The Disposition Effect in Closed-End Fund Market

By Peiran Jiao*

ABSTRACT

This paper finds that the disposition effect, well-known in many financial markets, exists in the closed-end fund market, where fundamental values are known, yet the magnitude of the effect varies with the adoption of different reference points. Using the prospect theory explanation to this effect, this paper evaluates the empirical validity of three candidate reference points: last period price, previous extreme price and purchasing price. Under a valid reference point, the disposition effect diminishes as deviations of price from the reference point widen. Knowing the fundamental values, closed-end fund investors exhibit behavior that compromises the disposition effect under certain circumstances.

Key Words: Closed-End Fund, Disposition Effect, Reference Points

JEL Classification: G02, G12

* Department of Economics and Nuffield College, University of Oxford; Address: Mannor Road Building, Mannor Road, Oxford, OX1 3UQ, UK; Email: Peiran.Jiao@economics.ox.ac.uk. The author thanks Sean Flynn's for his generous sharing of data and help, and Paul Zak， Joshua Tasoff and participants at the 2013 WEAI annual conference for valuable comments.

I. INTRODUCTION

The disposition effect, which refers to the investors' tendency to sell winners too early while holding on to losers too long, has been one of the most extensively examined phenomena in behavioral finance, where the definitions of winners and losers are often relative to the initial or the average purchasing price of the investor. Shefrin and Statman (1985) document this effect for the first time, and explain it as a result of the investors' psychological mistakes. Tests of the disposition effect abound in both empirical and experimental literature, raising supporting evidence for this effect, although many studies proved that the disposition strategy is oftentimes mistaken. To demonstrate the existence of the well-known disposition effect in a new arena, the closed-end fund (CEF) market, will be the goal of this paper. No study so far has tested this effect among CEF investors.

Empirical tests have been focusing on the prospect theory explanation to the disposition effect. The main ingredients in the prospect theory are threefold: nonlinear probability weighting, reference-dependent loss aversion and diminishing sensitivity. The first one is hard to observe or test in the aggregate level data that the author of this paper obtained, rendering the other two essential[1]. In Kahneman and Tversky's (1979, 1992) contributions to prospect theory, there is not a clear definition of what an appropriate reference point should be, whereas the determination of reference point is a critical issue in the studies of prospect-theory-based explanations to the disposition effect. In the literature, researchers have adopted many candidate reference points: the price of last period, such as in Weber and Camerer (1998); the purchasing price, either initial or average, such as in Weber and Camerer (1998) and Odean (1998); and the prior extreme

1. The modeling attempts of the prospect theory usually treat the nonlinear probability weighting and reference-dependent loss aversion separately. In models such as Koszegi and Rabin (2006, 2007) and etc., reliance on nonlinear probability weighting is not necessary in generating the results of interest.

prices, such as in Gneezy (2000).[2] Although each specification of the reference point can, in some context and to some extent, generate the observed disposition effect, no study has compared the relative empirical validity of candidate reference points in one specific market. To compare the strength of disposition effect in the CEF market under the above three categories of reference points will be the first task of this paper.

Another component of the prospect theory is diminishing sensitivity, which implies that although investors may suffer from the disposition effect, they sell winners and hold on to losers only within some ranges of gains and losses. Simply put, the disposition effect never states that investors never keep winners, or never sell losers.[3] As the current price is further away from the reference price, the effect of loss aversion should diminish, i.e. the investor's propensity to sell winners or to hold losers decreases. Investors can be risk-seeking in the domain of losses, but they still should sell when suffering from sufficiently large losses. Based on the valid reference points, this paper will then examine the diminishing sensitivity in the disposition effect.

Additionally, although it is still debatable whether the theories of investor preference, such as the prospect theory, can provide the appropriate explanation to the phenomenon or not, the disposition effect itself is not inherently about preferences. For example, the belief in mean reversion in stock performances, i.e. the expectations of winning stocks to decline in value and losing stocks to bounce back, can also generate similar trading strategies. An intriguing question

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2. In recent developments of the prospect theory modeling, such as Koszegi and Rabin (2006), researchers have used the rational expectation of the decision maker as the reference point, which has also been incorporated in the disposition effect in the work of Meng (2011). However, this study will not address issues of investor expectations because they are unobservable from the aggregate level data.

3. In the modeling attempt of Barberis and Xiong (2009), the authors incorporate both loss aversion and diminishing sensitivity to generate the disposition effect. Yet, Meng (2011) demonstrate that with expected capital gains as the reference point, there can be the disposition effect without assuming diminishing sensitivity.

would be: does the belief in mean reversion, also known as the gambler's fallacy, necessarily generate predictions exactly the same as the disposition effect? If we think of the gambler's fallacy as the biased probabilistic judgment based on the observed past trend, then the answer to this question should be positive; but if the decision maker knows something about the underlying price-generating process then the answer is a little bit ambiguous. Therefore, the other main topic in this paper is to evaluate the strength of the disposition effect in the face of biased beliefs, in an environment where the fundamental value of the asset is known. The CEF market gives us the privilege to test the disposition effect in this novel setting, because one feature of the CEF market is that the funds' fundamental value, or their net asset value (NAV) is public information, calculated by the value of a fund's assets less its liabilities divided by the number of its outstanding shares. Knowing the NAV of the CEF leads the mean-reversion believers to predict that the market price of the fund should converge to the fundamental value, creating the incentive to arbitrage.

The special features of the CEF market makes it more intriguing to conduct such a behavioral study with it. The methodology in testing the hypotheses in this paper regarding the disposition effect in the CEF market is to perform an analysis of the trading volume, where the abnormal trading volume is the dependent variable. The abnormality in volume refers to an abnormally high or low volume compared with the historical mean of the past six months for each specific fund. The results suggest that the previous peak price is a more salient reference point than the other two candidates, that diminishing sensitivity exists when the previous peak price is the reference point, and that when the fundamental value is introduced, the magnitude of the disposition effect is compromised when the fund's share price is moving away from the NAV.

II. CLOSED-END FUNDS AND THEIR ADVANTAGE FOR THIS STUDY

Closed-End Funds

The CEFs are a type of investment vehicle managed by separate entities called investment advisors. Legally known as "closed-end companies", CEFs are one of the three types of investment companies categorized by the U.S. Securities and Exchange Commission (SEC), the other two being mutual funds and unit investments trusts. As of October 2009, the number of CEFs registered with the Closed-End Fund Association (CEFA) of the United States is 673, with a total market capitalization of approximately $32 billion.

The CEF has many distinguishing features compared to its more popular open-end counterpart, mutual funds. First, the way in which shares of CEFs are traded is different from the open-ended mutual funds. At its initial public offering, a CEF, like a mutual fund, sells its shares to raise money for the fund manager to invest in securities of other corporations with specific charter regulations. From then on, however, CEFs rarely issue new shares or redeem existing shares for cash or securities until the fund liquidates; thus trades of shares of CEFs happen mainly on the secondary market among investors, brokers and market makers, following the rules of the market. In contrast, transactions of mutual funds ultimately involve the fund company creating new shares to exchange for cash or securities, or redeeming existing shares. Thus, shares of mutual funds are only tradable at closing price at the end of the market day.

