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Investor Misvaluation, Signaling, and Takeovers:

Evidence from Closed-End Fund Discounts

Sujung Choi*

Abstract

This study investigates investor misvaluation as a motivation for closed-end fund mergers and acquisitions (M&As). Following previous studies, I view the closed-end fund discount as a proxy for investor misvaluation at the individual fund level. When a closed-end fund suffers from investor misvaluation in the stock market, closed-end fund M&As can be served to investors to signal a rosy prospect for the closed-end fund, or a synergy effect. Using comprehensive data of closed-end fund M&As from 1994 through 2009, I find that (1) both acquirer and target funds experience deep fund discounts over pre-announcement periods and (2) acquirer funds are *less* likely to be undervalued than target funds, and target funds are *more* deeply undervalued than acquirer funds when M&As occur. After M&A announcements, fund discounts shrink for targets, but go slightly deeper for acquirers. In the long run, fund discounts of the combined funds shrink even for acquirers, and the misvaluation on acquirer and target closed-end funds is corrected. Post-merger objective-adjusted performance initially improves for both acquirer and target funds because of the synergies perceived by investors, but generally worsens on average in the third year following the M&As.

* The School of Technology Management, Ulsan National Institute for Science and Technology (UNIST), Ulsan, Korea; Email: sujungc@uci.edu. Tel: +82 52 217 3146. Fax: +82 52 217 3146. I am grateful to my PhD committee members, David Hirshleifer (Chair), Lu Zheng, Zheng Sun, Yu Zhang, and Fabio Milani, for great comments and suggestions. I also thank Ulrike Malmendier, and the participants at the 2011 FMA Doctoral Student Consortium. All errors are mine.

1 Introduction

Closed-end fund discounts have been interesting research topics because of their persistent and puzzling existence in the stock market.[1] Closed-end funds issue a fixed number of shares, which are subsequently publicly traded on the market. The portfolios of the underlying assets are subject to being marked to market, and the net asset values (NAVs) are reported on a daily or weekly basis. The empirical observation on closed-end funds documents the difference between NAVs and share prices, which is referred to as the closed-end fund discount puzzle because closed-end funds are often traded at discounts to their NAVs in the stock market. More specifically, the existence of discounts violates the law of one price; it remains, therefore, a puzzle and challenges the traditional efficient market hypothesis.

Numerous studies have attempted to explain why closed-end fund discounts exist in the market, but they provide only a partial explanation for the persistent existence of fund discounts. For example, Lee et al. (1991) argue that fluctuations in the discounts of closed-end funds are driven by changes in individual investor sentiment (Bodurtha et al. 1995; Neal and Wheatley 1998; Baker and Wurgler 2007). Alternatively, Swaminathan (1996) insists that closed-end fund discounts are related to the fundamental risk of future economic conditions. But, in fact, their empirical results on fund discounts can be interpreted both ways as rational-based and sentiment-based explanations.

Even now, scholarly debate continues over the closed-end fund discount puzzle, but this study is not intended to provide additional evidence toward explaining why closed-end fund discounts exist in the market; rather, based on previous findings (Lee et al. 1991; Baker and

[1] For the theories of closed-end fund discounts, see the survey of Cherkes (2012).

Wurgler 2007), I view the closed-end fund discount as a reasonable proxy to indicate relative misvaluation by investors in the stock market at the individual fund level. Therefore, in this study, closed-end fund discounts measure the degree of fund-specific idiosyncratic misvaluation. Then, I investigate the dynamics of closed-end fund discounts as a motivation for closed-end fund mergers and acquisitions (M&As).

Stock prices directly reflect investor sentiment or misvaluation, whereas NAVs can be considered the fundamental values of the underlying assets that closed-end funds currently hold. Closed-end funds are generally held by individual retail investors; therefore, fund discounts might reflect the expectations of individual investors (Zweig 1973; Lee et al. 1991). On the other hand, more than 70 % of closed-end funds are mainly invested in bonds. More specifically, their asset-based objectives are stated as balanced (5.4%), municipal bonds (39.8%), and taxable bonds (26.6%). Bonds are generally perceived as less affected by mispricing than stocks because the majority of bond market participants are institutional investors who appear relatively rational in comparison to individual investors.[2] Therefore, the NAVs of closed-end funds seem to reflect the fundamental values of their holding assets.

Closed-end fund discounts, as market price-to-fundamental ratios, would be interpreted in much the same way as book-to-market ratios. Pontiff (1995) argues that a similarity exists between the book-to-market ratio and the closed-end fund premium.[3] The NAV of a closed-end fund's portfolio can be viewed as the book value of shareholder equity; thus, the future return predictability of closed-end fund premia is analogous to the book-to-market effect in predicting

[2] Individual investors held 37.1% of the U.S. municipal securities and 10.1% of the U.S. Treasury securities in the first quarter of 2011.
(Sources: Federal Reserve System, SIFMA http://www.sifma.org/research/statistics.aspx)

[3] To avoid confusion, negative premia represent fund discounts. That is, when the discounts are calculated, negative (positive) numbers refer to fund discounts (premia).

future returns. The NAVs of closed-end funds provide even purer fundamental values than the accounting book values in typical firms since NAVs are undistorted by accounting conventions, such as depreciation methods. As a result, a closed-end fund discount, expressed as a form of stock market prices divided by the NAVs of the closed-end funds, is an ideal proxy for measuring market price-to-fundamental ratios.

Dong et al. (2006) employed a market price-to-book ratio and a market price-to-residual-income-value as a market price-to-fundamental ratio to investigate the misvaluation hypothesis of takeovers proposed by Shleifer and Vishny (2003). According to previous studies (Shleifer and Vishny 2003; Rhodes-Kropf et al. 2005; Dong et al. 2006), a possible determinant in takeover activities was investor misvaluation over the period, 1990-2000. In Shleifer and Vishny's model, relative valuations on acquirer and target firms in the stock market are critical in driving M&As between two firms. Therefore, given that closed-end fund discounts proxy the degree of investors' relative misvaluation on acquirer and target funds in the stock market, the magnitude of closed-end fund discounts in the pre-announcement period determines who buys whom between two closed-end funds involved in the M&As, as predicted in Shleifer and Vishny's model.

Before M&A announcements over the sample period from 1994 through 2009, a one-year averaged discount of acquirer closed-end funds is -6.15, whereas a one-year averaged discount of target closed-end funds is -8.58 as a mean value. During a one-year pre-announcement period, the difference in the mean fund discounts between acquirer and target funds is 2.98; this is highly statistically significant and implies that closed-end fund discounts would be important in determining who buys whom in the closed-end fund M&As. That is, acquirer funds are *less* likely to be undervalued with narrower discounts than target funds, and at

the same time, target funds are *more* deeply undervalued than acquirer funds when M&As occur.

Interestingly, I also find that both acquirer and target funds experience deep fund discounts over pre-announcement periods. The averaged fund discount of non-merger closed-end funds is -4.24 as a mean value over a one-year pre-announcement period; thus, non-merger closed-end funds are *less* likely to suffer from investors' undervaluation than acquirer and target funds in the stock market. Therefore, I posit that the market's severe undervaluation on the individual closed-end fund incentivizes closed-end fund managers to signal the quality of fund management, a rosy prospect for the fund, or a synergy effect (e.g., economies of scale).

Through the M&As, closed-end fund managers can capture investors' attention and signal actual values of their closed-end funds. The actual values would be higher than current investors' perceptions because investors might be ignorant of what the fund managers know. Thus, I propose that fund managers are perfectly rational and informed, whereas investors are less informed than fund managers about information that might relate to individual closed-end funds.

For example, this information might derive from fund managers' unobserved skills, private information that fund managers currently hold, governance structures inside the individual closed-end funds, and potential investment opportunities. Also, fund managers might think that the market's severe undervaluation on their funds seems to relate to investor sentiment but with no clear reason. In this case, both acquirer and target fund managers believe that the stock prices of their closed-end funds do not reflect current and future potential of the funds because their closed-end funds are being ignored by investors in the stock market. Therefore, deep closed-end fund discounts motivate fund managers to correct investor misvaluation, so both acquirer and target fund managers voluntarily choose the M&As to

eliminate their deep fund discounts.[4] Thus, the M&As between two closed-end funds become endogenous events chosen by fund managers.

In this paper, I identify 200 target and 174 acquirer closed-end funds using comprehensive data on closed-end fund M&As from1994 through 2009; the closed-end fund data are obtained from MorningStar and Bloomberg. The empirical results support the investor misvaluation hypothesis: closed-end fund discounts that proxy the degree of relative investor misvaluation on acquirer and target funds are statistically significant at the 1% level in determining who buys whom when fund M&As occur. As fund discounts go deeper, closed-end funds are more likely to be targets than acquirers in takeover activities. These results hold, even after controlling for other factors that might drive fund M&As, such as net expense ratios, turnover ratios, fund sizes, investment objectives, and pre-announcement objective-adjusted performance.

In addition, I provide supporting evidence of the signaling incentive by fund managers via fund M&As. First, I find that both acquirer and target funds are more severely undervalued than other non-merger closed-end funds in pre-announcement periods even though target funds are more deeply undervalued than acquirer funds when M&As occur. Second, post-merger objective-adjusted NAV-based performance of the combined funds initially improves for both acquirer and target funds because only funds that are sufficiently confident of future NAV performance would voluntarily choose M&As as a commitment. If investors find such a signal credible, they would positively react to the fund M&As because of the synergies perceived by

[4] Some closed-end funds have a written obligation to reduce their fund discounts through repurchasing shares in case they experience deep fund discounts. Activist arbitragers sometimes attack the closed-end funds under deep fund discounts for liquidation. Therefore, fund managers might be intimidated by the risk of losing their jobs via liquidation, or the pressure of activist arbitragers. In this case, they need to monitor the level of fund discounts and deliberately make every effort to shrink deep fund discounts.

investors. Thus, the stock prices of both acquirer and target funds increase subsequent to M&As, and the objective-adjusted stock price-based performance of the combined funds also improves.

In the open-end mutual fund universe, objective-adjusted NAV- and stock price-based performance improves for the target funds following M&As, while acquirer funds do not perform better after M&As than before (Khorana et al. 2007). However, I find that post-merger objective-adjusted NAV-based returns significantly increase for the first two years following M&As. The improvement of NAV-based performance is more evident during the first six months in the post-merger period. Objective-adjusted NAV-based returns increase by 4.60% on average for acquirers during the first six months after M&As are finalized.

Also, objective-adjusted stock price-based returns improve for both target and acquirer closed-end funds in the first and second year following M&As. The objective-adjusted stock price-based returns of the combined funds initially increase by 5.39% on average for acquirers, from -1.79% in the one-year pre-announcement holding period to 3.60% in the first year after M&As. Then, stock prices overshoot because of the synergies perceived by investors, and the objective-adjusted stock price-based returns drop to -1.44% (0.67%) on average in the third (fourth) year after M&As are finalized. Therefore, the objective-adjusted stock price-based returns converge to zero on average in the long-run.

Interestingly, objective-adjusted *stock price*-based returns more positively reacts to M&As for the first two years after M&As than objective-adjusted *NAV*-based returns which relate to ex-post synergies of the combined funds. Therefore, the market's undervaluation on the acquirer and target closed-end funds is corrected through M&As in the long run. The post-merger performance is robust for two measures: (1) performance based on the objective-adjusted

returns and (2) performance based on propensity score-matching. Using the propensity score-matching method, holding-period returns are compared between combined funds and matched non-merger closed-end funds (i.e., a control group).[5]

2 Hypotheses and Discussion

A distinctive feature of this paper is that it tests predictions of the investor misvaluation hypothesis by Shleifer and Vishny (2003) in the closed-end fund M&As. In addition, this paper suggests a signaling hypothesis to explain the motivation of closed-end fund M&As.

2.1 Empirical predictions of the investor misvaluation hypothesis

Shleifer and Vishny (2003) present a model of takeovers based on stock market misvaluation. In their model, relative investor misvaluation of merging firms (i.e., targets and acquirers) affects takeover decisions under the assumption that financial markets are inefficient, so mispricing is given. According to the misvaluation hypothesis, acquirers will tend to be overvalued to targets. This overvaluation is expected to be stronger for stock offers; consequently, acquirers can expropriate the assets of targets with the overvalued stocks of acquirers. These acquirers may use their overvalued stocks to buy targets that are undervalued relative to acquirers so that the long-run returns of acquirers are likely to be negative.

In this study, the investor misvaluation hypothesis implies that relative valuations on

[5] Using the propensity score-matching methods, the control closed-end funds are selected by their similarity to the acquirer funds before the merger announcement dates. Four characteristics are considered: (1) the same investment objectives based on U.S. broad asset classes; (2) pre-announcement performance (a six-month holding-period objective-adjusted returns before the merger announcement date); (3) fund sizes (averages of monthly total net assets over a one-year pre-announcement period); and (4) fund discounts (averages of monthly fund discounts over a six-month pre-announcement period).

acquirer and target closed-end funds will affect fund M&A decisions if those funds are valued incorrectly in the stock market. By providing empirical evidence on the closed-end fund discounts, which affect the odds of being acquirers or targets, this paper generally supports the investor misvaluation hypothesis on closed-end fund M&As. That is, acquirer funds are *less* likely to be undervalued to target funds, and at the same time, target funds are *more* deeply undervalued than acquirer funds when fund M&As occur.

