disappears (if the fund is open-ended), so that overall activist arbitrage is found to have a substantial effect on CEF discounts. Aside from the discount, the ability of shareholders to communicate and coordinate with each other and the governance of the fund are found to be important

[30] While it is true that a fund gets to an older age because it survived attacks, our results go further in that the "instantaneous hazard" conditional on the fund's surviving to the current date is also negatively related to age.

[31] At this stage there is no powerful econometric method to identify the feedback or anticipation effect in duration models (see a recent discussion by Abbring and van den Berg (2003)).

factors in determining which funds are being targeted. Our work shows that activist arbitrage is an important activity undertaken by market participants to eliminate the difference between market prices and potential security values. In the remainder of this section, we draw some broad implications from our work to several fields.

Source of CEF discounts: One of the biggest puzzles in the CEF literature (with broad implications to financial economics) is the source of the discount. The two main hypotheses in the literature link discounts to irrational mispricing (Lee, Shleifer, and Thaler, 1991) or to agency problems (Barclay, Holderness, and Pontiff, 1993; Ross, 2002; Berk and Stanton, 2007; Cherkes, Sagi, and Stanton, 2009). Our study offers suggestive evidence that agency problems play at least some role in the emergence of CEF discounts. First, we show that activist arbitrageurs consider governance variables when selecting their targets. Second, in the vast majority of events in our sample, discounts fall after managers take corrective actions such as a share repurchase, dividend increase, or change in investment advisors.

Limits to arbitrage: The persistence of CEF discounts is often used to demonstrate the presence of limits to arbitrage in financial markets (see Lee, Shleifer, and Thaler, 1991; Pontiff, 1996; Gemmill and Thomas, 2002). A large body of literature has pointed out various market frictions that contribute to such limits. Our work shows that the costs of communication and coordination—imposed by law, ownership structure, or the trading environment of funds—can also be viewed as limits to arbitrage since they interfere with the work of activist arbitrageurs. Importantly, our work also has indirect implications for pure-trading arbitrage, given that without the work of activist arbitrageurs there is no guarantee that CEF share prices will ever converge to the NAVs, and thus, the profit from pure-trading arbitrage becomes more uncertain.

The 1992 *proxy reform*: The evidence presented in this paper suggests that the proxy reform implemented by the SEC in 1992 had a major effect on closed-end funds. Measuring the value created by open-ending attempts based on the decrease in discount following attempts, we calculate that the reform created $124 million per year to CEF shareholders. Adjusting for mean reversion in discounts (as we did in columns 4 and 8 of Table 3), the estimated value created by the reform to CEF shareholders amounts to $32 million per year. The only other paper of which we are aware that tries to quantify the effects of the proxy reform of 1992 is by Choi (2000). Using a much smaller sample of shareholder proposals in regular corporations, he does not find any real effect of the 1992 reform.

Feedback loops in financial markets: A basic feature of the interaction between financial markets and corporate finance is that market prices affect and reflect corporate activities simultaneously. As we argued above, CEF discounts attract activist arbitrageurs, but these discounts shrink in anticipation of an activist arbitrageurs' attack. This negative feedback loop has many interesting implications; most of them have not yet been explored in the literature. For example, the fact that market prices reflect anticipated activist attacks creates a disincentive to engage in activist arbitrage. This is because the decrease in the discount that results from the anticipation effect reduces the profit from open-ending the fund.[32] The econometric methodology that we use in this paper to disentangle the two effects is new in corporate finance, and could be used in future research for settings that feature a similar feedback loop.

Appendix A

Several comments regarding the execution of the estimation methods (1)–(2) are in order. First, as a feature of probit analysis, the estimation of Eq. (2) identifies the coefficients $\{\beta/\sigma_\eta, \gamma/\sigma_\eta, \theta/\sigma_\eta\}$ up to scale. It has been a convention to report probit estimates by normalizing the variance of the disturbance term ε to be unit. Given that $\sigma_\eta^2 = (1-\rho^2)\sigma_\varepsilon^2$, we need to rescale the coefficients from (2) by $1/\sqrt{1-\rho^2}$ to obtain the coefficients in the original system (1). Second, though $\hat{\omega}_{i,t-1}$ enters Eq. (2) for estimation, it is not a conventional covariate as the X variables in the same equation. More specially, $\hat{\omega}_{i,t-1}$ is not a "determinant" of an attempt, and the coefficient in front of $\hat{\omega}_{i,t-1}$ should not be interpreted as the partial effect of a unit change of the residual discount on the propensity of an attempt. In fact, $\hat{\omega}_{i,t-1}$ should be integrated out to obtain consistent estimates of $\{\beta, \gamma\}$ in the original system (1). Third, the probit coefficients are not of direct interest to researchers. The interesting parameters are the average partial effects (APE) of the covariates, that is, the average effect of a unit change in the covariates on the incremental probability of an attempt.

As a result of these considerations, we compute the parameters $\{\tilde{\beta}, \tilde{\gamma}\}$ with $\hat{\omega}$ integrated out, which are related to those from (2) by a scaling factor [33]:

$$\tilde{\beta} = \hat{\beta} \Big/ \left[(1-\hat{\rho}^2)\left(1 + \frac{\hat{\theta}^2 \hat{\sigma}_\omega^2}{(1-\hat{\rho}^2)}\right)\right]^{1/2};$$

$$\tilde{\gamma} = \hat{\gamma} \Big/ \left[(1-\hat{\rho}^2)\left(1 + \frac{\hat{\theta}^2 \hat{\sigma}_\omega^2}{(1-\hat{\rho}^2)}\right)\right]^{1/2}. \quad (4)$$

They serve to compute the sample analogue of the average partial effects of the covariates:

$$E[\partial\Phi(\tilde{\beta}DISCOUNT + \tilde{\gamma}X)/\partial DISCOUNT]$$
$$= E[\tilde{\beta}\phi(\tilde{\beta}DISCOUNT + \tilde{\gamma}X)],$$

$$E[\partial\Phi(\tilde{\beta}DISCOUNT + \tilde{\gamma}X)/\partial X]$$
$$= E[\tilde{\gamma}\phi(\tilde{\beta}DISCOUNT + \tilde{\gamma}X)]. \quad (5)$$

[32] Some theoretical implications of the negative feedback loop between financial markets and corporate activities are explored in a recent paper by Bond, Goldstein, and Prescott (2009).

[33] The derivation is standard. See, for example, Wooldridge (2003), chapter 15 "Discrete Response Models."

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