Second, due to the fact that closed-end companies are not subject to daily redemption requests, CEF managers can be fully invested all the time, which permits them to purchase various types of assets, some in relatively illiquid markets, allowing them more freedom than mutual fund managers.

Third, supply and demand conditions on the secondary market determine the CEFs' share price. An inelastic supply curve, i.e., a fixed number of shares, implies that shifts in demand fully lead to changes in the market price. If on some day, some buying bids push the trading volume to an above-average level, price has to rise to correct this excess demand; and conversely, large selling offers push the price downward. But open-end funds have perfectly elastic supplies, making all the shifts in demands reflected in money flowing in or out of the fund. Therefore, CEFs have larger volatility in share prices, while open-end funds have more volatile fund flows.

Fourth, the exchange-traded property allows investors to buy and sell shares of CEFs just like other publicly traded securities. This leads to another major difference between open-end and closed-end funds. Trades in the former can only occur at the price that is equal to the value of the underlying portfolio, the NAV, while investors usually buy and sell the latter at a premium or discount over the NAV.

The trading of CEFs at premiums or discounts poses a puzzling problem, which has attracted a lot of academic attentions. Theoretically, whenever a fund's price is different from its NAV, arbitrageurs should arbitrage away this price difference in an efficient market. For example, when a CEF trades at a discount, a well-capitalized investor could buy up the fund at the discounted market price per share, gain control of the fund, and ask the fund manager to liquidate at the portfolio's value, making profits. Similarly, the arbitrage in the opposite direction can take place when the fund trades at a premium. Although explaining the CEF puzzle is not a focus of this paper, tests of the disposition effect needs to control for the arbitrage incentives.

The Advantages of Closed-End Funds for the Current Study

The purpose of the present study is to use the CEF market to explore the aggregate effects of behavioral biases in investors' decision making, particularly the disposition effect and biased beliefs. There are several advantages of doing such a study in the CEF market.

One advantage of working with CEFs for behavioral finance research in general is that it is mainly individual investors that invest in this market, rather than institutional investors. In the stock market, with large amount of trading made by institutional investors, it is difficult to argue the existence or prevalence of the behavioral biases commonly found among individuals, unless it can be proved that institutional investors also fall under the spell of these biases[4], because group decision making process can eliminate lots of biases and mistakes. Lee, Shleifer and Thaler (1991) argue that institutional investors only trade a small proportion of CEF shares. They documented that in the 1987 intraday trading data, 64 percent of the trades of CEFs, 79 percent of the trades of the smallest decile of NYSE stocks and only 28 percent of the largest decile of NYSE stocks were smaller than $10,000. With individual investors trading most of the CEF shares, we can more confidently test hypotheses that are more relevant to individual behavior.

In the research of both conventional and behavioral finance, researchers often discuss fundamental values. Under the efficient market hypothesis, asset prices, such as stock prices, should fully incorporate all available information regarding the fundamental value that is calculated by estimating all future incomes generated by the asset, and discounting the sum to the present value, i.e. the actual value of a security as opposed to the market or book value. Thus, understanding the fundamental value of a stock entails a clear analysis of the financial statement, growth potential, management competence, competitive advantages, and the competitors in the market. Merton (1973), Lucas (1978) and Breeden (1979) show that in addition to the specific factors of a firm, the factors that affect the stock price also include the fundamentals of the

4. For example, Benartzi and Thaler (1995) argue that institutional investors also commit the mistake of using an investment strategy that exhibits myopic loss aversion, with data of some pension funds. Of course, one of the reasons why institutional investors might also commit these mistakes is that they are also managed by some individual portfolio managers, and some organizational issues make these individual mistakes of the managers also exhibit in the organizational decisions, such as in Camerer and Malmendier (2007).

economy, such as consumption. Therefore, in a study with real-world stock data, it is almost an impossible mission to figure out the exact fundamental value of a stock at each point in time, let alone to identify deviations from it. In experimental asset trading tasks, such as in Smith, Suchanek and Williams (1988), dividends are generated from some exogenous processes, and the fundamental values are calculated from the expected value of all future dividends. However, these fundamental values are far from being similar to those in the real world. Given these obstacles in obtaining the intrinsic value of assets, CEFs provide us with a simple measure. The fundamental value of a CEF is just the net asset value (NAV), which reflects the value of the underlying portfolio averaged over the total number of shares. Thus, deviations of CEF market prices from NAV can reflect deviations from the fundamental values.

The investors' knowledge of the NAV enables us to test the robustness of the disposition effect in an environment where the fundamental value is known. As will be discussed later, this may create biased judgments that work in the completely opposite direction than the disposition effect under some conditions.

One way to examine the behavioral biases in mutual fund investors is to look at the fund flows, which is a measure of the amount of new capital flowing into or out of the fund due to transactions in the market. For instance, there exists a strong positive cross-sectional relationship between net inflows to individual mutual funds and past performance, such as in Chevalier and Ellison (1997), Ippolito (1992), Sirri and Tufano (1998). With CEFs, the measure of fund flows is not meaningful because of the closed-end nature of the funds, but we can observe the trading volumes in the secondary market as the dependent variable.

III. THE DISPOSITION EFFECT

Shefrin and Statman (1985) coined the term disposition effect. Since its debut in the academic literature, there has been abundant evidence of it in various markets: not only its common existence among individual investors in the stock market, such as in Odean (1998) and Grinblatt and Keloharju (2001); but also among professional futures traders, such as in Heisler (1994); individual commodity and currency traders, such as in Locke and Mann (2000); mutual fund managers, such as in Wermer (2003) and Scherbina and Jin (2005); home sellers in the real estate market, such as in Genesove and Mayer (2001); and so forth[5].

Shefrin and Statman originally explained the disposition effect by resorting to a combination of four behavioral elements: prospect theory, regret aversion, mental accounting and self-control, all of which can be modeled as a modification to traders' preferences. However, considerable attention has only been placed on the prospect theory explanation in the literature.

Several studies on trading volume also examine the aggregate market implication of the disposition effect. An increase in the trading volume of a stock indicates that there are increasing heterogeneous beliefs among investors regarding the future performance of the stock. Statman, Thorley and Vorkink (2006) argue that disposition effect can lead to changes in volume, e.g. if a volume increase is following a recent stock price increase, from which more investors are making a gain, then it is likely to be driven by the disposition effect. Kaustia (2004) tests the relationship between price change from the IPO price and trading volume of stocks, because immediately after the IPO, most sellers have a purchasing price close to the IPO price. He finds that turnover is lower for initial losers than for initial winners, but the turnover of initial losers increases as their prices go above the IPO price. A better way to test the disposition effect should

5. There is also evidence for the nonexistence of disposition effect among some traders. For example, O'Connell and Teo (2009) find that institutional currency traders have no disposition effect, but instead risk-averse after losses and risk-seeking after gains.

be in observing the individual level decisions in a controlled environment, such as that in Weber and Camerer (1998) and later in Oehler et al. (2000), Chui (2001), and Kirchler et al. (2004). Purchasing price and last period price are both valid reference points in Weber and Camerer (1998). Using a different experimental procedure, Gneezy (2000) also find supporting evidence for the disposition effect, and the validity of historical extreme prices, maximums or minimums, as the reference point.