Also, the characteristics of M&As in the closed-end fund industry look similar to those of the large merger wave in the late 1990s (Shleifer and Vishny 2003): (1) the medium of payment in most of the deals is generally stock; (2) both acquirer and target funds are included in the same industry or often in the same objective; and (3) hostile takeovers are very rare in the fund industry. Since human capital (i.e., fund managers) of target funds is critical for acquirer funds to decide on their counterparts (Khorana et al. 2007; Park 2008), the motivation of target funds' managers in takeover deals is important; thus, friendly deals dominate hostile takeovers.

However, contrary to the prediction on overvalued acquirers in the merger wave, acquirer closed-end funds experience deep undervaluation even though target funds are more deeply undervalued than acquirers. Therefore, I propose a signaling hypothesis as a possible M&A motivation specific to the closed-end fund industry, especially for acquirer funds.

2.2 Signaling incentives by fund managers

The signaling hypothesis sheds light on why acquirer funds experiencing deep undervaluation attempt M&As with more deeply undervalued target funds. The signaling hypothesis is based on the idea of closed-end funds voluntarily adopting certain policies or changes as a way to distinguish themselves from other closed-end funds. Therefore, the

signaling hypothesis predicts that combined funds exhibit stronger post-merger NAV-based performance, at least in the short run. This prediction is consistent with the dividend signaling model of closed-end funds (Johnson et al. 2006; Wang and Nanda 2011). In the dividend signaling model, a closed-end fund adopting an aggressive payout policy would signal the fund's strong future NAV-based performance. Only funds that are sufficiently confident about their future NAV-based performance would commit to such a target policy. Thus, I posit that investors find such a signal credible.

As explained earlier, M&As between two closed-end funds are endogenous events chosen by fund managers. Consistent with the prediction of the dividend signaling model, fund M&As can thus serve as a credible signal of the future performance of the combined closed-end funds. This paper shows that post-merger NAV-based performance improves for both acquirer and target funds, especially in the first and second year following the M&As. Therefore, realized improvement in the NAV-based performance of combined funds provides ex-post credibility of the signal to investors. Moreover, if an acquirer fund has completed several M&As (i.e., a repeated game), the fund M&As would become an even more credible signal of strong future NAV-based performance to investors in the stock market.

Stock price-based performance of the combined funds also improves more than NAV-based performance following M&As since stock prices of closed-end funds somewhat reflect investor sentiment, or the irrational behavior of fund investors. Stock prices are, in general, more volatile around closed-end fund M&A announcements than NAVs, or fundamental values. Therefore, stock prices increase more than NAVs under a positive signal; thus, fund discounts shrink through M&As.

2.3 The medium of payment in closed-end fund M&As

Under the signaling hypothesis of fund M&As, I predict that friendly *stock*-financed mergers dominate hostile *cash*-financed mergers. In the closed-end fund industry, most M&A deals are friendly because of the importance of motivation by target funds' managers. Shareholders of deeply discounted target funds could have an alternative option (i.e., liquidation). However, target fund managers are more likely to continue to manage their funds and thus resist the attempt to liquidation by activist arbitragers. Therefore, even though target funds' managers prefer M&As to liquidation, there could be a conflict of interest between target funds' managers and shareholders if the wealth of target funds' shareholders is hurt through the M&As. In other words, as long as their wealth is not hurt through the M&As, target funds' shareholders vote for M&As.

On the other hand, acquirer funds should be careful in deciding to choose counterparts in an attempt to correct investor undervaluation on their funds. For example, human capital (i.e., fund managers) of target funds is critical for acquirer funds in deciding on their counterparts (Khorana et al. 2007; Park 2008). Both acquirer and target fund managers need to signal to investors regarding the improved quality of fund management, or a synergy effect through the M&As by combining two management teams. Therefore, stock payment seems to be an industry standard to facilitate friendly takeovers between two closed-end funds.[6] Also, some studies show that cash payment is connected to hostile M&As between firms in unrelated businesses, whereas stock payment is mainly used in friendly M&As between firms in

[6] The conversion ratio is determined by the ratio of NAVs between acquirer and target funds, so target fund shareholders would benefit from the NAV-based conversion ratio and easily accept the offers from acquirer funds. In addition, NAVs are a quite clear measure for fundamental values on the valuation process of fund M&As since NAVs are reported on a daily and weekly basis. Therefore, there would be little disagreement between acquirer and target funds if the NAV-based conversion ratio is used.

overlapping businesses for a strategic purpose (Healy et al. 1997; Yook 2003). Among a total of 233 closed-end fund mergers, 212 (90.6%) mergers were paid with stocks, and only 6 (2.6%) mergers were paid in cash.[7] Over the sample period 1994-2009, stock payments dominate the closed-end fund mergers; particularly, almost all transactions in recent years were paid with stocks.

Besides, the stock-for-stock deal is consistent with the investor misvaluation hypothesis on takeovers in that transactions are driven by the stock market's relative misvaluation between a target and an acquirer. When a stock-for-stock M&A occurs, the acquirer fund pays its own shares to the target fund's shareholders according to the specified exchange ratio.[8] Basically, the acquirer fund issues new shares for the payment, and it obtains all of the assets of the target fund at the same time. If a target fund is undervalued by experiencing deep fund discounts, it would be more likely to accept the offers from an acquirer fund since the NAV-based conversion ratio could be considered as a *premium* for the target fund shareholders. In other words, target fund shareholders receive a premium and thus agree to the stock merger. Target shareholders expect short-run gains even though they might lose in the long run.

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[7] Most cash mergers were inevitable cases: (1) three closed-end funds were merged into a private company, (2) two closed-end funds were merged into a Canadian financial service company, and (3) the remaining one case was a hostile merger. Private and Canadian acquirers would not be able to suggest stock-for-stock deals to target closed-end funds.

[8] According to Form N-8F, the exchange ratio is determined by the ratio of NAVs between target and acquirer funds. An example is as follows: "The common shares of Van Kampen Strategic Sector Municipal Trust (the "Target Fund") were converted into common shares of Van Kampen Select Sector Municipal Trust ("the Acquiring Fund") at a ratio of 1.001654 to 1 for common shares. The exchange ratio was calculated by dividing the 10/7/05 NAV of the Target Fund by the 10/7/05 NAV of the Acquiring Fund. The preferred shares of each Fund had a liquidation preference of $25,000 per share, so the preferred shares of the Target Fund were converted into preferred shares of the Acquiring Fund on a 1-for-1 basis."

(Sources: http://www.sec.gov/Archives/edgar/data/894241/000095013706003270/0000950137-06-003270.txt)

As for the acquirer shareholders, Shleifer and Vishny (2003) argue that the price that acquirers pay for the assets of targets would be lower than the perceived synergies (i.e., enhanced efficiencies via mergers) because there are many potential targets in the market. In their model, as long as the perceived synergies of the merger by market participants are high enough, an acquisition for stock is the best strategy for the shareholders of acquirers in the long run. Furthermore, a firm prefers a stock takeover to new equity issuance (i.e., seasoned equity offerings). As long as the perceived synergies are higher than the price paid to targets, the long-run benefits to the shareholders of acquirers would outweigh the benefits of investments in cash through the new equity issuance.[9]

In practice, stock-for-stock mergers are convenient from the standpoint of the fund managers since stock deals generally do not require the approval of acquirer shareholders. Only registration of new stocks that are necessary for mergers needs to be voted on by the shareholders of acquirer funds. Furthermore, stock-for-stock mergers are tax-free events to fund shareholders. Tax is deferred until disposition or sale of the stocks because received stocks are unrealized capital gains. Since most closed-end fund shareholders are generally tax-sensitive investors, stock-for-stock mergers would be preferred to cash-financed mergers.

3 Literature Review

3.1 Determinants of mutual fund M&As

[9] Akhigbe and Madura (2001) find that closed-end funds are more likely to engage in seasoned equity offerings (SEOs) when they experience a high fund premium and a high degree of liquidity. In addition, the SEOs of closed-end funds show poor post-offering performance over the three-year period. Therefore, the empirical observation on the SEOs of closed-end funds implies that the motivation of the close-end fund SEOs would differ significantly from the motivation of the M&As.

This paper contributes to the closed-end fund M&A literature by exploring the determinants of mutual fund mergers. Despite the growing body of literature on mutual funds, the incentives associated with M&As between closed-end funds are less studied. In the open-end mutual fund universe, Khorana et al. (2007) argue that fund mergers are more likely related to the past underperformance of funds and the number of independent directors on the board. As the proportion of independent directors on boards becomes larger and fund performance becomes poorer, a fund is more likely to be merged. The inverse relationship between fund performance and merger probability is likely to be stronger for in-family mergers. However, for strategic reasons, fund underperformance may not be a main driver of across-family mergers. Consequently, strategic consideration to realign underlying product offerings is an important factor in across-family mergers (Jayaraman et al. 2002; Khorana et al. 2007).

Another possible motive for mergers between open-end mutual funds is fund flows. Fund outflows of open-end funds are significant, especially for in-family mergers, even after fund performance is controlled (Sirri and Tufano 1998; Khorana et al. 2007). As a result, a fund with higher net asset inflows or lower net asset outflows is less likely to be merged. Exploiting economies of scale also provides a possible explanation for fund mergers. Small funds are more likely to charge higher fees or expenses; thus, both fund size and net expense ratios are related to the likelihood of fund mergers (Jayaraman et al. 2002).

3.2 Investor misvaluation hypothesis of takeovers

Dong et al. (2006) empirically examine the misvaluation hypothesis and the Q theories of takeovers by using contemporaneous measures of the valuations. They employ a market price-to-fundamental ratio as a proxy for investor misvaluation, growth opportunities, and

agency problems. Over the various proxies, acquirers are more highly valued relative to targets in the full sample. Evidence for the misvaluation hypothesis is stronger during the 1990-2000 period than the pre-1990 period.

Rhodes-Kropf and Viswanathan (2004, 2005) suggest that periods of high stock merger activities are correlated with high market valuation. They present a rational theory based on valuation errors, which are decomposed into firm-specific and sector-wide errors in valuation for potential takeover synergies. In their model, a rational target makes mistakes in evaluating takeover synergies when sector-wide misvaluation error is high. During boom markets, a target is more likely to overestimate an acquirer's offer, where even greater market overvaluation exists. While a merger wave can occur mainly due to sector-wide misvaluation, which explains approximately 15% of merger waves, other factors such as economic shocks from various sources are also important: 85% of merger waves still remain unexplained. Firm-specific misvaluation is critical in understanding the role of participants in takeover deals.

Bouwman et al. (2007) find that acquirers buying targets during boom markets have high announcement returns, but lower long-run abnormal performance than those buying targets during depressed markets. They suggest managerial herding as a possible reason for the long-run underperformance. That is, the underperformance of acquisitions in boom markets is due to acquirers later following the merger wave.

3.3 Closed-end fund discounts puzzle and characteristics of closed-end funds

Lee et al. (1991) examine three potential explanations of the closed-end fund discounts puzzle: agency costs, illiquidity of assets, and tax liabilities on capital gains. However, these arguments do not explain the existence of closed-end fund discounts. Rather, they present

investor sentiment as an alternative explanation. According to the investor sentiment hypothesis, changes in closed-end fund discounts reflect the different sentiments of individual fund investors.

Del Guercio et al. (2003) analyze board structure and the independence of boards using 476 closed-end funds that exist in December 1994. In their analyses, the fund expense ratio is a proxy of board effectiveness. That is, funds with low expense ratios have smaller boards and charter provisions that specify remedial actions if fund discounts become large. Therefore, fund expense ratios are inversely related to board effectiveness. Del Guercio et al. (2003) also document puzzling results whereby fund expense ratios are positively associated with higher premia, even though the results are not statistically significant.

Regarding the return predictability of closed-end fund discounts, Swaminathan (1996) shows that the monthly value-weighted index of closed-end fund discounts forecasts future excess returns on small firms. Malkiel and Xu (2005) observe that discounts are highly persistent on an aggregate level. Given persistent fund discounts, they demonstrate that future return predictability is largely due to the persistence in discounts by modeling discounts as an AR(1) process. In addition, they find that the weekly NAV returns of closed-end funds predict future fund returns. One possible explanation of the return predictability by fund discounts is the different source of NAV- and stock price-based returns. Most closed-end funds invest in large stocks, but the majority of closed-end fund investors are individual investors. Therefore, NAV-based returns follow large stock portfolio returns, whereas stock price-based returns are similar to small stock portfolio returns. Previous studies have documented that large stock portfolio returns predicts small stock portfolio returns (Lo and MacKinlay 1990); thus, it seems obvious that NAV-based returns predict stock price-based fund future returns.