Many competing explanations to this same effect emerged. Odean (1998) first proposes that the biased belief of mean reversion, i.e. the gambler's fallacy, can also generate disposition effect. For example, if an investor, who holds shares of a stock that has recent increased in price, believes that the stock is overvalued, then the prediction of mean-reversion will motivate the investor to sell the stock; yet he will keep the stock that has experienced recent decrease in price. But it seems that the investor's patience and risk-aversion are also important factors for the gambler's fallacy to be eligible as a candidate explanation. Odean (1999) finds that individual investors tend to buy smaller, growth stocks or stocks that have experienced recent increase in price. This implies that individual investors are trend followers instead of believers of mean reversion. However this is not to say that gambler's fallacy cannot be a valid explanation, because we cannot assume that investors have the same expectation about future movements of prices regardless of whether they hold the stock or not. The literature on wishful thinking predicts that investors are more optimistic about the future profitability of the stocks they hold than what they don't hold. This asymmetry between predictions from buyers and sellers of a stock still requires further exploitation. Weber and Camerer (1998) also try to address the issue of mean-reversion beliefs in their experiment, but they find ambiguous results. So far which of the two approaches, preference or belief, can better explain the disposition effect is still debatable. And there can be an interesting interplay between investors' preferences and beliefs.

A clear understanding of the source of the disposition effect is very important because this effect relates to various anomalies in the financial market, leading to market inefficiency. Suppose a stock has experienced recent declines in value. Due to the disposition effect, holders of this stock are reluctant to realize losses. This will have at least two implications: one is that the stock price cannot fully and immediately reflect its correct value, leading to under-reaction and market inefficiency; the other is that stockholders will experience larger capital losses once the true value is correctly priced. For instance, Frazzini (2006) explored this effect. Grinblatt and Han (2002) use a model with both disposition investors and rational investors to demonstrate that the disposition effect can also make the stock prices predictable, and the under-reaction makes momentum strategy profitable for rational investors. Identifying the reason for disposition effect is not only important for correct asset pricing, but also for the investors' well-being. Cici (2005) and Locke and Mann (2005) both find that disposition effect makes mutual fund managers and investors lose a lot.

IV. DATA DESCRIPTION AND HYPOTHESES

Data Description

The source of the dataset used here is the same as that in Flynn (2010), with extended time periods. It includes all 464 bond and stock funds trading in the US and Canada as of June 22, 2001 with historical data on each fund dating back to January 1985, maintained by the Fund Edge data service, and sold by Weisenberger/Thompson Financial. The dataset provides comprehensive information on CEFs to subscribers. It is one of the most wide-ranging dataset used in CEF studies. The original data was in daily frequency but due to the large amount of missing observations, noises in daily fluctuations and the fact that the funds publish their NAV information only weekly, all analyses here use data converted to weekly frequency. The resulting dataset is an unbalanced panel because funds' inceptions and liquidations are on different dates. The important variables used here include price, NAV, and trading volume. The market return and the NAV return are respectively equal to the return on the fund's shares traded on the secondary markets, and the return calculated based on changes in NAV of the fund.

In what follows, the definition of variable *PREM* is as follows: the ratio of price over NAV is equal to *PREM* plus 1, shown in equation (1), so that *PREM* is positive when the fund is traded at a premium, and discounts are negative *PREM*.

$$1 + PREM = \frac{P}{NAV} \tag{1}$$

For example, if *PREM*=-0.02, that means the fund has a 2% discount.

TABLE 1 provides the summary statistics. *SPYRET*, which represents the S&P 500 weekly return, is a measure of the market performance. Funds are traded on average at a discount of 4.0958%. The fluctuation of premiums/discounts is tremendous from -66.55% to 205.39% with a standard deviation of 11.1672%. FIGURE 1 is a histogram showing the distribution of weekly data of *PREM* across funds. It is a positively skewed unimodal distribution with a kurtosis of -1.2. The highest mode occurs at the bin from -6% to -5%. These observations confirm the stylized fact that funds are traded on average at a moderate discount. Thus, regardless of the reason for this average discount, be it the investor sentiment, management fee or the overestimation of NAV, investors should feel that a discount wider than 6% implies that the fund is undervalued, and conversely, if the fund has a premium or a discount narrower than 6%, the investors feel the fund is overvalued.

(Insert TABLE 1 approximately here.)

(Insert FIGURE 1 approximately here.)

More interestingly, the relationship between volume and discount is not linear around the -6% cutoff of *PREM*. To demonstrate this, a dummy variable *Dum* is generated which equals to 1 when *PREM* is above -6% and 0 otherwise. In the panel regression result in TABLE 2, when *PREM* is above -6%, volume increases as *PREM* increases, but on the other hand, when *PREM* is below -6%, volume is a decreasing function of *PREM*. This can be caused by investors' changing opinions towards the funds: as the discount deviates from the standard 6% above or below, more investors are going to think that the fund is over- or under-valued, generating more arbitraging incentives, thereby higher trading volume. This incentive will be controlled for in testing hypotheses regarding the disposition effect.

(Insert TABLE 2 approximately here.)

Hypotheses and Methodology

There are mainly three issues that this paper attempts to address: (1) the validity of three reference points for the disposition effect in the CEF market; (2) if there is disposition effect, the existence of diminishing sensitivity; (3) the robustness of the disposition effect when investors know the fundamental value.

In the existing literature on the disposition effect, four specifications of the reference point have been used: the last period price, the previous extreme prices (maximum or minimum), the purchase price, and the expected price[6]. The first three are testable in both experimental and empirical settings, whereas the direct test of the last one requires data on investor expectations which are not obtainable in the real market on a high frequency basis. Thus, in this paper only the first three reference points are relevant. The last period price and previous extreme prices as

6. Or expected capital gain.

reference point were mostly valid in experiments. In the real world, it is also conceivable, according to the peak-end rule, that investors may feel the experience from the immediate past or the previous extremities to be more salient, thereby evaluating their investments relative to prices of those periods. Thus, they may be comparing the current price with the price of last period to determine whether to keep or sell a stock in the current portfolio, which can give rise to the observed disposition effect. On the other hand, the previous extreme prices may also be a convenient reference point because investors may have an indelible impression on those maximums and minimums in the past. Meanwhile, on an aggregate level, if the current price is higher than previous peak or lower than previous trough, that is when many investors of the stock or fund are making gains or losses.