4 Description of Variables and Data

Before examining how closed-end funds are associated with the likelihood of fund mergers, this section explains the data source and the characteristics of acquirer and target closed-end funds. First, I explain a detailed procedure for constructing the fund merger sample dataset for the statistical analyses. Then, univariate statistics of three sample groups (i.e., acquirers, target, and non-merger closed-end funds) are presented to understand general characteristics of the closed-end fund M&As. In particular, I examine dynamic changes of the closed-end fund discounts of three sample groups in the pre- and post-merger periods. Finally, two-sample t-tests demonstrate that the difference in fund discounts is statistically significant among the three sample groups, especially in the pre-announcement period.

I obtained closed-end fund merger data from MorningStar. The data cover a total of 922 domestic closed-end funds with obsolete types (e.g., active, liquidated, and merged), inception dates, obsolete dates, acquirer fund names, and various fund characteristics, such as broad asset-based objectives (e.g., U.S. stock, international stock, municipal bond, taxable bond, and balanced), historical series of net expense ratios and turnover ratios. Since the MorningStar data include all obsolete funds after the year 1993, I believe that survivorship bias does not significantly affect the overall analyses in this study. To obtain more comprehensive closed-end fund M&A data, I incorporated separately identified closed-end fund M&A samples through Bloomberg and CRSP into the MorningStar data.

The MorningStar closed-end fund data do not provide monthly fund discounts and NAVs. Thus, I collected the monthly fund discount data from various sources: Bloomberg, Compustat

and CRSP.[10] However, even though Bloomberg provides a historical series of fund discounts, it does not provide various other fund characteristics, such as fund returns, net expense ratios, and turnover ratios as historical observations. Only the most recent fund characteristics are available at Bloomberg. Therefore, this study examines the closed-end fund M&As from 1994 through 2009 since they are concurrently available in both MorningStar (i.e., fund characteristics) and Bloomberg (i.e., fund discounts).[11]

Table 1 reports the historical changes of closed-end fund merger activities and median fund discounts. Panel A shows the annual number of closed-end mergers by means of payments and by designation as targets or acquirers. A total of 200 target and 174 acquirer closed-end funds are identified over the sample period, 1994-2009. Since CRSP provides the delisting codes for disappearing firms, closed-end fund mergers that are separately identified through CRSP disentangle the number of closed-end fund M&As by means of payments. Therefore, the total number on the left panel in each year is not exactly matched with the number on the right panel because data sources are different: target and acquire closed-end funds on the right panel are identified from MoringStar and Bloomberg due to the availability of various fund characteristics and fund discounts.

Approximately 34% of target closed-end funds were merged into open-end funds in the

[10] Based on the fund discount data provided by Bloomberg, I filled in the missing values with the calculated closed-end fund discounts through Compustat and CRSP. After identifying the closed-end funds with the second digit of the share code, *shrcd*, as 4, I extracted monthly price data from the CRSP monthly file. Then, fund NAVs were extracted from the Compustat security monthly file, and then closed-end fund discounts were calculated with monthly NAVs and security prices of the fund.

[11] One obstacle in merging data from various sources is that common identifiers do not clearly exist across various data sources because some of the closed-end funds have different or modified CUSIPs and tickers in each data source, especially if their trading statuses are currently inactive. Therefore, I tried to match individual funds based on the fund names and inception dates if CUSIPs were not identified across the data sources, or if they did not exist. I then confirmed the obsolete dates for the merged funds.

MorningStar sample. The motive for liquidating or open-ending the closed-end funds and merging to existing open-end funds has been mainly argued with the phenomenon documented as "activist arbitrage" (Bardley et al. 2010). Activist arbitragers attempt to liquidate, or open-end, the closed-end funds that are traded with deep discounts. They pursue arbitrage profits from the convergence of a share price to the fund's NAV at the time of termination. When closed-funds are terminated, the market price of a share would eventually converge to its NAV because of the nature of closed-end funds.

In the sample, if an acquirer closed-end fund makes multiple acquisitions in the same year or another year, the acquirer is counted multiple times for each single acquisition event. That is, some of the acquirer funds merged more than one fund, implying a one-to-many relationship between target and acquirer funds in takeover activities. Panel B reports the historical changes of closed-end fund discounts in the aggregate level for the 21 years from 1991 to 2009. The closed-end fund discount is calculated as follows:

$$Discount_{it} = \frac{SP_{it} - NAV_{it}}{NAV_{it}} \times 100,$$

where SP_{it} is the stock price (market price) of fund i in month t, and NAV_{it} is the net asset values of fund i in month t. By definition, negative (positive) numbers represent discounts (premia). The statistics of fund discounts are calculated among the monthly observations of closed-end fund discounts from January 1991 through December 2009.

As a whole, the number of closed-end funds per month increased during this period, from 191 in 1991 to 634 in 2010. Figure 1 shows the increasing trend of the closed-end fund industry over the period 1991-2009. The closed-end fund industry was in a steady state from

1995 through 2001, but after 2002, approximately 20 to 30 new closed-end funds entered the closed-end fund industry every year until 2007. In 2002 and 2003 (i.e., boom markets), the median discounts were -3.15 and -3.09, respectively, which were the narrowest levels over the sample period after 1994. Therefore, one can conclude that most new closed-end funds are likely to be launched when seasoned closed-end funds sell at a narrow discount in the market. In general, new closed-end funds sell at a premium at the IPO and subsequently experience price declines (Lee et al. 1991).

Figure 2 illustrates the historical fluctuations of the monthly closed-end fund discounts from January 1990 through May 2010. For almost every month, closed-end funds show only discounts on average, and the levels of fund discounts go deeper during recession periods. For example, for the most recent economic downturn from late 2007 to the middle of 2009, Panel B reports the deepest levels of median discounts as -8.55 in 2008 and -7.30 in 2009.

Interestingly, the volume of fund mergers increases with either the dispersion of discounts among closed-end funds or the deep fund discounts, especially in the lower quartile. For example, when the standard deviation of fund discounts was 13.12 (17.93) in 1998 (2008), the number of fund mergers was 31 (14). Also, when fund discounts were deep in the years 2000, 2005, and 2009, the number of fund mergers was 31, 25, and 25, respectively. Therefore, fund M&As seem to be highly active when the historical fluctuation of fund discounts is large. This empirical finding is consistent with the prediction of Shleifer and Vishny (2003) where the volume of stock mergers increases with the dispersion of valuations of firms.

Figure 3 exhibits a series of monthly historical fund discounts, which are equally-averaged by the funds' objectives with regard to U.S. broad asset classes. Closed-end funds investing mainly in international stocks show the most volatile fund discounts over the sample

period. On the other hand, closed-end funds investing in municipal and taxable bonds are relatively less discounted, and the changes in discounts are less volatile during the entire sample period. Overall, international funds (although their regions of investment are mainly foreign countries) look most sensitive to the sentiment of the U.S. closed-end fund investors, or retail investors, and generally co-move with other class funds investing mainly in U.S.-based assets. This observation on international closed-end funds is consistent with the findings of Hwang (2011), who examine the pricing of international closed-end funds. He provides evidence that U.S. investors' demand, which is related to the sentiment of the U.S. stock market, significantly affects the pricing of international closed-end funds. Therefore, international closed-end funds often deviate from their fundamental values, or NAVs, relative to other asset-class closed-end funds.

Table 2 summarizes the characteristics of closed-end funds. Panel A lists the counts of the closed-end fund sample from MorningStar by investment objectives on U.S. broad asset classes from 1994 through 2009. Among a total of 922 domestic closed-end funds, 612 (66.4%) funds invest mainly in municipal and taxable bonds. International stock closed-end funds represent 12.8% of the total sample, and U.S. stock closed-end funds constitute 15.2%. The majority of acquirers are bond closed-end funds, and in general, M&As between bond closed-end funds are more active than M&As between stock closed-end funds.

Panel B shows the correlation matrix among fund characteristics. Net expense ratios are the total operating expenses, including management fees but excluding interest expenses, divided by average net assets. Turnover ratios are annually measured numbers showing the trading activities of funds. In general, high turnover ratios relate to high brokerage transaction fees. Net expense and turnover ratios are collected from MorningStar and the annual reports, N-CSR

or 10-K, of funds. The fund sizes are calculated by taking the natural log of annually averaged total net assets from t-7 to t-18, where *t* is the month of the mergers. Total net assets are calculated as monthly NAV * monthly outstanding shares (*shrout* in CRSP).

When funds are terminated through mergers to open-end funds, the share prices are likely to converge into reported NAVs (minus relevant trading costs). Therefore, after the announcement of open-ending mergers or liquidations, fund discounts gradually shrink (Brauer 1984; Brickley and Schallheim 1985; Lee et al. 1991). Even for closed-to-closed end fund M&As, the merger announcement affects the share prices in the stock market. For that reason, using the most recent stock price and NAV data just prior to the obsolete date in the sample would not be appropriate for examining whether closed-end fund discounts affect fund M&A decisions in all analyses. Thus, I assume the M&A announcement period between M&A announcement dates and fund obsolete dates as a three- to seven-month period, depending on the fund.

For example, the "BlackRock Enhanced Equity Yield Fund" was merged into the "BlackRock Enhanced Capital and Income Fund" on October 31, 2008, and the deal had been announced on March 28, 2008; then, the announcement period lag was about seven months. The "ACM Managed Dollar Income Fund" was merged into the "AllianceBernstein Global High Income Fund" on September 25, 2009, and the deal was announced on March 13, 2009; thus, the announcement period lag was approximately six months.

Therefore, to mitigate the announcement effect of fund M&As until the obsolete dates in the sample, I assume the most recent six-month period just prior to the month of the fund obsolete dates as an announcement period; thus, an estimated pre-announcement period from t-7 to t-18, where *t* is the month of fund obsolete dates, is used for the empirical analyses of this

study. Accordingly, the difference in various characteristics, such as net expense ratios, turnover ratios, fund sizes, pre-announcement performance, and fund discounts, among the three groups provides meaningful evidence regarding the M&A decisions of the closed-end funds.

As for the fund performance, two measures are estimated in this paper: NAV- and stock price-based objective-adjusted performance. Both NAV- and stock price-based pre-announcement performance (one-year holding period returns from t-7 to t-18) is adjusted based on the investment objectives. Jayaraman et al. (2002) argue that objective-adjusted performance "implicitly adjusts for sector, industry, or style-specific factors that may exogenously affect all funds in the same investment category."

First, the NAV-based return ($NR_{i,k}$) of fund *i* in month *k* is calculated as follows:

$$NR_{i,k} = \frac{NAV_{i,k} + Dividend_{i,k} - NAV_{i,k-1}(1 + risk\ free\ rate_k)}{NAV_{i,k-1}} .$$

Then, the NAV-based objective-adjusted performance over a one-year holding period from t-7 to t-18 in the pre-announcement period is calculated as,

$$\left[\sum_{k=t-7}^{k=t-18}\left(1 + NR_{i,k}\right) - 1\right] - \left[\sum_{k=t-7}^{k=t-18}\left(1 + NR_{o,k}\right) - 1\right],$$

where *t* is the month of M&As, and $NR_{o,k}$ is the equally-averaged NAV-based return of all closed-end funds in the same broad asset-based investment category with fund *i* in month *k*. Similarly, the stock price-based performance over a one-year holding period from t-7 to t-18 in the pre-announcement period is calculated as,

$$\left[\sum_{k=t-7}^{k=t-18}\left(1+R_{i,k}\right)-1\right]-\left[\sum_{k=t-7}^{k=t-18}\left(1+R_{o,k}\right)-1\right],$$

where $R_{i,k}$ is the stock price-based return of fund i in month k, and $R_{o,k}$ is the equally-averaged stock price-based return of all closed-end funds in the same broad asset-based investment category with fund i in month *k*.

Overall, closed-end fund premia in the pre-announcement period are negatively correlated with other fund characteristics variables such as net expense ratios, turnover ratios, fund sizes, NAV-based performance, and stock price-based performance. Net-expense ratios and fund sizes are negatively correlated since small funds are more likely to charge higher fees and have larger expenses (Jayararaman et. al. 2002). Interestingly, the correlation coefficient between NAV-based performance and stock price-based performanace is just 0.5267, which is much smaller than 1 (i.e., a perfect positive correlation). Therefore, the correlation size of 0.5267 implies that the variability of stock price-based performance cannot be perfectly explained by the variability of NAV-based performance over the sample period.

Panel C compares summary statistics on the fund characteristics for acquirers, targets, and non-merger-involved closed-end funds. The mean net expense ratio of the acquirers is 1.15%, which is lower than the mean net expense ratio of the targets (1.43%) and non-merger funds (1.29%). Also, the mean turnover ratio of the acquirers shows the lowest value (51.85%) among the three groups. Therefore, one can conclude that target funds generally charge higher expenses and their holdings are more frequently changed than the holdings of acquirer funds. However, the difference among the three groups is not highly distinctive with regard to net expense and turnover ratios.

The mean fund size of acquirers shows the highest level, 12.16, which is equal to 190.995 million in total net assets (TNA), whereas the targets' mean fund size is 11.47, which is converted to 95.798 million in TNA. The absolute difference between the TNA values of the two groups is 95.196 million on average; thus, the fund size of acquirers is almost twice as large as the fund size of targets in the sample. Small funds would be more likely to be merged; thus, exploiting economies of scale might be a possible explanation of the fund mergers.

Interestingly, both target and acquirer funds exhibit statistically significant negative NAV- and stock price-based pre-announcement performance in terms of one-year holding period objective-adjusted returns on average.[12] Even though the NAV-based pre-announcement performance of *targets* (-5.02%) is poorer than the NAV-based pre-announcement performance of *acquirers* (-2.94%) on average, the difference in the stock price-based pre-announcement performance between acquirer and target funds is not statistically significant. The stock price-based pre-announcement performance of *acquirers (targets)* is also negative, -1.79% (-1.67%), on average, whereas the stock price-based pre-announcement performance of *non-merger* closed-end funds is 0.14% on average, which is marginally positive and statistically significant.

Therefore, closed-end funds, which performed poorly during the previous one-year period relative to other funds sharing the same investment objectives, are more likely to be involved in merger activities than other adequately performing closed-end funds. Before the M&As, acquirer and target funds experience poor performance in both measures based on NAVs and stock prices; thus, pre-announcement poor performance of funds would be an incentive for the merger decisions in the closed-end fund industry. In the open-end fund industry, the

[12] The reported T-statistics are for the null hypotheses, H(0): the mean returns over the period from t-7 to t-18 are zero.

likelihood of fund mergers is also related to the past poor performance of the funds, especially for in-family mergers (Khorana et al. 2007). Therefore, fund size and pre-announcement underperformance would be considered determinants of fund mergers in both the closed- and open-end fund industries.

Panel D illustrates how the averaged fund discounts over the various time periods change around fund M&A events. In this paper, the averaged fund discounts proxy relative misvaluation by uninformed investors on individual closed-end funds in the stock market. Therefore, according to the misvaluation hypothesis by Shleifer and Vishny (2003), the magnitudes of averaged fund discounts would determine who buys whom in the deals of closed-end fund M&As.

The time frame is divided into three parts: a one-year pre-announcement period, a three- or six-month merger announcement period, and a one-year post-merger period. As mentioned earlier, the estimated time-lag between merger announcement dates and merger dates is approximately three to seven months, depending on the funds. Therefore, I examine the three-, four-, and five-months just prior to the month of the merger dates as an announcement period of fund M&As. For example, if an M&A occurs in month *t*, the fund discounts are averaged over a one-year period from t-6 to t-17 to estimate the degree of investor misvaluation in the pre-announcement period.

In Section 4, as a proxy for relative misvaluation by investors affecting fund M&A decisions, I use the average of the monthly fund discounts during the previous twelve-month period, excluding the three- or six-month discount data prior to the merger dates of the closed-end funds. For example, if the recent previous three-month period is estimated as an announcement period when the M&A occurs in month *t*, the proxy of investor misvaluation in

the pre-announcement period would be calculated as the average of monthly fund discounts from t-4 through t-15. The empirical findings are consistently and statistically significant for all timing variations for calculating fund discounts as a proxy for investor misvaluation.

In Panel D, the one-year averaged discounts of target funds are between -8.58 (-9.00) and -8.63 (-9.58) as mean (median) values over the various announcement periods, whereas acquirer funds report the one-year averaged discounts from -5.61 (-6.15) to -6.09 (-6.78) as mean (median) values. The median values are slightly lower than the mean values because some closed-end funds occasionally experience unreasonably high premia in their historical records. Thus, the distributions of one-year averaged fund discounts have a long right tail, or positive skewness.

To examine whether the difference between acquirers and targets is statistically significant, a two-sample t-test is reported for the null hypothesis, H(0): the mean discounts of *acquirers* are equal to those of *targets*, in the middle/left panel. The null hypothesis is rejected: the difference in the mean values of fund discounts between acquirers and targets in the pre-announcement period is from 2.59 to 2.98 and statistically significant at the 1% level. After the M&A announcement, the difference in fund discounts shrinks since the fund discounts of target (acquirer) funds become narrower (deeper) in the announcement period. The fund discounts of both parts are likely to converge to the same level during the announcement period. Moreover, if acquirer funds are open-end funds, the discounts of target funds would be close to zero in the month of the obsolete date. The two-sample t-test results of testing the equality of the fund discounts between acquirers and targets show that the difference is not statistically significant in the announcement period.

After M&As are complete (*t* is the month of mergers), the averaged fund discounts of

acquirer funds over a one-year period (i.e., t+1: t+12 or t+2: t+13) initially go deeper, but the fund discounts of *target* funds gradually shrink. In the long-run following M&As, the fund discounts of combined funds significantly shrink from -7.01 in the first year to -3.06 in the fourth year, on average. Even for acquirer funds, the fund discounts of combined funds shrink over the *post*-merger period and eventually converge to the discount level of non-merger funds in the fund objectives. In Panel D, the mean (median) value of *post-merger* one-year averaged fund discounts of *combined* funds is -2.66 (-5.55) in the third year and becomes -3.06 (-5.48) in the fourth year; over the sample period, the mean (median) value of one-year averaged fund discounts of *non-merger* funds is -4.64 (-5.51) and -4.70 (-5.60), respectively.

A two-sample t-test is reported for the null hypothesis, H(0): for *acquirers*, the mean averaged fund discounts of *post-merger* periods are equal to those of *pre-announcement* periods from t-6 to t-17, in the middle/right panel. The null hypothesis is rejected at the 5% level of significance in the third- and fourth-year, implying that the fund discounts of combined funds shrink even for acquirers through fund M&As. Therefore, closed-end fund investors in the stock market correct the misvaluation on acquirer and target funds through fund M&As. In other words, the market's undervaluation on both acquirer and target funds is corrected via mergers in the long run.

Interestingly, the non-merger closed-end funds show narrower discounts than acquirers and targets from -4.24 (-4.89) to -4.28 (-4.94) as mean (median) values in the pre-announcement period. That is, both acquirers and targets that make merger decisions experience deep historical fund discounts relative to other non-merger closed-end funds. On the other hand, non-merger closed-end funds are less likely to suffer from investor undervaluation in the stock market. This implies that the market's severe undervaluation on both acquirer and target

closed-end funds incentivizes fund managers to signal the quality of fund management and a rosy prospect of their combined funds.

Over the sample period 1994-2009, the fund discounts of non-merger closed-end funds are persistent from -4.24 (-4.89) to -4.70 (-5.60) as mean (median) values regardless of M&A activities of acquirer and target funds. In the bottom panel, a two-sample t-test is reported for the null hypothesis, H(0): the mean discounts of *acquirers* are equal to those of *non-merger* closed-end funds. Non-merger closed-end funds show narrower fund discounts than acquirers during the pre-announcement period and the first year following M&As. The mean difference in the averaged fund discounts between acquirer and non-merger funds is from -1.37 to -2.38, which is statistically significant at the 1% level. The sign of the difference is reversed to positive in the second year after M&As are finalized.

In conclusion, merger activities would benefit the shareholder of acquirer funds (i.e., the combined funds) as well as target funds through the synergies perceived by market participants. Accordingly, the fund discounts of combined closed-end funds gradually shrink in the post-merger period, and the market's undervaluation on acquirer and target funds would be corrected in the long run through M&As. As a result, the fund discount size of combined funds as a median value becomes similar to that of non-merger closed-end funds in the third year following M&As.

5 Empirical Results

First, this section reports the empirical results of the logistic regressions on the determinants of closed-end fund M&As between acquirers and targets. I discuss whether the fund discounts as a proxy for the degree of relative misvaluation by investors affect the odds of

being involved in fund M&As (i.e., being acquirers or targets). Second, the performance of acquirers and targets around fund M&A events is investigated. That is, objective-adjusted holding period stock price- and NAV-based returns are examined over the pre-announcement and post-merger periods. As a robustness check, post-merger performance by propensity score-matching methods is presented to complement the long-run event study.

5. 1 Who buys whom in the closed-end fund M&As?

In this section, I discuss the results using the logistic regressions on the target, acquirer, and non-merger closed-end funds that are identified from MorningStar and Bloomberg. The main objective of these logistic regressions is to examine whether closed-end fund discounts affect the M&A decisions of acquirer and target funds. The sample includes closed-end fund M&As from 1994 through 2009. Several alternative specifications are also investigated for variations of control variables as a robustness check.

Following Shleifer and Vishny's model, I tested the hypothesis that acquirer funds are *less* likely to be overvalued on average, and at the same time, target funds are *more* deeply undervalued than acquirers when M&As occur. Therefore, I conducted a logistic regression analysis with several fund characteristic variables: net expense ratios, turnover ratios, fund sizes, pre-announcement performance, and investment objective dummies. The pre-announcement performance is estimated as one-year (t-7:t-18) holding period objective-adjusted NAV- and stock price-based returns, where *t* is the month when M&As are completed.

Table 3 reports the estimation results. The dependent variable of the regression is a binary variable with a value being a target or acquirer. If the fund is a target, the value is 1; if the fund is an acquirer, the value is 0. As explained earlier, monthly fund discounts are

averaged over the one-year pre-announcement period (t-7:t-18 or t-4:t-15) and fund sizes are calculated by taking the natural log of annually averaged total net assets from t-7 to t-18. In all regressions, the coefficients of the averaged fund discount variables are statistically significant at the 1% significance level. The statistical significance of averaged fund discounts is robust, regardless of the addition of other fund characteristic variables.

Since the estimation was conducted with a logistic regression model, the dependent variable can be interpreted as a conditional probability of being a target relative to an acquirer. Consequently, negative coefficients of the averaged fund discount variables, from -0.0619 in equation (i) to -0.1518 in equation (vii), imply that a closed-end fund with deeper averaged fund discounts in the pre-announcement period is more likely to be a target than an acquirer when the M&A occurs. That is, the difference in relative valuations between an acquirer and a target in the stock market motivates M&As in the closed-end fund industry.

Net expense ratios are statistically significant at the 5% level only when other control variables are not included in the estimation (e.g., equations (i) and (ii)), but net expense ratios turn out to be statistically insignificant if other characteristics are added. The positive coefficients of net expense ratios in equations (i) and (ii) imply that a fund charging a high net expense ratio would be more likely to be a target in fund merger activities.

Net expense ratios closely relate to fund sizes. In general, small funds are more likely to charge higher fees and expenses, thus, net expense ratios are negatively correlated with fund sizes. In all four cases of regressions including the fund size variable (e.g., equations (iii), (v), (vi), and (vii)), *fund size* is significant at the 1% significance level. The negative coefficients of fund sizes imply that a small-cap closed-end fund is more likely to be a target than a large-cap closed-end fund. In other words, large-cap funds are likely to merge with small-cap funds.

The positive coefficient of turnover ratios and pre-announcement performance is not statistically significant in all regressions. Therefore, both NAV- and stock price-based pre-announcement performance does not seem to affect the designation decisions in closed-end fund M&A deals. Rather, the fund discounts, as a proxy of relative misvaluation by investors, more strongly affect the decisions regarding being an acquirer or a target in closed-end fund M&As than pre-announcement performance. Thus, the investor misvaluation hypothesis by Shleifer and Vishny (2003) holds in that acquirer funds are *less* likely to be overvalued on average, and at the same time, target funds are *more* deeply undervalued than acquirers when M&As occur.

Table 4 shows the results of logistic regressions to examine whether the fund discounts averaged over a one-year pre-announcement period (t-7: t-18 or t-4: t-15) affect the odds of being acquirers (Panel A) or targets (Panel B) relative to non-merger closed-end funds. The dependent variable is binary: 1 for acquirers (Panel A) or for targets (Panel B), and 0 for non-merger closed-end funds.

In Panel B, the coefficients of averaged fund discounts are negative and statistically significant at the 1% level in all estimations, while in Panel A, the coefficients are negative and statistically significant only in some estimations, (iii), (v), (vi), and (vii). This implies that if a fund experiences deep historical fund discounts, that fund is more likely to be a *target* than other closed-end funds that have premia, or narrow fund discounts. However, deep historical fund discounts are not the single important determinant of being an *acquirer* in the takeover activities. In Panel A estimation (vii), the stock price-based pre-announcement performance seem to be a more important determinant of being an *acquirer* than the averaged fund discounts. Net expense ratios and fund sizes are not consistently robust in the estimations with the variation of control variables.

Overall, based on the results, it concludes that severe undervaluation by investors on an individual closed-end fund significantly affects the odds of being a *target* relative to general closed-end funds. For an *acquirer*, both investor misvaluation and stock price-based performance in the pre-announcement period affect the odds of being an *acquirer*; thus, fund managers of the acquirer fund would need to signal the quality of fund management through M&As. In that case, closed-end fund managers can catch investors' attention and correct investors' neglect in the stock market.

5.2 Post-merger performance and propensity-score matching

This section discusses post-merger performance subsequent to closed-end fund M&As. The objective-adjusted holding period returns (i.e., stock price- and NAV-based returns) are presented for pre-announcement and post-merger performance regarding fund M&As. To complement the long-run event study, I employ a propensity score-matching method to examine whether the difference in holding period returns between combined funds and control closed-end funds is statistically significant. By examining post-merger performance, I shed light on how investors react to closed-end fund M&As and whether they find such a signal from fund managers credible.