Both experimental and empirical literature based on individual brokerage account data adopt purchasing price as a reference point. However, in the aggregate level it is impossible to find a purchase price. Following Kaustia (2004), to test whether purchase price can be a reference point, this paper will study the period (6 months) immediately after the initial public offering (IPO) of the CEFs. This is because during that period, most holders of the fund purchased at IPO or at prices close to IPO price, and even if they didn't the IPO price should still be a salient price.

This gives rise to the first hypothesis.

Hypothesis 1: Last period price and previous extreme prices are valid reference points; the IPO price, a proxy for purchasing price in the periods immediately after IPO, is also a valid reference point.

Next, given the validity of the three reference points, the second hypothesis tests the diminishing sensitivity of loss aversion.

Hypothesis 2: Given that there is disposition effect, the strength of this effect should diminish as the magnitude of price deviation from the reference point is larger.

The argument here is that although the disposition effect predicts that investors tend to sell winners too early but hold losers too long, it does not predicts that investors never keep a winner or never sell a loser regardless of the magnitude of gains and losses incurred by the price changes. For example, in the case of a price drop, if it is steep enough, investors will experience large losses, which can make more investors feel the loss is intolerable and start to sell, although they may hate the feeling of losses or regret on earlier decisions. On the other hand, if there is a price rise, the larger the price rise, the more investors are going to be surprised and convinced that further price increases can be supported by the strong fundamentals. Thus the effect of loss aversion should be diminishing as the magnitude of price deviations from the reference point increases.

One can perform the above tests of the disposition effect in many types of markets if well-structured aggregate level data can be obtained. The third hypothesis involves the idiosyncrasy of the CEF market, i.e. the fact that funds trade in the secondary market at prices different from their fundamental values, the NAV. The presence of premiums and discounts, together with the NAV of funds being known to the investors, poses a problem to the disposition effect. Suppose that a fund currently has a discount, so that the investors holding this fund know they are underpaying relative to the NAV. Keeping the NAV constant, when there is a price increase, the discount narrows and the holders of this fund experience a gain. The prediction of the disposition effect should be that the investors are eager to sell to realize the capital gain, because they are risk-averse in the domain of gains. However, if they know the fundamental value is still higher than the current price, leaving more room for price increases, then they should hold on to it. This is similar to the gambler's fallacy, where subjects, knowing something about the underlying data-generating process, would overestimate reversion to the mean. On the other hand, when the fund has a discount and price decreases, the disposition effect predicts that the investors of this fund should be reluctant to sell, and the prediction of the gambler's fallacy is the same as the disposition effect. Therefore, when we take into account the fundamental value of the funds, the expected result is that the disposition effect should hold when the gap between the share price and NAV of the fund is widening, and the disposition effect should be weakened when the share price is converging to the NAV. As an example, TABLE 3 exhibits the predictions of the disposition effect and the belief in convergence to the fundamental value.

(Insert TABLE 3 approximately here.)

Hypothesis 3: When the investors know the fundamental value, the disposition effect becomes weaker as the gap between the current price and the NAV is shrinking.

The way in which these three hypotheses are tested involves investigating whether the disposition effect can cause abnormal changes in trading volume of the funds. The trading volume of CEFs reflects the trends in the buying and selling of CEF shares, in such a way as illustrated in Karpoff (1986) that an increase in the trading volume implies an increasing number of agreements among buyers and sellers upon the price for each share of the fund, as well as an increasing number of disagreements over the interpretation of new information, or the movements in buyers' and sellers' expectations towards the fund.

V. RESULTS

Modeling the CEF Abnormal Volume

Before testing the above hypotheses, it is important to notice that all the tests in this paper use the trading volume as the dependent variable, because the general methodology is to see whether the disposition effect, under different reference points, can influence the trading volumes, or more precisely the standardized abnormal volume, as will be defined shortly. This requires an understanding of volume fluctuations.

Lakonishok and Smidt (1986) analyze the abnormal volume of winner and loser stocks, where they define abnormal volume as the residual in a regression of turnover of a specific security over some time period on the market turnover in that same period. Compared with their method, the procedures here have several modifications. Firstly this paper uses the trading volume per se instead of the turnover because there is no comparison or aggregation across funds, but just explanation of fund-specific abnormal volumes; secondly, the abnormality in this paper is in the sense of abnormal amount of trading based on the trading history of specific funds instead of relative to the general market. The standardized abnormal volume for fund *i* in period *t* is generated by equation (2), where Vol_{it} is the trading volume of fund *i* in period *t*, μ_{it} is the average trading volume for fund *i* in the six months prior to period *t*, and σ_{it} is the standard deviation of the trading volumes within the same period. In this way, the standardized abnormal volume represents the number of standard deviations that the current volume is away from the average trading volume for the specific fund in the previous half year.

$$SAV_{it} = \frac{Vol_{it} - \mu_{it}}{\sigma_{it}} \tag{2}$$

Before modeling the effect of the disposition effect, a baseline model for SAV_{it} is necessary. The first set of variables considered is past abnormal volumes, i.e. SAV_{it-1} and SAV_{it-2}, for potential serial correlations. Ferris et al. (1988) study the autocorrelation in turnovers, and find that the stock turnover process has autocorrelation, but the abnormal turnover doesn't. Their abnormal turnover is similarly as that in Lakonishok and Smidt (1986). It's worth identifying the existence of autocorrelation in abnormal volume under the circumstance of this paper. For the second set of variables in this regression adds in the effect from premiums and discounts, in order to control for the gap between share price and NAV, and thereby the arbitrage incentives. Section IV establishes the nonlinear relationship between volume and discounts above and below -6%. So here, discounts should affect abnormal volume, and this effect is asymmetric above and below -6% *PREM*. Therefore the second set of variables included in the regression are interactions between discounts and the dummy variable *Dum*, i.e. $PREM_{it} \cdot Dum_{it}$ and $PREM_{it} \cdot (1-Dum_{it})$. The third set of variables is the contemporaneous and lagged values of abnormal returns, i.e. $ARet_{it}$ and $ARet_{it-1}$, where the abnormal return for a specific period is the difference between the return of a fund and the general market return, whereas the S&P 500 return represents the latter here. There should also be an asymmetric effect from positive and negative abnormal returns, because as the abnormal return becomes both more positive and more negative, there should be more people willing to trade, creating the nonlinear relationship. This nonlinearity can be modeled by taking the absolute value of all $ARet_{it}$, but that is unsoundly presuming that positive and negative abnormal returns have the same marginal effects. Thus, a dummy variable $ARetD_{it}$ is introduced here: it is equal to 1 when the abnormal return is positive, and 0 otherwise. The last variable in this regression is the volatility measured by squared returns, i.e. Ret_{it}^2. Higher volatility means the investment is more risky, thus affecting investors' willingness to buy and sell. The above discussion gives rise to the following regression model:

$$\begin{aligned} SAV_{it} = {} & \beta_{0i} + \beta_1 SAV_{it-1} + \beta_2 SAV_{it-2} + \beta_3 PREM_{it} \cdot Dum_{it} + \beta_4 PREM_{it} \cdot (1 - Dum_{it}) \\ & + \beta_5 ARet_{it} \cdot ARetD_{it} + \beta_6 ARet_{it} \cdot (1 - ARetD_{it}) + \beta_7 ARet_{it-1} \cdot ARetD_{it-1} \\ & + \beta_8 ARet_{it-1} \cdot (1 - ARetD_{it-1}) + \beta_9 Ret_{it}^2 + \varepsilon_{it} \end{aligned} \tag{3}$$

where β_{0i} captures the fund-fixed effects, which are allowed to be different for different funds. TABLE 4 reports the results of the above model, but it omits the fund-specific intercepts.