Table 5 reports the fund performance around fund M&As over the various holding periods. In Panel A, the fund performance is measured as one-year holding-period objective-adjusted returns from January 1992 through December 2010, and the merger sample includes acquirer and target closed-end funds during 1994-2009. Previous literature argues that the objective-adjusted returns adjust the exogenous effects from macroeconomic conditions (Jayaraman et al. 2002; Park 2008); thus, I use the objective-adjusted returns to avoid the

exogenous macroeconomic effects on the fund performance in different time periods. Panel A shows the summary statistics of objective-adjusted stock price-based (upper panel) and NAV-based (lower panel) returns. The objective-adjusted returns in the announcement period (six-months subsequent to the M&A announcements) are excluded from Panel A to directly compare *pre-announcement* performance with *post-merger* performance.

Both target and acquirer funds show negative pre-announcement performance in objective-adjusted stock price- and NAV-based returns. The NAV-based returns are even worse than the stock price-based returns in the pre-announcement period. For the target (acquirer) funds, the mean of the pre-announcement objective-adjusted *stock price-based* returns over a one-year holding period is -1.67% (-1.79%), whereas the mean of the pre-announcement objective-adjusted *NAV-based* returns over a one-year holding period is -5.02% (-2.94%). Therefore, closed-end funds that are experiencing poorer performance than other closed-end funds in the same investment objective categories are more likely to be involved in merger activities.

As for post-merger performance, both target and acquirer funds significantly improve during the first six-months, the first-year, and the second-year following the fund M&As compared to the pre-announcement period. Subsequent to the fund M&As, the objective-adjusted stock price-based returns of *acquirers* become positive, from -1.79% in the pre-announcement period (t-7:t-18) to 3.6% in the first post-merger year (t+1:t+12), on average. A two-sample t-test examines whether the improvement in the objective-adjusted stock price-based returns through M&As is statistically significant. The return difference between the pre-announcement period and the post-merger period is 5.39% (5.07%) in the first (second) post-merger year, and it is statistically significant at the 1% level.

However, the improvement in fund performance measured by the objective-adjusted stock price-based returns does not continue in the long run. The mean value of objective-adjusted stock price-based returns drops to -1.44% (0.67%) in the third (fourth) year from 3.6% (3.27%) in the first (second) year. The objective-adjusted NAV-based returns also exhibit a similar pattern over the whole sample period even though those returns are less improved via M&As than the objective-adjusted stock price-based returns. In general, stock prices are more volatile than NAVs, or fundamental values, thus stock prices increase more than NAVs under a positive signal (i.e., fund M&As). In other words, the stock market perceives the synergies or enhanced efficiency through the M&As in the short run; thus, the stock prices of combined funds overshoot. Therefore, investor undervaluation on the acquirer and target closed-end funds is corrected subsequent to the M&As. However, the post-merger objective-adjusted performance worsens on average in the long run. The mean value of objective-adjusted stock price-based returns of combined funds is close to zero in the third and fourth year following the M&As. That is, the objective-adjusted performance of combined funds becomes similar to that of other non-merger closed-end funds in the same investment objectives.

Panel B reports how the post-merger performance of fund mergers changes relative to other non-merger closed-end funds in the post-merger period. The sample of closed-end fund M&As includes acquirers and targets during 1994-2006 to examine long-run (i.e., a four-year period) performance. Using a propensity score-matching method, the non-merger closed-end funds (control samples) are selected based on their similarity to the acquirer funds before the M&A announcement dates. Four characteristics are considered: (1) the same investment objectives based on U.S. broad asset classes, (2) pre-announcement performance (six-month holding-period objective-adjusted returns before the merger announcement date), (3) fund sizes

(averages of monthly total net assets over a one-year pre-announcement period), and (4) fund discounts (averages of monthly fund discounts over a six-month pre-announcement period).

First, I estimated the parameters for the four characteristics using a logistic regression in each acquirer fund. That is, the conditional probability of being the acquirer is an estimated propensity score of the closed-end fund. A non-merger closed-end fund, which has an estimated propensity score close to that of the acquirer fund, is selected as a control sample.[13] The propensity score-matching methods complement the non-experimental long-run event studies for causal effects (Rosenbaum and Rubin 1983; Dehejia and Wahba 2002).

The propensity score-matching methods provide similar results with the objective-adjusted returns above. In the first year after mergers, the stock price-based returns of combined funds are higher by 3.29%, on average, than those of matched non-merger closed-end funds. However, combined funds show poorer performance than matched funds in terms of stock price-based returns in the third year. The difference in the stock price-based returns between combined funds and matched funds becomes negative (i.e.., -2.68%) on average. That is, the performance of combined funds in the stock market improves in the short run following M&As because of the synergies perceived by investors through M&As, but the stock prices overshoot. Therefore, the stock prices are adjusted in the third year after mergers, so the performance of combined funds becomes similar to the performance of matched non-merger closed-end funds in the fourth year, on average. The NAV-based returns also exhibit a similar pattern in the post-merger performance even though the difference in the NAV-based returns between combined funds and matched non-merger closed-end funds is not statistically significant.

[13] The matching is one-to-one with replacement.

In conclusion, the synergies perceived by investors through M&As affect the performance of combined funds in the short run, but not in the long run.

6 Conclusions

This study investigates the dynamics of closed-end fund discounts as a motivation of closed-end fund M&As. In this paper, the closed-end fund discounts indicate the relative misvaluation by investors in the stock market at the individual fund level. Fund NAVs reflect fundamental values of the holding assets of the closed-end funds; thus, the NAVs provide even purer fundamental values than accounting book values in typical firms because they are undistorted by various accounting conventions such as depreciation methods.

Therefore, as a market price-to-fundamental ratio, closed-end funds discounts have an optimal feature to examine the investor misvaluation hypothesis on takeover activities which is proposed by Shleifer and Vishny (2003). Consistent with Shleifer and Vishny's model, acquirer funds are found to be *less* likely to be undervalued to targets, and at the same time, target funds are found to be *more* deeply undervalued than acquirers when M&As occur. Subsequent to M&As, fund discounts of the combined funds shrink for targets, but go slightly deeper for acquirers. In the long run, the fund discounts shrink even for acquirers, so the investor misvaluation is corrected.

The logistic regressions show that the averaged fund discounts over the one-year period before the M&A announcements are statistically significant in the prediction of being a target in the fund M&A activities. The empirical result is robust after controlling for net expenses, turnover ratios, fund sizes, investment objectives, and pre-announcement performance. Net expense ratios are statistically significant for only some specifications, and their significance

turns weak when other control variables are included. Fund sizes are consistently robust in the variation of control variables; thus, a large fund would be more likely to merge a small fund.

In addition to examining the investor misvaluation hypothesis, this paper shed light on why closed-end fund managers attempt mergers with other closed-end funds, especially for acquirer funds. I propose a signaling incentive by fund managers. The market's severe undervaluation on both target and acquirer closed-end funds incentivizes fund managers to voluntarily signal a rosy prospect for the funds through M&As. The misvaluation (i.e., undervaluation) on the individual closed-end funds could be caused by fund managers' unobserved skills, fund governance structures, or investor sentiment, so the actual values that fund managers know would be higher than the values perceived by investors in the stock market. Therefore, the M&As chosen by better-informed fund managers can be served to investors as a positive signal for the future prospect of the combined funds.

Post-merger objective-adjusted *NAV*-based performance of combined funds supports the signaling hypothesis: it improves for both target and acquirer funds during the first two years following M&As because only funds that are sufficiently confident of future NAV performance would voluntarily choose M&As as a commitment. Post-merger objective-adjusted *stock price*-based performance also improves because the stock market perceives the synergies or enhanced efficiency via M&As in the short run, and then stock prices of the combined funds overshoot. Therefore, both post-merger objective-adjusted NAV- and stock price-based performance worsens on average in the long run. Accordingly, the objective-adjusted performance of combined funds becomes similar to that of other non-merger closed-end funds in the same investment objectives. As a robustness check, I used a propensity score-matching method in which the holding period returns between combined funds and matched non-merger closed-end

funds are compared. The propensity score-matching method provides results similar to the performance measure using post-merger objective-adjusted returns.

To sum up, this paper supports some predictions of the misvaluation hypothesis by Shleifer and Vishny (2003) given that closed-end fund discounts proxy the degree of relative misvaluation on individual closed-end funds in the stock market. Furthermore, the empirical results offer a possible M&A motivation that is specific to the closed-end fund industry: severe undervaluation (i.e., deep fund discounts) on both acquirer and target closed-end funds. Overall, by examining comprehensive data from 1994 through 2009, this paper contributes to a better understanding of the closed-end fund M&As.

References

Akhigbe, A. and J. Madura, 2001, Motivation and performance of seasoned offerings by closed-end funds, *Financial Review* 36, 101-122.

Baker, M. P. and J. Wurgler, 2007, Investor sentiment in the stock market, *Journal of Economic Perspectives* 21, 129-151.

Bodurtha, J., D.-S. Kim, and C. M. C. Lee, 1995, Closed-end country funds and U.S. market sentiment, *Review of Financial Studies* 8, 879-918.

Bouwman, C., K. Fuller, and A. Nain, 2009, Market valuations and acquisition quality: Empirical evidence, *Review of Financial Studies* 22, 633-679.

Bradley, M., A. Brav, I. Goldstein, and W. Jiang, 2010, Activist arbitrage: A study of open-ending attempts of closed-end funds, *Journal of Financial Economics* 95, 1-19.

Brauer, G. A., 1984, “Open-ending" closed-end funds, *Journal of Financial Economics* 13, 491-507.

Brickley, J. A. and J. S. Schallheim, 1985, Lifting the lid on closed-end investment companies: A case of abnormal returns, *Journal of Financial and Quantitative Analysis* 20, 107-117.

Cherkes, M., 2012, The 2012 survey of closed-end funds' literature, Working paper, Columbia University.

Daniel, K. D., D. Hirshleifer, and S. H. Teoh, 2002, Investor psychology in capital markets: Evidence and policy implications, *Journal of Monetary Economics* 49, 139-209.

Dehejia, R. H. and S. Wahba, 2002, Propensity score-matching methods for nonexperimental causal studies, *The Review of Economics and Statistics* 84, 151-161.

Del Guercio, D., L. Y. Dann, and M. M. Partch, 2003, Governance and boards of directors in closed-end investment companies, *Journal of Financial Economics* 69, 111-152.

Dong, M., D. Hirshleifer, S. Richardson, and S. H. Teoh, 2006, Does investor misvaluation drive the takeover market?, *Journal of Finance* 61, 725-762.

Healy, P. M., K. G. Palepu, and R. S. Ruback, 1997, Which takeovers are profitable: Strategic or financial?, *MIT Sloan Management Review* 38, 45-57.

Hwang, B.-H., 2011, Country-specific sentiment and security prices, *Journal of Financial Economics* 100, 382-401.

Jayaraman, N., A. Khorana, and E. Nelling, 2002, An analysis of the determinants and shareholder wealth effects of mutual fund mergers, *Journal of Finance* 57, 1521-1551.

Johnson, S. A., J.-C. Lin, and K. R. Song, 2006, Dividend policy, signaling, and discounts on closed-end funds, *Journal of Financial Economics* 81, 539-562.

Khorana, A., P. Tufano, and L. Wedge, 2007, Board structure, mergers, and shareholder wealth: A study of the mutual fund industry, *Journal of Financial Economics* 85, 571-598.

Lee, C., A. Shleifer, and R. Thaler, 1991, Investor sentiment and the closed-end fund puzzle, *Journal of Finance* 46, 75-109.

Lo, A. W. and A. C. MacKinlay, 1990, When are contrarian profits due to stock market overreaction?, *Review of Financial Studies* 3, 175-205.

Malkiel, B. G. and Y. Xu, 2005, The persistence and predictability of closed-end fund discounts, Working paper, Princeton University.

Neal, R. and S. M. Wheatley, 1998, Do measures of investor sentiment predict returns?, *Journal of Financial and Quantitative Analysis* 33, 523-547.

Park, M., 2012, Understanding merger incentives and outcomes in the US mutual fund industry, Working paper, University of California, Berkeley.

Pontiff, J., 1995, Closed-end fund premia and returns implications for financial market

equilibrium, *Journal of Financial Economics* 37, 341-370.

Rhodes-Kropf, M., D. T. Robinson, and S. Viswanathan, 2005, Valuation waves and merger activity: The empirical evidence, *Journal of Financial Economics* 77, 561-603.

Rhodes-Kropf, M. and S. Viswanathan, 2004, Market valuation and merger waves, *Journal of Finance* 59, 2685-2718.

Rosenbaum, P. R. and D. B. Rubin, 1983, The central role of the propensity score in observational studies for causal effects, *Biometrika* 70, 41-55.

Shleifer, A. and R. W. Vishny, 2003, Stock market driven acquisitions, *Journal of Financial Economics* 70, 295-311.