(Insert TABLE 4 approximately here.)

The regression results show that the current standardized abnormal volume depends on the variables listed above. Firstly, the SAV_{it} series has positive autocorrelation for individual funds. Although it is not shown in the table, more lags fail to improve the model significantly. For parsimony, the regression only includes two lags of SAV_{it}. Secondly, the effects of discounts above and below -6% still have asymmetric effects, but the signs are the same, just with different magnitudes. When $PREM_{it}$ is below -6%, the current abnormal volume decreases more, as $PREM_{it}$ increases, than when $PREM_{it}$ is above -6%, therefore investors are more responsive to discount changes when they perceive the fund is undervalued. This difference in coefficients (0.65) is significant under Wald test ($p<0.001$). Thirdly, the regression equation distinguishes the effects of positive and negative abnormal returns on abnormal volume. The results show two patterns in the effect from abnormal returns: as the change in both the contemporary and lagged abnormal returns become larger, the abnormal volume becomes higher, the absolute value of coefficients on positive and negative abnormal returns are significantly different by Wald test (contemporary: $p=0.0068$; lagged: $p<0.001$). This is understandable because as the fund is performing far better or worse than the market, there will be increasingly more investors willing to buy or sell, generating more transactions. On the other hand, this effect is drastically reduced when abnormal return is lagged. Lastly, there is positive correlation between abnormal trading volume and return volatility. As Bessembinder and Seguin (1993) demonstrate, there is a positive relationship between volume and return volatility, which became weaker after the introduction of futures trading in 1982. Testing the three hypotheses involves the introduction of variables related to the disposition effect into the model above.

Testing Hypothesis 1

Hypothesis 1: Last period price and previous extreme prices are valid reference points; the IPO price, a proxy for purchasing price in the periods immediately after IPO, is also a valid reference point.

With a valid reference point, the disposition effect predicts that investors have a larger propensity to sell at prices higher than the reference price, but to hold at prices lower than that. If a considerable amount of investors are making such investment decisions, their behavior will show in the aggregate outcome in that there will be an increase of selling as most investors experience gains, and a decrease of selling as most investors experience losses relative to the reference prices. This leads to changes in trading volume.

In order to test the last period price as a reference point, two dummy variables are generated here: dummy variable DPD is equal to 1 when price increased from last period and 0 otherwise; the other dummy variable DPDD is equal to 1 when the price decreased from last period and 0 otherwise. Thus when the price stayed the same, both DPD and DPDD are 0. Since there were sufficiently many periods when there were no price change from one period to the next, putting DPD and DPDD in the same regression does not lead to multicollinearity. Movements of prices above and below the reference point should cause changes in the opinions and expectations of investors. In this occasion, for example, when there is the disposition effect with last period price as the reference point, if price increased from last period, there should be more people willing to sell shares of the fund, driving the volume up or abnormally high compared to regular trading volumes of the fund; whereas on the other hand, if price decreased, sellers will be reluctant to sell, driving the volume down. But note that every change in volume should be a two-sided story, although the disposition effect only has predictions on the sellers' side. Say, for example, if price increased, in order to have an abnormally higher volume than usual, we also need some buyers interpreting this price movement in a way that leads them to buy.

The similar logic of the argument applies to the examination of other reference points. In testing the previous extreme price as reference point, the peak (trough) prices refer to the maximum (minimum) prices for the 6-month period immediately preceding each week, and then there are two sets of dummy variables: variable HPeak (HTrough) is equal to 1 when the current price is higher than the previous peak (trough), and LPeak (LTrough) is equal to 1 when the current price is lower than the previous peak (trough). Therefore, when the previous extreme price is the reference point, if the current price is higher than the previous extreme, most investors are making a gain from investment in this particular fund, thus the disposition effect prediction is that the number of sales should increase, driving up the trading volume. On the other hand, if the current price is lower than the previous extreme price, a relatively lower volume is consistent with the disposition effect.

(Insert TABLE 5 approximately here.)

From regression (1) in TABLE 5, when the last period price is the reference point, the coefficients clearly indicate that compared to the situation when the price stayed the same, price increases and decreases both incur larger abnormal volumes, but the effect is slightly larger for price increases, which is consistent with the disposition effect; the difference (0.009307), however, is not statistically significant (Wald test: p=0.1534). Therefore, there is no significant disposition effect in this case. On the other hand, when the previous peak is adopted as the reference point, in regression (2) of TABLE 5, we can observe significant disposition effect, where the abnormal volume is higher if price is higher than the previous peak, but slightly lower if price is lower, and this difference (0.245777) is statistically significant (Wald test: $p<0.001$). However, in regression (3) of TABLE 5, when the previous minimum price is the reference point, the result is significantly the opposite of the disposition effect. This is probably because prices lower than the previous trough incur a capital loss that is large enough for most holders of the fund, so that they tend to sell the fund. This relates to the magnitude of the price change, leading to diminishing sensitivity, which will be the focus of the second hypothesis. Thus, the previous trough is not a valid reference point that causes the disposition effect.

When the IPO price, as a proxy for purchasing price, is the reference point, in the period immediately after IPO, the disposition effect implies that when the current price is higher than the IPO price, there should be an increase in abnormal volume due to the fact that many people who purchased at the IPO price made a gain and are eager to realize it. On the other hand, when price is lower than the IPO price, abnormal volume should be relatively lower. The time period chosen here is one year (52 weeks) after the each fund's IPO. Testing this requires another set of dummy variables: *FHIPO* is equal to 1 when the price goes above the IPO price for the first time after the fund's inception. There are two cases for this: if a fund starts by falling below the IPO, then *FHIPO* is equal to 1 when the price is for the first time higher than the IPO price; but if a fund starts by rising above the IPO price, then *FHIPO* is equal to 1 when the price falls below and then cross the IPO price from below to above for the first time. Similarly, *FLIPO* is equal to 1 when the price of a fund falls below the IPO price for the first time. The disposition effect prediction is that when *FHIPO* is equal to 1, there should be larger trading volume than when *FLIPO* is equal to 1.