Sirri, E. R. and P. Tufano, 1998, Costly search and mutual fund flows, *Journal of Finance* 53, 1589-1622.

Swaminathan, B., 1996, Time-varying expected small firm returns and closed-end fund discounts, *Review of Financial Studies* 9, 845-887.

Wang, Z. J. and V. Nanda, 2011, Payout policies and closed-end fund discounts: Signaling, agency costs, and the role of institutional investors, *Journal of Financial Intermediation* 20, 589-619.

Yook, K. C., 2003, Larger return to cash acquisitions: Signaling effect or leverage effect?, *Journal of Business* 76, 477-498.

Zweig, M. E., 1973, An investor expectations stock price predictive model using closed-end fund premiums, *Journal of Finance* 28, 67-78.

Table 1 Historical Overview of Fund Mergers and Discounts

Panel A reports the number of closed-end fund mergers by means of payments and by designation as targets or acquirers over the period from 1991 through 2009. The annual counts by the means of payments are based on the CRSP delisting codes. Following the description from CRSP, I re-classified the codes: if the delisting code is 200, payment details are unknown; if the delisting codes include 205, 231, 232, 234, 242, 331 or 332, payments are made with all stocks; if the delisting code is 233, payments are made with all cash; and if the delisting codes are 241 or 251, the means of payment are mixed with stocks and cash. The target and acquirer funds are identified through MorningStar and Bloomberg; fund discount data for those funds are available mainly from Bloomberg. Panel B reports historical changes of the monthly closed-end fund discounts. By definition, negative (positive) numbers represent fund discounts (premia).

Panel A: Annual Numbers of Mergers by Means of Payments (Left); and by Designation as Targets or Acquirers (Right)

Year	Unknown	Stock	Cash	Mixed	Total	Targets	Acquirers
1991	1		1		2		
1992		2			2		
1993		2			2		
1994	1	13			14	7	13
1995	7	12		1	20	10	12
1996	1	6	4		11	8	5
1997		6			6	7	6
1998	4	27			31	10	26
1999		1			1	7	1
2000		30		1	31	33	28
2001		10	1		11	13	10
2002		9			9	13	6
2003		2			2	3	2
2004		4			4	4	3
2005		25			25	25	17
2006		10			10	10	5
2007		14			14	14	9
2008		14			14	15	11
2009		25			25	21	20
Total	14	212	6	2	234	200	174
%	6.0%	90.6%	2.6%	0.9%	100.0%		

Panel B: Historical Changes of Closed-End Fund Discounts

Year	Total # of Obs.	# of Funds per Month	Mean Discounts	Median Discounts	Lower Quartile	Upper Quartile	Standard Deviation
1991	2,292	191	-1.86	-0.51	-7.12	4.27	9.45
1992	2,997	250	0.45	1.31	-3.55	5.22	8.38
1993	3,711	309	0.46	0.03	-4.81	4.72	7.96
1994	4,913	409	-3.72	-4.83	-9.52	0.73	9.12
1995	5,690	474	-6.91	-7.65	-12.17	-2.79	8.17
1996	5,634	470	-6.76	-7.10	-12.68	-1.50	8.30
1997	5,555	463	-5.10	-5.70	-11.02	-0.05	9.85
1998	5,619	468	-2.87	-3.76	-9.47	2.08	13.12
1999	5,878	490	-5.86	-6.71	-13.40	-0.45	12.60
2000	5,796	483	-9.82	-10.19	-15.25	-4.96	11.33
2001	5,664	472	-4.13	-5.01	-9.76	0.61	10.63
2002	6,078	507	-2.62	-3.15	-7.84	1.61	9.52
2003	6,606	551	-2.29	-3.09	-7.48	1.89	8.56
2004	7,053	588	-3.20	-4.49	-8.90	0.79	8.25
2005	7,439	620	-3.86	-5.14	-9.74	0.43	8.11
2006	7,472	623	-3.10	-4.58	-8.82	0.86	8.84
2007	7,712	643	-4.05	-5.43	-9.40	-0.43	8.30
2008	7,756	646	-7.61	-8.55	-12.93	-3.32	17.93
2009	7,613	634	-6.31	-7.30	-12.66	-1.25	11.24

Table 2 Summary Statistics

Table 2 exhibits the descriptive statistics of the characteristics of closed-end funds. Panel A lists counts of the closed-end funds from MorningStar by investment objectives over the sample period from 1994 through 2009. Panel B shows a correlation matrix of the fund characteristic variables. Panel C reports summary statistics of the fund characteristics for acquirer, target, and non-merger closed-end funds. Net expense ratios are the total operating expenses, including management fees but excluding interest expenses, divided by average net assets. Turnover ratios are annually measured numbers showing the fund's trading activities. Net expense ratios and turnover ratios are collected from MorningStar and funds' annual reports, N-CSR or 10-K. The fund sizes are calculated by taking the natural log of annually averaged total net assets, which are calculated as follows:

monthly NAV * monthly outstanding shares (*shrout* in CRSP),

over the periods from t-7 to t-18, where *t* is the month of the mergers. Both NAV- and stock price-based pre-announcement performance are one-year holding period objective-adjusted returns from t-7 to t-18. The NAV-based return ($NR_{i,k}$) of fund *i* in month *k* is calculated as follows:

$$\frac{NAV_{i,k}+Dividend_{i,k}-NAV_{i,k-1}(1+risk\ free\ rate_k)}{NAV_{i,k-1}}.$$

Then, the NAV-based pre-announcement performance is,

$$\left[\sum_{k=t-7}^{k=t-18}\left(1+NR_{i,k}\right)-1\right]-\left[\sum_{k=t-7}^{k=t-18}\left(1+NR_{o,k}\right)-1\right],$$

where $NR_{o,k}$ is the average NAV-based return of all closed-end funds in the same broad asset-based investment category with fund *i* in month *k*. T-statistics are reported for the null hypotheses, H(0): the mean returns over the period from t-7 to t-18 are zero. Panel D exhibits how fund discounts, which are averaged over various time windows, change around the fund M&A events. Two-sample t-tests are reported for the null hypotheses, H(0): the mean discounts of *acquirers* are equal to those of *targets* (middle/left panel); for *acquirers*, the mean discounts of *post-merger* periods are equal to those of *pre-announcement* periods from t-6 to t-17 (middle/right panel); and the mean discounts of *acquirers* are equal to those of *non-merger* closed-end funds (bottom panel). ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively.

Panel A: Distribution of the Closed-End Fund Samples

Investment Objectives	Acquirers	Targets	Non-mergers	Total	% of Total Sample
Alternative	0	0	2	2	0.2
Balanced	2	5	43	50	5.4
International Stock	5	21	92	118	12.8
Municipal Bond	79	95	193	367	39.8
Taxable Bond	23	66	156	245	26.6
U.S. Stock	10	25	105	140	15.2
Total	119	212	591	922	100.0

Panel B: Correlation Matrix

	Avg. Discount (t-4:t-15)	Avg. Discount (t-7:t-18)	Net Expense Ratio	Turnover Ratio	Fund size	NAV-Based Pre-announcement Performance
Avg. Discount (t-4:t-15)	1					
Avg. Discount (t-7:t-18)	0.97309	1				
Net Expense Ratio	-0.05804	-0.05116	1			
Turnover Ratio	-0.01782	-0.01895	0.05110	1		
Fund size	-0.05287	-0.05262	-0.24935	0.09568	1	
NAV-Based Pre-announcement Performance (t-7:t-18)	-0.03315	-0.02724	-0.11981	-0.01204	0.04060	1
Stock-Price Based Pre-announcement Performance (t-7:t-18)	-0.00657	-0.05867	-0.05222	-0.02103	0.04418	0.52668

Panel C: Fund Statistics									
	Variables	Mean	Median	Std Dev	Maximum	Upper Quartile	Lower Quartile	Minimum	T-Stat
Acquirers	Net Expense Ratio	1.15	1.01	0.50	3.18	1.33	0.82	0.20	
	Turnover Ratio	51.85	32.50	49.27	342.30	78.00	16.00	2.00	
	Fund size; ln(TNA)	12.16	12.04	0.83	14.44	12.61	11.58	9.45	
	NAV-Based Pre-announcement Performance (t-7:t-18)	-0.0294	-0.0087	0.1035	0.4140	0.0056	-0.0487	-0.4030	-3.59***
	Stock Price-Based Pre-announcement Performance (t-7:t-18)	-0.0179	-0.0257	0.0976	0.4132	0.0257	-0.0696	-0.3426	-2.16***
Targets	Net Expense Ratio	1.43	1.21	0.90	6.84	1.51	0.94	0.45	
	Turnover Ratio	62.61	39.00	88.21	814.50	68.00	19.00	2.00	
	Fund size; ln(TNA)	11.47	11.37	0.89	13.86	12.08	10.83	9.45	
	NAV-Based Pre-announcement Performance (t-7:t-18)	-0.0502	-0.0094	0.2662	0.6018	0.0132	-0.0370	-2.3166	-2.39**
	Stock Price-Based Pre-announcement Performance (t-7:t-18)	-0.0167	-0.0245	0.1722	0.8859	0.0429	-0.0732	-0.6588	-1.29
Non-mergers	Net Expense Ratio	1.29	1.15	0.66	13.15	1.49	0.89	0.10	
	Turnover Ratio	57.67	34.81	74.02	1722.00	71.50	16.50	0.00	
	Fund size; ln(TNA)	12.06	12.02	1.04	16.78	12.74	11.36	4.61	
	NAV-Based Pre-announcement Performance (t-7:t-18)	-0.0136	-0.0002	0.1851	2.8470	0.0283	-0.0327	-3.1573	-22.97***
	Stock Price-Based Pre-announcement Performance (t-7:t-18)	0.0014	0.0010	0.1327	3.6394	0.0499	-0.0505	-0.9141	3.37***

Panel D: Changes of Average Fund Discounts over Various Time Windows around Fund Mergers (Pre- and Post-Mergers)

		Before Announcement			After Announcement		Post-Mergers				
	Periods	t-6:t-17	t-5:t-16	t-4:t-15	t-1:t-6	t-1:t-3	t+1:t+12	t+2:t+13	t+13:t+24	t+25:t+36	t+37:t+48
Acquirers	# of Obs.	170	170	172	174	174	173	173	153	145	131
	Mean	-5.61	-5.83	-6.09	-6.72	-6.57	-7.01	-6.88	-4.46	-2.66	-3.06
	Median	-6.15	-6.50	-6.78	-7.67	-6.93	-7.88	-7.85	-6.33	-5.55	-5.48
	Lower Quartile	-10.23	-10.38	-10.04	-10.37	-10.73	-11.53	-11.20	-8.90	-7.45	-8.32
	Upper Quartile	-2.97	-3.16	-2.88	-3.26	-3.20	-3.76	-3.79	-2.70	-0.66	-0.85
Targets	# of Obs.	199	199	199	200	200					
	Mean	-8.58	-8.63	-8.68	-7.51	-7.04					
	Median	-9.58	-9.42	-9.00	-7.24	-6.36					
	Lower Quartile	-12.25	-12.18	-11.77	-10.91	-10.56					
	Upper Quartile	-5.17	-5.33	-5.40	-4.25	-3.23					
Diff in Means; (Acquirers) – (Targets)		2.98	2.80	2.59	0.80	0.47					
T-Stat (Diff)		4.18***	3.94***	3.66***	1.03	0.57					
Diff in Means; (Post-Mergers) – (t-6:t-17)							-1.40	-1.27	1.15	2.95	2.55
T-Stat (Diff)							-1.67*	-1.53	1.32	2.94***	2.55**
Non-mergers	# of Obs.	112,612	113,606	114,609	117,674	117,674	117,857	116,828	106,144	95,262	84,822
	Mean	-4.24	-4.26	-4.28	-4.43	-4.50	-4.63	-4.64	-4.64	-4.64	-4.70
	Median	-4.89	-4.92	-4.94	-5.19	-5.29	-5.37	-5.38	-5.45	-5.51	-5.60
	Lower Quartile	-9.73	-9.76	-9.78	-10.06	-10.23	-10.07	-10.08	-10.15	-10.15	-10.22
	Upper Quartile	0.54	0.52	0.50	0.44	0.43	-0.23	-0.24	-0.25	-0.30	-0.38
Diff in Means; (Acquirers) – (Non-Mergers)		-1.37	-1.57	-1.80	-2.28	-2.08	-2.38	-2.24	0.18	1.99	1.64
T-Stat (Diff)		-2.46**	-2.77***	-3.16***	-3.48***	-2.95***	-3.80***	-3.63***	0.27	2.28**	1.85*

Table 3 Logistic Regression Results on M&A Decisions

Table 3 reports the results of logistic regressions on the M&A decisions between closed-end funds. The sample includes closed-end fund M&As from 1994 through 2009. The dependent variable is binary, 1 for targets and 0 for acquirers. As for the averaged discounts, *Avg. Discounts*, monthly discounts are equally averaged over the pre-announcement period, from t-7 to t-18 or from t-4 to t-15, where *t* is the month when fund M&As are completed. The fund sizes are calculated by taking the natural log of annually averaged total net assets (TNAs). TNAs are calculated as monthly NAV * monthly outstanding shares (*shrout* in CRSP) over the periods from t-7 to t-18. NAV- and stock price-based pre-announcement performance is a one-year holding period objective-adjusted returns from t-7 to t-18. The NAV-based return ($NR_{i,k}$) of fund *i* in month *k* is calculated as follows:

$$\frac{NAV_{i,k}+Dividend_{i,k}-NAV_{i,k-1}(1+risk\ free\ rate_k)}{NAV_{i,k-1}}.$$

Then, the NAV-based pre-announcement performance is,

$$\left[\sum_{k=t-7}^{k=t-18}\left(1+NR_{i,k}\right)-1\right]-\left[\sum_{k=t-7}^{k=t-18}\left(1+NR_{o,k}\right)-1\right],$$

where $NR_{o,k}$ is the average NAV-based return of all-closed-end funds in the same broad asset-based investment category with fund *i* in month *k*. *P-values* are shown in parentheses, and ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively.