The results in regression (4) of TABLE 5 are just the opposite of the disposition effect: prices lower than the IPO generate significantly higher abnormal trading volume, but prices higher than the IPO do not incur significantly different volume from the baseline. From this sense, purchasing price is not a valid reference point. But there can be several explanations to this. For example, the IPO price may not be a good proxy for purchasing price. This might be the result of an important difference between CEFs and other equities, such as stocks used in Kaustia (2004), because CEFs usually start at a premium and then move into discounts on average, so that people know the funds are overpriced at IPO, and they expect the price to fall within 6 months after IPO. One reason why these investors buy the CEF shares that are expected to fall in value is that most funds initiated by having successful fund managers, and part of the premium is the management fees. Hanley, Lee and Seguin (1996) argue that the marketing tactics of the brokerage firms and the informational disadvantage of small investors also contribute to this. Therefore, prices lower than the IPO are standard and realize people's expectations, so that investors can sell even when the current price is lower than IPO.

For the reason that the adoption of previous trough prices and IPO prices as reference points leads to results different from the disposition effect prediction, they will not continue to be used in the following analyses.

Testing Hypothesis 2

Hypothesis 2: Given that there is disposition effect, the strength of this effect should diminish as the magnitude of price deviation from the reference point is larger.

Results from tests of Hypothesis 1 only associates the direction of price changes with ups and downs of the abnormal volume. What matters to investors also include the magnitude of price changes. Specifically, according to the curvature of the utility function of prospect theory, there is risk-aversion in the domain of gains and risk-seeking in the domain of losses, but near risk-neutrality for small gains and losses. If prices deviate more above or below the reference point, creating larger gains or losses, people should exhibit more risk-aversion and risk-seeking. But meanwhile, larger price changes are so salient that they encourage investors to evaluate their investments carefully, decreasing the chance of making a mistake. There are at least two forces that drive investors' decisions: their prospect theory preference and the probabilistic judgment of the price movements. Therefore, the disposition effect should initially be an increasing function of price deviation magnitudes, then a decreasing function.

This implies that under the adoption of an appropriate reference point, price increases above the reference price raise volume, but the marginal effect diminishes; on the other hand, price decreases also raise volume but to a smaller extent than price increases, with diminishing marginal effect. Although last period price is not a significant reference point when Hypothesis 1 only distinguishes directions of price changes, it is still worth testing whether there are asymmetric price effects on volume under the introduction of magnitudes of price changes. The foregoing test consists of only the overall effects of price changes in the gain versus loss domains, the insignificance of the disposition effect might be due to the fact that although the effect is significant for small gains and losses, but it diminishes faster in the domain of gains than losses. In other words, it is possible that price increases above the reference point make people more likely to abandon the disposition strategy.

Testing hypothesis 2 requires the calculation of price changes from two of the above reference points, last period price and previous peak price, and the addition of the interactions between the magnitudes and directions of price changes into equation (3). The quadratic functional form captures the nonlinear relationship. Variable *ABDP* measures the absolute value of price change from last period. The coefficients on $ABDP*DPD$ and $ABDP^2*DPD$ are for gains from last period, while those on $ABDP*DPDD$ and $ABDP^2*DPDD$ are for losses. Similarly, variable AP measures the absolute value of the difference between the current price and the previous peak price. Interacting AP and AP^2 with dummy variables *HPeak* and *LPeak* generates coefficients for prices higher and lower than the previous peak price, respectively. The results are in TABLE 6 below.

(Insert TABLE 6 approximately here.)

(Insert TABLE 7 approximately here.)

We can see that in both cases, whether it's last period price or previous peak price as the reference point, there is significant nonlinear relationship between magnitudes of price changes and the abnormal volume in both gain and loss domains. Combining this with the summary statistics of *ABDP* in TABLE 7 reveals the relationship more clearly. Regression (1) in TABLE 6 uses last period price as the reference point. Differentiation gives the marginal effects: for equal price change magnitudes, each unit of price increase raises abnormal volume more than price decrease if the absolute change of price is greater than 1.10, which is a large number given the statistics in TABLE 7; thus within reasonable ranges (lower than 1.10) of price changes, a unit price decrease from last period raises abnormal volume more than a unit price increase does, which is the opposite of the disposition effect; but the marginal effect diminishes faster in the domain of price decreases than price increases, which is evident in the coefficients of the squared terms, whose difference (0.003056) is marginally significant (Wald test: $p=0.0908$). Additionally, the maximum abnormal volume in the domain of price increases occurs at an absolute price change of 9.478190, while in the domain of price decrease at an absolute price change of

8.613566. This indicates that for price changes beyond these magnitudes, larger price changes decrease the abnormal volume.

In regression (2) of TABLE 6, the previous peak price is the reference point. The significant disposition effect confirms the previous result. The nonlinear relationship exists in both gain and loss domains, but significantly asymmetric here. When price increased or decreased from the previous peak by small amounts, the marginal effect of price on abnormal volume is significantly larger for price increases than for price decreases (Difference=0.673415, Wald test: $p<0.001$), and this continues to be the case for $AP \leq 8.769579$, which is consistent with the disposition effect prediction, but the reversed relationship emerges beyond that. However, the marginal effect diminishes much faster when price increased than decreased (difference=0.038398, Wald test: $p=0.002$). Thus, within a considerable range of price deviations from the previous peak, the disposition effect exists, and it diminishes as the price deviation gets larger. The abnormal volume is peaked in the domain of gains when AP=9.130614, and in the domain of losses when AP=27.588549, indicating that the disposition effect is very robust when the previous peak price is the reference point.

Testing Hypothesis 3

Hypothesis 3: When the investors know the fundamental value, the disposition effect becomes weaker as the gap between the current price and the NAV is shrinking.

As discussed in the previous section, the special feature of CEFs, that they trade at premiums or discounts with prices notably different from the publicly known NAV, allows us to examine the disposition effect in a novel setting with known fundamental values. The test of Hypothesis 3 needs two new dummy variables to distinguish when investors feel the fund is over-valued or under-valued: variable *DPrem* is equal to 0 when the fund has a discount; the definition of variable *Dum* is in Section IV, and it captures the fact that funds trade on average at a 6% discount. Testing Hypothesis 3 involves the addition of interaction terms between the premium/discount dummy variables (*PREM* and *Dum*) and price changes from different reference points, the direction of which is measured by *DPD*, *DPDD*, *HPeak*, *LPeak*, and the magnitude of which is measured by *ABDP* and *AP*. The coefficients in TABLE 8 reflect the effects on abnormal volume from unit changes of price in each domain.

(Insert TABLE 8 approximately here.)

When we distinguish premiums and discounts above and below some specific level, 0% or –6%, the strengths of the disposition effect are different. Regressions (1) and (3) of TABLE 8 adopt last period price as the reference point. According to Hypothesis 3, the expected result should be that the effect of a unit price increase (decrease) is stronger when the fund trades at a premium (discount) than at a discount (premium). This is not the case in regression (1) where the 0% *PREM* is the cutoff line. However, in regression (3) where the –6% is the cutoff, the expected pattern emerges, in that there is a stronger disposition effect when *PREM* is greater than –6% in the gain domain, with the difference in coefficients (0.041609) being statistically significant (Wald test: p=0.0220), and that the effect of a unit price decrease has a smaller effect on volume, as well as a weaker disposition effect, when *PREM* is greater than –6%, with the difference in coefficients (0.029045) being statistically significant (Wald test: p=0.0783). It is also worth noting that, although the disposition effect was not significant when last period price is the reference point in testing Hypothesis 1 and 2, here when the fundamental value is introduced, regressions (1) and (3) of TABLE 8 both indicate significant disposition effect when the fund is traded at a premium[7], but the disposition effect is not significant in the domain of losses. From these results, the insignificant disposition effect in general when last period price is the reference point is not caused by the marginal effect of price changes on volume diminishing too fast as is tested in Hypothesis 2, but possibly by the investors' knowledge of the fundamental value and the related incentive to arbitrage compromising the disposition effect as price converges to the NAV.

Regressions (2) and (4) of TABLE 8 adopt the previous peak price as the reference point. The disposition effect is strong in both premium and discount ranges in both equations, reaffirming the salience of this reference point. In regression (2) with the 0% *PREM* cutoff the effect of a unit price increase is larger when the fund trades at a discount than when at a premium, contradicting Hypothesis 3. However, in regression (4) when the –6% is the cutoff, the difference (0.049467) between the effects of a unit price increase in the gain and loss domains is no longer significant (Wald test: $p=0.1342$), thereby weakly supporting Hypothesis 3. The effects of a unit price decrease on volume are smaller in the loss domain than in the gain domain in both regression (2) (difference=0.024168, Wald test $p<0.001$) and (4) (difference=0.016464, Wald test $p<0.001$), supporting Hypothesis 3. The above results also suggest that –6% is a better cutoff line than the natural 0% discount. If investors know that funds trade on average at a 6% discount, they may feel that a fund is over- or under-priced relative to this, instead of comparing with 0% cutoff.

Alternative Explanations

Admittedly, due to the aggregate nature of the data used in this paper, although the results are in general consistent with the disposition effect predictions, it is still not sufficient to

7. Regression (1): the difference in coefficients is 0.049456, and Wald test $p=0.0220$; regression (3): the difference in coefficients is 0.066044, and Wald test $p<0.001$.

conclude that the disposition effect exists and causes these patterns. The results reveal the relationship between abnormal volume changes and the price deviations from some previous levels. Higher volumes can be an indication of increasing disagreements over the interpretation of information among investors, yet the disposition effect only makes prediction about the sellers. Since this study does not control for the outsiders' buying behavior, it is equally possible that the observed pattern is a result of buyers being more willing to buy (or sell) when price goes up (or down) or when price is higher (or lower) than previous peak. Thus, an improvement on the current study would be to control for buyers' behavior by introducing variables such as the spread, which can indicate whether there is excess demand or excess supply.

Meanwhile the aforementioned relationship can also be a story of the salience of different price changes. For example, price increases to a level higher than the previous peak can be a more salient event than prices lower than the previous peak, attracting investors' attention, so they are more likely to evaluate the relevant information about the fund and make more transactions.

And obviously, even if the disposition effect is behind the observed relationship, there is no direct evidence that prospect theory, the preference-based explanation, is the explanation. Selling at gains and holding at losses become rational when there is sufficient ground to believe in mean reversion in the CEFs.

VI. CONCLUSION

In this paper is the first test of the disposition effect in the CEF market, where the accurate measure of fundamental values of assets is public information. Among the various explanations to the disposition effect, this paper mainly relies upon the prospect theory, evaluating the validity of three reference points and further testing the strength of the disposition effect as the price deviation from the reference point varies, or when there is room for the investors' belief in price convergence to the NAV causing arbitrage incentives.

The results presented identify the previous peak price as the most salient reference point. Although the last period price is a good reference point in the laboratory, it does not constitute a significant reference point in this empirical study for several reasons, such as the selection of data frequency: frequent traders cannot rely on weekly prices as reference points, but they may rely on last period price as the reference point on a high frequency basis. The purchasing price generates the opposite predictions than the disposition effect probably due to the limitations of using the IPO method within the CEF market. Diminishing sensitivity of the disposition effect also exists among CEF traders. And lastly, the disposition effect is affected when the investors believe that price converges to the fundamental value. When the price is converging to the NAV, investors know that they are underpaying for shares of the fund and if they believe that the price will bounce back to realign with the NAV, then their arbitraging incentives compromises the disposition effect.

The research of the disposition effect in the CEF market is intriguing. Not only the existence of such a behavioral bias, but also the implications, is interesting. Further studies on this topic can focus on the profitability of rational versus the disposition investors in the CEF market. If the disposition strategy is no a losing one, then the disposition effect is not a mistake of CEF investors. Based on the findings here, it is also possible to identify return anomalies in the CEF market, and design profitable strategies for CEF trading accordingly.

Also of interest is the relationship between the CEF puzzle and biased CEF investor strategies, such as the disposition strategy. One of the most famous explanations to the CEF puzzle is the investor sentiment theory, proposed by Lee, Shleifer and Thaler (1991), which assumes that individual investors trade on stochastic sentiments. But the evidence here is that CEF investors are not trading completely stochastically, but relying on some, although sometimes mistaken, systematic strategies that associates with their behavioral biases. A more appropriate approach would be to use individual account data of CEF trading, and identify the behavioral mistakes committed by those investors, rather than indirectly test the aggregate implications.

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TABLE 1

Summary Statistics

This table provides the descriptive statistics. Description of variables: *PRICE*=the market price per share of the CEF; *NAV*=net asset value; *MKTRET*=the return on the market price; *NAVRET*=the return on NAV; PREM=premium; SPYRET=S&P 500 return. All data are in weekly frequency.

	Mean	Max	Min	Std. Dev.	Skewness	Kurtosis
PRICE	13.02758	268.7500	1.150000	8.615273	11.98226	240.2607
NAV	13.65930	300.8200	1.160000	9.125165	12.73530	268.3431
MKTRET	-0.00037	0.752146	-0.990399	0.029554	-0.537624	31.55948
NAVRET	-0.000163	0.779302	-0.758754	0.021147	-1.896836	68.05352
PREM	-0.040958	2.053900	-0.665470	0.111672	2.001995	20.95487
SPYRET	0.002392	0.073172	-0.121967	0.021334	-0.291837	5.154276

TABLE 2

Relationship between Volume and *PREM*

This table tests the nonlinear relationship between volume and PREM above or below -6%.

*** denotes significance at 99%; ** denotes significance at 95%; * denotes significance at 90%. This notation will be the same for all regression results below. Description of variables: *VOL* is the trading volume; *Dum* is a dummy variable which is equal to 1 when *PREM* is above -6%, and 0 otherwise.