	Model (Acquirers =0; Targets =1)						
Independent Variables	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
Intercept	-0.6353 (0.06)*	-0.9846 (0.00)***	14.6499 (0.00)***	-0.1155 (0.55)	19.0389 (0.00)***	18.9243 (0.00)***	18.7454 (0.00)***
Avg. Discounts(t-7:t-18)	-0.0619 (0.00)***		-0.1262 (0.00)***	-0.0767 (0.00)***	-0.1575 (0.00)***	-0.1541 (0.00)***	-0.1518 (0.00)***
Avg. Discounts(t-4:t-15)		-0.0606 (0.00)***					
Net Expense Ratio	0.4436 (0.05)**	0.4829 (0.02)**			-0.2855 (0.44)	-0.2868 (0.41)	-0.28 (0.44)
Turnover Ratio					0.00442 (0.21)	0.00414 (0.23)	0.00424 (0.22)
Fund size; ln(TNA)			-1.2682 (0.00)***		-1.5794 (0.00)***	-1.5585 (0.00)***	-1.5457 (0.00)***
NAV-Based Pre-announcement Performance (t-7:t-18)						1.0408 (0.31)	0.8764 (0.43)
Stock-Price Based Pre-announcement Performance (t-7:t-18)				-0.2238 (0.80)	0.7729 (0.54)		0.53 (0.69)
Balanced Dummy					-2.0666 (0.02)**	-2.1513 (0.02)**	-2.1144 (0.02)**
International Dummy					0.0862 (0.92)	0.0319 (0.97)	-0.0897 (0.92)
Municipal Dummy					-1.4847 (0.00)***	-1.57 (0.00)***	-1.5247 (0.00)***
Taxable Dummy					-0.0962 (0.87)	-0.1907 (0.75)	-0.1628 (0.78)
# of Observations	252	371	293	287	239	236	235

Table 4 Logistic Regression Results on the Odds of Being Merger-Involved Closed-End Funds

Table 4 reports logistic regression results to examine whether closed-end fund discounts in the pre-announcement period affect the odds of being *acquirers* (Panel A) or *targets* (Panel B) relative to general *non-merger* closed-end funds. The dependent variable is 1 for *acquirers* (Panel A) or for *targets* (Panel B) and 0 for non-merger closed-end funds. To calculate the averaged discounts, the monthly discounts are equally averaged over the pre-announcement period, from t-7 to t-18 or from t-4 to t-15, where *t* is the month when M&As are completed. The fund sizes are calculated by taking a natural log of annually averaged total net assets (TNAs). TNAs are calculated as monthly NAV * monthly outstanding shares (*shrout* in CRSP) over the periods from t-7 to t-18. Both NAV- and stock price-based pre-announcement performance are a one-year holding period objective-adjusted returns from t-7 to t-18. The NAV-based return ($NR_{i,k}$) of fund *i* in month *k* is calculated as follows:

$$\frac{NAV_{i,k}+Dividend_{i,k}-NAV_{i,k-1}(1+risk\ free\ rate_k)}{NAV_{i,k-1}}.$$

Then, the NAV-based pre-announcement performance is,

$$\left[\sum_{k=t-7}^{k=t-18}\left(1+NR_{i,k}\right)-1\right]-\left[\sum_{k=t-7}^{k=t-18}\left(1+NR_{o,k}\right)-1\right],$$

where $NR_{o,k}$ is the average NAV-based return of all-closed-end funds in the same broad asset-based investment category with fund *i* in month *k*. The sample includes all closed-end fund M&As during the period 1994-2009. *P-values* are shown in parentheses; ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively.

Panel A: Logistic Regression Results for Acquirers (=1) and Non-Mergers (=0)

	Model						
Independent Variables	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
Intercept	-5.9532 (0.00)***	-5.9528 (0.00)***	-8.6416 (0.00)***	-6.9588 (0.00)***	-9.7681 (0.00)***	-9.5916 (0.00)***	-9.7018 (0.00)***
Avg. Discounts(t-7:t-18)	-0.0156 (0.22)		-0.0196 (0.10) *	-0.0176 (0.13)	-0.0324 (0.04)**	-0.0303 (0.05)**	-0.0315 (0.04)**
Avg. Discounts(t-4:t-15)		-0.0194 (0.13)					
Net Expense Ratio	-0.7157 (0.00)***	-0.7292 (0.00)***			-0.0999 (0.64)	-0.0532 (0.80)	-0.0820 (0.70)
Turnover Ratio					0.0018 (0.13)	0.0019 (0.08)*	0.0018 (0.11)
Fund size; ln(TNA)			0.1359 (0.14)		0.2011 (0.06)*	0.1891 (0.08)*	0.1979 (0.07)*
NAV-Based Pre-announcement Performance (t-7:t-18)						-0.5253 (0.40)	2.1836 (0.01)**
Stock-Price Based Pre-announcement Performance (t-7:t-18)				-1.3129 (0.09)*	-2.5030 (0.02)**		-3.9636 (0.00)***
Balanced Dummy					0.3237 (0.56)	0.2823 (0.61)	0.2991 (0.59)
International Dummy					-0.8104 (0.15)	-0.7973 (0.17)	-0.7358 (0.19)
Municipal Dummy					0.6996 (0.06)*	0.6286 (0.09)*	0.6518 (0.08)*
Taxable Dummy					-0.1508 (0.71)	-0.1958 (0.63)	-0.1779 (0.66)
# of Observations	95,928	96,849	105,530	99,622	95,652	92,626	87,775

Panel B: Logistic Regression Results for Targets (=1) and Non-Mergers (=0)

	Model						
Independent Variables	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
Intercept	-7.4741 (0.00)***	-7.4870 (0.00)***	-0.2442 (0.77)	-6.7388 (0.00)***	-1.4152 (0.24)	-1.1473 (0.35)	-1.1515 (0.35)
Avg. Discounts(t-7:t-18)	-0.0769 (0.00)***		-0.0562 (0.00)***	-0.0606 (0.00)***	-0.0880 (0.00)***	-0.0880 (0.00)***	-0.0887 (0.00)***
Avg. Discounts(t-4:t-15)		-0.0757 (0.00)***					
Net Expense Ratio	0.1283 (0.15)	0.1265 (0.16)			0.0122 (0.91)	-0.0226 (0.84)	-0.0209 (0.86)
Turnover Ratio					0.0017 (0.04)**	0.0016 (0.05)**	0.0016 (0.06)*
Fund size; ln(TNA)			-0.5505 (0.00)***		-0.4928 (0.00)***	-0.5097 (0.00)***	-0.5095 (0.00)***
NAV-Based Pre-announcement Performance (t-7:t-18)						-0.2871 (0.51)	0.0354 (0.95)
Stock-Price Based Pre-announcement Performance (t-7:t-18)				-0.9694 (0.08)*	-1.1530 (0.12)		-1.0353 (0.25)
Balanced Dummy					-0.5779 (0.24)	-0.4901 (0.32)	-0.5129 (0.30)
International Dummy					-1.0039 (0.01)**	-1.0085 (0.01)**	-0.9395 (0.02)*
Municipal Dummy					-0.2528 (0.40)	-0.2603 (0.40)	-0.2617 (0.39)
Taxable Dummy					0.1710 (0.56)	0.1882 (0.53)	0.1920 (0.52)
# of Observations	95,923	96,842	105,601	99,693	90,512	88,157	87,792

Table 5 Performance around Fund M&As over Various Holding Periods

In Panel A, fund performance around fund M&As is measured as objective-adjusted holding-period returns for the targets and acquirers from January 1992 through December 2010. Stock price-based returns are obtained from CRSP, and NAVs are mainly from Bloomberg and Compustat. The sample includes the closed-end fund M&As from 1994 through 2006.

The NAV-based return ($NR_{i,k}$) of fund *i* in month *k* is calculated as follows:

$$\frac{NAV_{i,k}+Dividend_{i,k}-NAV_{i,k-1}(1+risk\ free\ rate_k)}{NAV_{i,k-1}}.$$

Then, the NAV-based pre-announcement performance is,

$$\left[\sum_{k=t-7}^{k=t-18}\left(1+NR_{i,k}\right)-1\right]-\left[\sum_{k=t-7}^{k=t-18}\left(1+NR_{o,k}\right)-1\right],$$

where *t* is the month of M&As, and $NR_{o,k}$ is the average NAV-based return of all closed-end funds in the same broad asset-based investment category with fund *i* in month *k*. As for targets and acquirers, t-statistics are reported for the null hypotheses, H(0): the mean returns are zero in each period.

Two-sample t-tests are also reported for the null hypotheses, H(0): the mean stock price-based and NAV-based returns of *acquirers* are equal to those of *targets* (left panel); and as for *acquirers*, the mean stock price- and NAV-based returns of *post-merger* periods are equal to those of *pre-announcement* periods from t-7 to t-18 (right panel).

Panel B reports how post-merger performance of the fund M&As changes relative to other non-merger closed-end funds over the various post-merger periods. The non-merger closed-end funds are chosen by a propensity score-matching method. Each propensity score is calculated by a logistic regression. The matching is one-to-one based on the following four characteristics: (1) the same investment objectives based on U.S. broad asset classes, (2) pre-announcement performance (six-month holding-period objective-adjusted returns before the merger announcement date), (3) fund sizes (averages of monthly total net assets over a one-year pre-announcement period), and (4) fund discounts (averages of monthly fund discounts over a six-month pre-announcement period). To compare the long-run performance between acquirers and the matched closed-end funds, the acquirer sample includes closed-end fund M&As from 1994 through 2006.

T-statistics are reported for the null hypotheses, H(0): the difference of mean returns between *combined funds* and *matched-non-merger funds* is zero in each period. ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively.

Panel A: Objective-Adjusted Performance								
		Pre-announcements		Post-Mergers				
	Periods	t-7:t-18 (1-Year)	t-7:t-12 (6-Month)	t+1:t+6 (6-Month)	t+1:t+12 (1-Year)	t+13:t+24 (1-Year)	t+25:t+36 (1-Year)	t+37:t+48 (1-Year)
Objective-Adjusted Holding-Period Stock Price-Based Returns								
Targets	# of Obs.	176	185					
	Mean	-0.0167	-0.0103					
	T-Stat (Mean)	-1.29	-1.31					
	Median	-0.0245	-0.0067					
Acquirers	# of Obs.	138	144	170	170	151	135	123
	Mean	-0.0179	-0.0100	0.0243	0.0360	0.0327	-0.0144	0.0067
	T-Stat (Mean)	-2.16**	-1.74*	3.56***	2.99***	2.94***	-1.64	0.81
	Median	-0.0257	-0.0139	0.0151	0.0223	0.0249	-0.0007	0.0052
Diff in Means; (Acquirers) – (Targets)		-0.0013	0.0003					
T-Stat (Diff)		-0.08	0.03					
Diff in Means; (Post-Mergers) – (t-7:t-18)				0.0423	0.0539	0.0507	0.0035	0.0246
T-Stat (Diff)				3.93***	3.69***	3.65***	0.29	2.10**
Objective-Adjusted Holding-Period NAV-Based Returns								
Targets	# of Obs.	161	170					
	Mean	-0.0502	-0.0212					
	T-Stat (Mean)	-2.39**	-1.96*					
	Median	-0.0094	-0.0083					
Acquirers	# of Obs.	160	166	169	154	145	133	127
	Mean	-0.0294	-0.0207	0.0167	0.0099	0.0006	-0.0177	-0.0015
	T-Stat (Mean)	-3.59***	-3.52***	2.75***	1.04	0.05	-2.54**	-0.26
	Median	-0.0087	-0.0125	0.0050	0.0159	0.0064	0.0036	0.0004
Diff in Means;		0.0208	0.0005					

(Acquirers) – (Targets)							
T-Stat (Diff)	0.93	0.04					
Diff in Means;							
(Post-Mergers) – (t-7:t-18)			0.0460	0.0392	0.0300	0.0117	0.0279
T-Stat (Diff)			4.52***	3.13***	2.13**	1.08	2.75***

Panel B: Performance by Propensity Score-Matching Methods						
		Post-Mergers				
	Periods	t+1:t+6 (6-Month)	t+1:t+12 (1-Year)	t+13:t+24 (1-Year)	t+25: t+36 (1-Year)	t+37: t+48 (1-Year)
	Difference in Returns; (Combined Funds) – (Matched Non-Merger Closed-End Funds)					
Stock Price-Based Returns	# of Obs.	77	77	76	75	73
	Mean	0.0058	0.0329	0.0100	-0.0268	0.0143
	T-Stat (Mean)	0.81	2.94***	0.70	-2.36**	1.17
	Median	0.0025	0.0280	0.0108	-0.0222	-0.0015
NAV-Based Returns	# of Obs.	78	78	77	76	75
	Mean	0.0082	0.0228	-0.0002	-0.0128	-0.0109
	T-Stat (Mean)	1.43	1.56	-0.02	-1.61	-0.62
	Median	0.0034	0.0052	0.0024	-0.0093	0.0019

Figure 1 Historical Changes in Closed-End Fund Numbers

Figure 1 presents the historical changes in the number of all closed-end funds per month over the 19 years from January 1991 through December 2009.