	Volume
Constant	359.3647***
	(136.3656)
*PREM*Dum*	200.7413***
	(5.731490)
PREM(1-Dum)*	-585.4672***
	(-18.95150)
R^2	0.472239
Adjusted R^2	0.470722

TABLE 3

Predictions of the Two Theories Involved in Hypothesis 3

This table shows the predictions of the disposition effect and the belief in convergence to the fundamental, when the investors know the fundamental. Price Increase and Price Decrease indicate positive and negative price deviations form the reference point. The strength of the observed disposition effect is weaker as the gap between price and the NAV is shrinking.

		Disposition Effect	Belief in Convergence to the Fundamental	Strength of the Disposition Effect
Premium	Price Increase	Sell	Sell	Stronger
	Price Decrease	Hold	Sell	Weaker
Discount	Price Increase	Sell	Hold	Weaker
	Price Decrease	Hold	Hold	Stronger

TABLE 4

A Model for Abnormal Volume of CEFs

This table reports the panel regression results for equation (3). The fund-specific intercepts are omitted. Description of variables: *SAV* is the standard abnormal volume; *ARet* is the abnormal return defined as the difference between the fund's return and the contemporaneous market return, which is measured by the S&P 500 return; *ARetD* is a dummy variable that is equal to 1 when *ARet* is positive, and 0 otherwise; Ret^2 is return squared, as a measure of volatility.

	SAV_{it}
Constant	-0.153824***
	(-28.65155)
SAV_{it-1}	0.145818***
	(57.97745)
SAV_{it-2}	0.117126***
	(46.89020)
$PREM_{it} \cdot Dum_{it}$	-0.385116***
	(-7.031044)
$PREM_{it} \cdot (1 - Dum_{it})$	-0.905817***
	(-19.15885)
$ARet_{it} \cdot ARetD_{it}$	3.407820***
	(22.51963)
$ARet_{it} \cdot (1 - ARetD_{it})$	-3.806174***
	(-27.14421)
$ARet_{it-1} \cdot ARetD_{it-1}$	-0.829288***
	(-5.950958)
$ARet_{it-1} \cdot (1 - ARetD_{it-1})$	-0.649411***
	(-5.263786)
Ret_{it}^2	11.81925***
	(18.23430)
Adjusted R^2	0.060751
DW	2.017314

TABLE 5

Testing Last Period Price and Previous Extreme Prices as the Reference Point

This table reports the results for the regressions testing for last period price, previous peak, previous trough and purchasing price as the reference point, in regressions (1), (2), (3) and (4) respectively. "Gain" and "Loss" are dummy variables for price higher or lower than the reference point in each case. The "Gain" variables are DPD, HPeak, HTrough and FHIPO, and the "Loss" variables are DPDD, LPeak, LTrough and FLIPO, in regressions (1), (2), (3) and (4). Note that each regression also contain a full set of variables from equation (3), but the coefficients are not reported here, all of which are significant and have the same signs and similar magnitudes.

	(1) Last Period	(2) Prior Peak	(3) Prior Trough	(4) IPO Price
Gain	0.10***	0.22***	-0.12***	0.14
	(18.41)	(15.19)	(-9.63)	(0.38)
Loss	0.09***	-0.03**	0.33***	1.00**
	(12.54)	(-2.38)	(21.42)	(2.46)
Adjusted R^2	0.06	0.06	0.73	0.12
DW	2.02	2.02	2.03	2.06

TABLE 6

Testing for Diminishing Sensitivity of the Disposition Effect

This table reports the results of the tests of Hypothesis 2. Last period price and previous peak price are the reference points in regression (1) and (2) respectively. ABDP is the absolute value of price change from last period; AP is the absolute value of price deviation from the previous peak, which is measured for the half-year period prior to each week.

	(1) Last Period	(2) Prior Peak
*ABDP*DPD*	0.50***	
	(33.76)	
*$ABDP^2$*DPD*	-0.03***	
	(-18.16)	
*ABDP*DPDD*	0.51***	
	(35.84)	
*$ABDP^2$*DPDD*	-0.03***	
	(-23.56)	
*AP*HPeak*		0.71***
		(30.09)
*AP^2*HPeak*		-0.04***
		(-21.05)
*AP*LPeak*		0.04***
		(17.17)
*AP^2*LPeak*		-0.00***
		(-11.34)
Adjusted R^2	0.07	0.07
DW	2.02	2.02

TABLE 7

Summary Statistics of *ABDP* and *AP*

This table provides the summary statistics of *ABDP*, the absolute change of price from last period, and *AP*, the absolute value of price deviation from previous peak. Both variables are summarized separately in the domain of gains (when *DPD*=1, or *HPeak*=1), and in the domain of losses (when *DPDD*=1, or *LPeak*=1).

	ABDP		*AP*	
	DPD=1	*DPDD*=1	*HPeak*=1	*LPeak*=1
Mean	0.29	0.30	0.29	1.21
Median	0.19	0.19	0.13	0.67
Maximum	25.38	26.00	25.38	88.75
Minimum	0.00	0.00	0.00	0.00
Std. Dev.	0.42	0.45	0.56	1.88
Skewness	11.54	13.16	14.07	9.15
Kurtosis	324.87	402.55	405.52	206.98
Observations	90935	89829	16168	184123

TABLE 8

Testing the Disposition Effect with the Presence of the Fundamental Value

This table reports the results for Hypothesis 3. *DPrem* is a dummy variable that is equal to 1 when the fund has a premium, or *PREM*>0, and 0 otherwise. In regressions (1) and (2), 0% is used as a cutoff for *PREM*; in regressions (3) and (4), -6% is used as a cutoff for *PREM*. Regressions (1) and (3) adopt last period price as the reference point; regressions (2) and (4) adopt the previous peak price as the reference point.

	Dummy=*DPrem*		Dummy=*Dum*	
	(1)	(2)	(3)	(4)
*ABDP*DPD*Dummy*	0.32***		0.36***	
	(18.89)		(24.18)	
*ABDP*DPD*(1-Dummy)*	0.36***		0.32***	
	(25.51)		(20.93)	
*ABDP*DPDD*Dummy*	0.27***		0.30***	
	(14.89)		(21.45)	
*ABDP*DPDD*(1-Dummy)*	0.32***		0.33***	
	(26.20)		(22.62)	
*AP*HPeak*Dummy*		0.24***		0.35***
		(9.66)		(14.72)
*AP*HPeak*(1-Dummy)*		0.47***		0.40***
		(20.31)		(15.97)
*AP*LPeak*Dummy*		0.00		0.01***
		(1.20)		(6.30)
*AP*LPeak*(1-Dummy)*		0.03***		0.03***
		(13.51)		(11.63)
Adjusted R^2	0.07	0.06	0.06	0.06
DW	2.02	2.02	2.02	2.02

FIGURE 1

Distribution of PREM across Funds Using Weekly Data