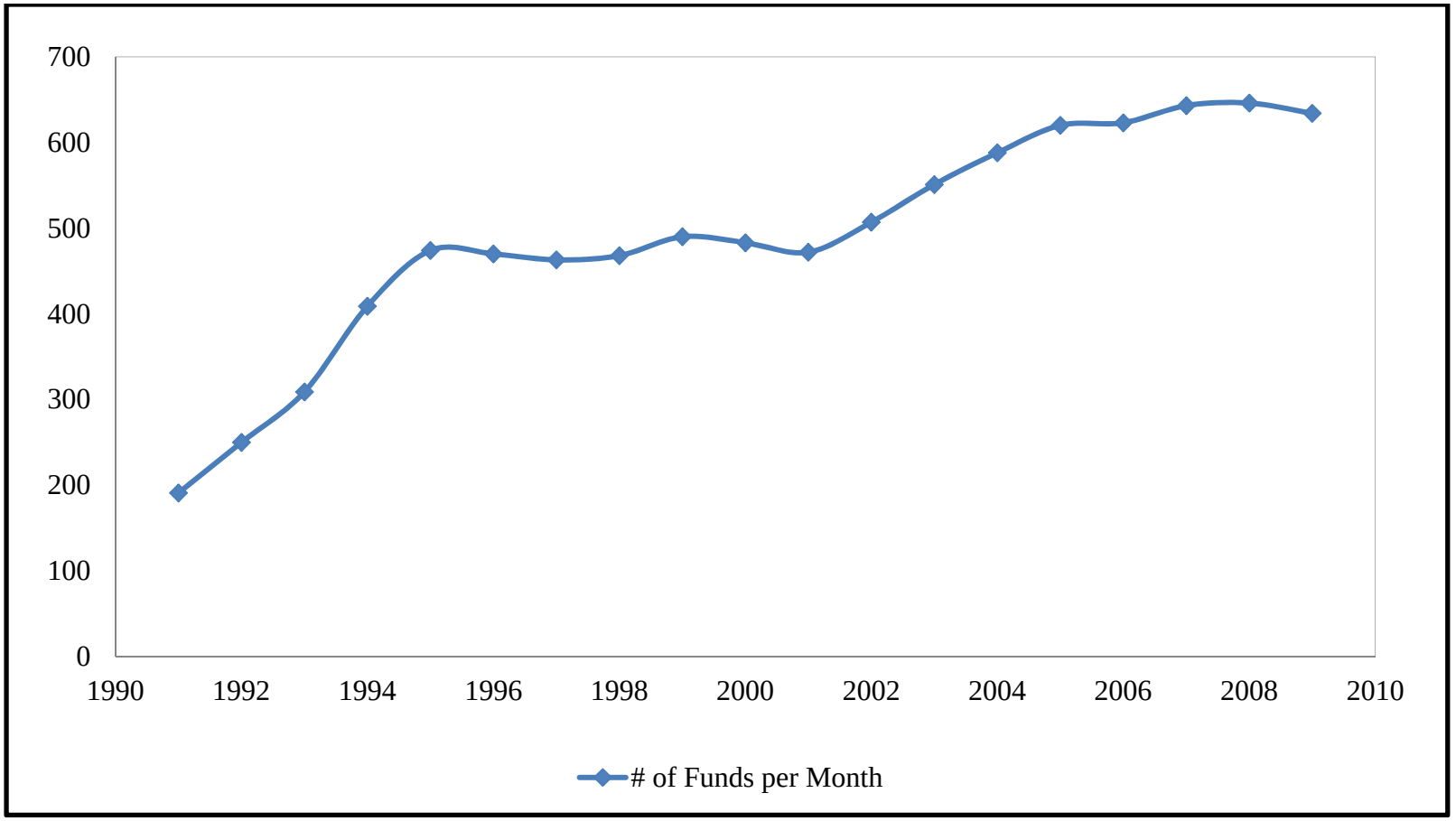

Figure 2 Historical Changes of Closed-End Fund Discounts

Figure 2 shows the historical changes of monthly closed-end fund discounts over the 21 years from January 1990 through May 2010. By definition, negative (positive) numbers represent fund discounts (premia).

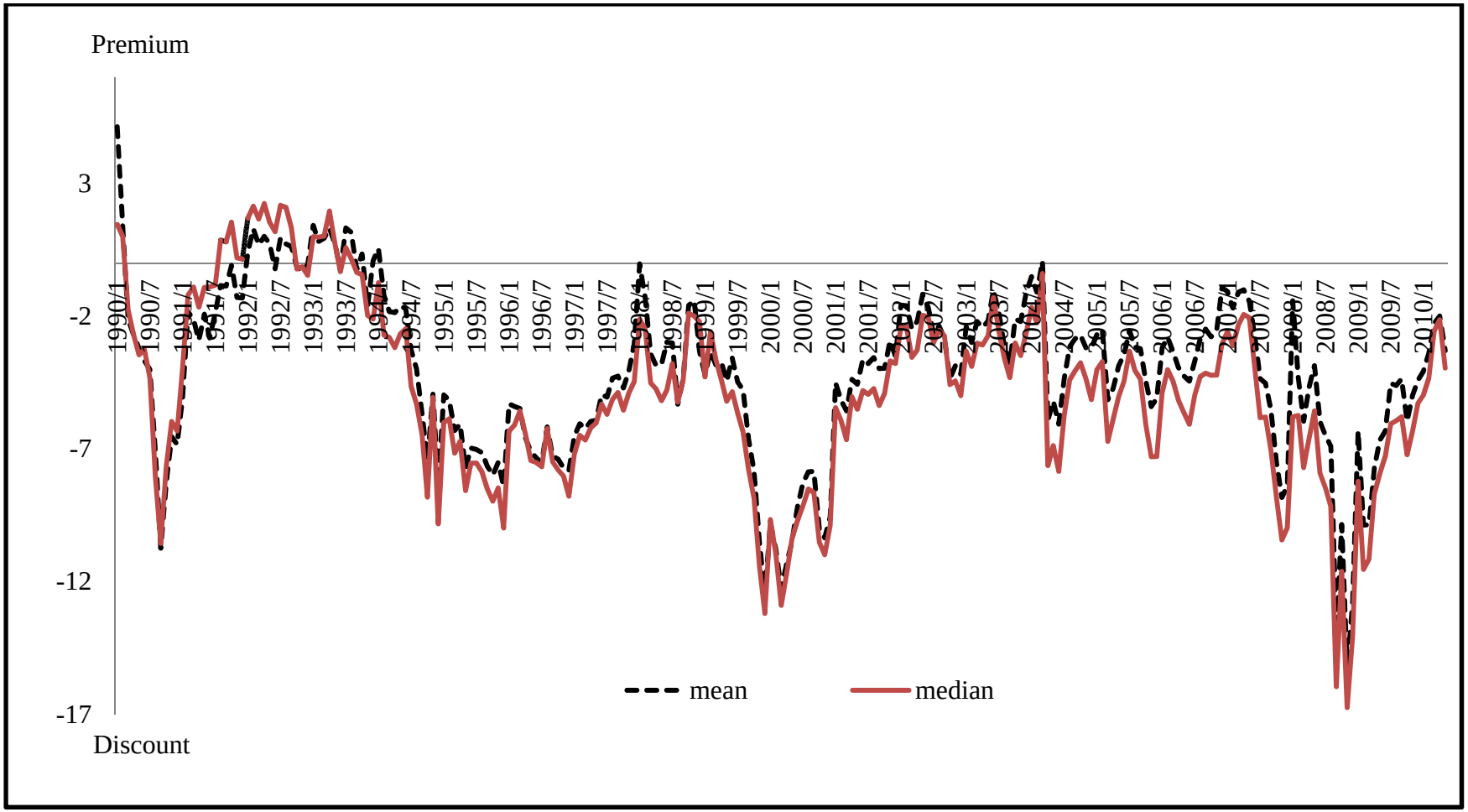

Figure 3 Historical Changes of Closed-End Fund Discounts by U.S. Broad Asset Classes
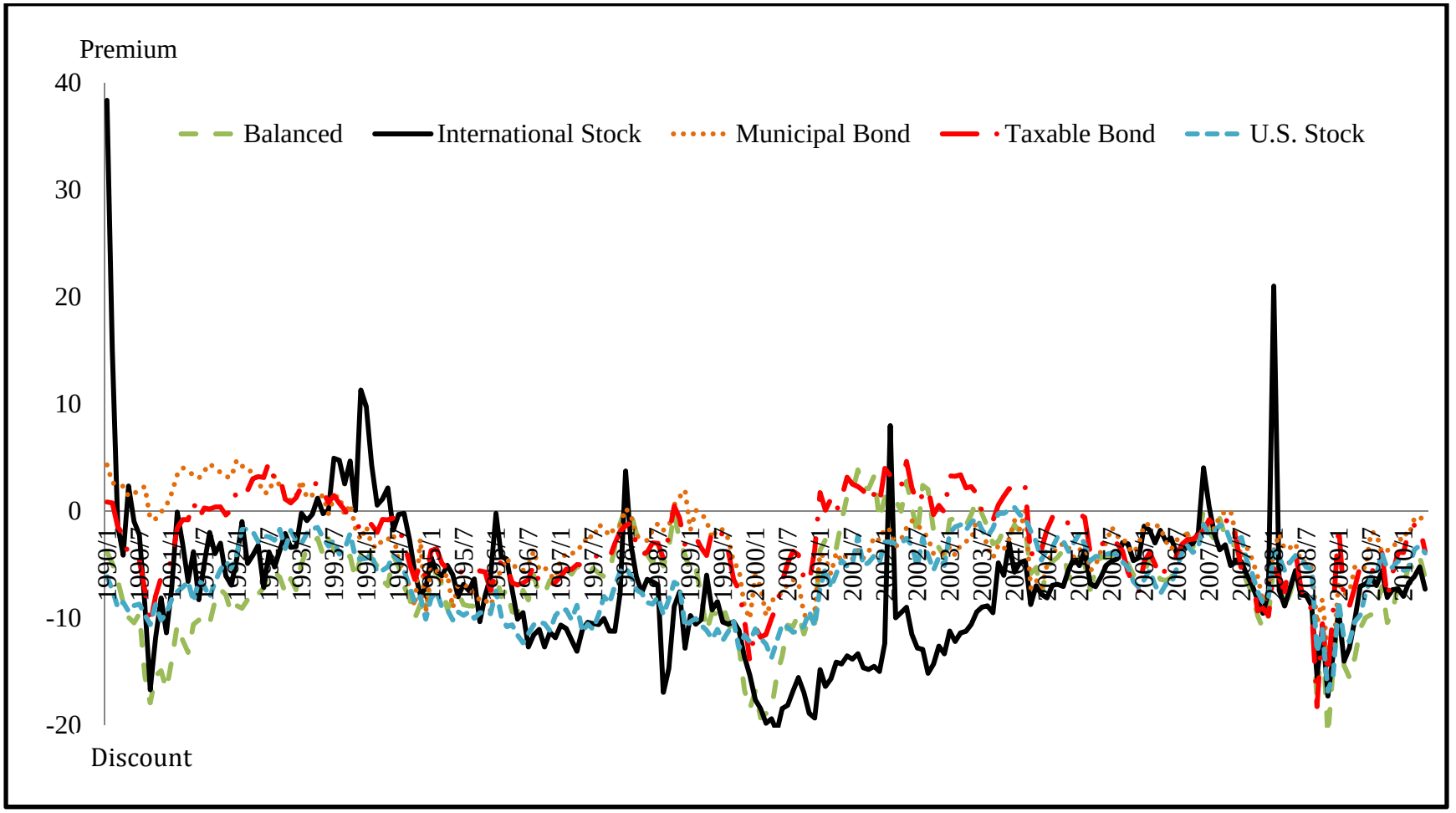
Figure 3 exhibits a series of monthly historical fund discounts that are equally-weighted averages by the fund objectives based on U.S. broad asset classes over the 21 years from January 1990 through May 2010. By definition, negative (positive) numbers represent fund discounts (premia).