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The Prevalence of the Disposition Effect in Mutual Funds' Trades

Abstract

US equity mutual funds, on average, prefer realization of capital losses to capital gains. Nevertheless, a substantial fraction exhibits the disposition effect of realizing gains more readily than losses. My analysis suggests that learning effects have reduced the manifestation of the disposition effect over time, implying that academic research has influenced industry practices. When funds experience outflows and are managed by teams of portfolio managers they are more susceptible to selling disproportionately more winners than losers. Disposition-driven behavior affects investment style, causing lower market betas and characteristics of value-oriented and contrarian styles but has no observable effect on fund performance.

I. Introduction

The tendency to hold onto losses and sell winning investments, termed the disposition effect, is a form of irrational behavior explained by the prospect theory of Kahneman and Tversky (1979). While this effect has been extensively tested among retail investors (e.g., Shefrin and Statman (1985); Odean (1998); and Grinblatt and Keloharju (2001))[1], similar behavioral tendencies among money managers are also receiving growing attention (e.g., Wermers (2003); Frazzini (2006); O'Connell and Teo (2009); and Jin and Scherbina (2010)). This paper examines issues related to the presence of the disposition effect within an important class of professional money managers, US equity mutual funds. Employing thirty years of holdings data from a comprehensive set of 3,268 US equity mutual funds, I conduct a two-fold analysis: First, I examine the extent to which the disposition effect is present in the equity trades of mutual funds. Second, I investigate how the disposition effect influences mutual funds' investment style and performance.

As professional investors, mutual funds have access to superior investment technologies and constantly trade securities in the financial markets. The experience acquired through continuous trading presumably makes mutual funds more skilled and consequently more likely to avoid behavioral biases than the average retail investor.[2] Consistent with this view, I document that, on average, mutual funds do not show a tendency to realize gains more readily than losses. This finding is robust to different measurement methods, different subperiods, and different fund subgroups defined by the funds' investment objectives and even holds after controlling for past stock returns.

[1] This effect has been documented in an experimental setting (e.g., Weber and Camerer (1998)); for home buyers and sellers (e.g., Case and Shiller (1988) and Genesove and Mayer (2001)); for Israeli investors (e.g., Shapira and Venezia (2001)); for futures traders at the Chicago Mercantile Exchange (e.g., Locke and Mann (2005)); and for treasury bond futures' traders (e.g., Coval and Shumway (2005)).

[2] Seru et al. (2010) show that investors are more likely to avoid behavioral biases as they gain experience through trading.

This is welcome news as it suggests that, given the size of their trades and holdings, mutual funds serve as potential mitigators of distortions caused by the behavioral biases of retail investors.

Despite the aggregate results, I observe a great deal of heterogeneity among my sample funds, as 22 to 55 percent of them exhibit a propensity to realize gains more readily than losses. While this pattern is consistent with the disposition effect for this subset of funds, it could also be caused by random variation in the empirical distribution. Exploring this alternative explanation, I find that the tendency of these particular funds to sell winners rather than losers is persistent through time. I also find that these funds show another related behavioral tendency, whereby they add shares to their losses. Like holding onto losses, this doubling of sorts is another form of gambling with losses. Taken altogether, these findings suggest that for the subset of funds that sell more winners than losers, I cannot rule out the disposition effect as a contributing factor.

My mutual fund setting allows me to answer research questions that cannot be addressed when studying the behavior of retail investors. One such question is "How do investors react when they are under pressure to act on their investments?" Dror et al. (1999) show that, when placed under time pressure, participants in their experiment were even more likely to take a gamble in a high risk scenario, but less likely to do so in a low risk scenario. Unlike in the retail investment arena, it is possible to identify situations, when mutual funds are under time pressure and trade due to liquidity shocks. Specifically, mutual funds often experience redemptions, which they are under time pressure to meet by selling portfolio securities to raise cash. I find that, when they are under such pressure, mutual funds are more susceptible to sell disproportionately more winners than losers, as compared to situations when they are not under such pressure.

My mutual fund setting also provides a unique opportunity to examine the impact that teams have on disposition-prone behavior. Specifically, I examine whether an individual manager's portfolio decisions are more or less likely to be influenced by the disposition effect than portfolio decisions made by a team. One view is that the presumed objectivity of other team members might

help break possible attachments to portfolio stocks that certain portfolio managers could develop. Conversely, members of a portfolio management team might gravitate toward "groupthink", a tendency for group members to reach agreement without evaluating ideas in a critical manner.[3] Such a tendency could intensify any behavioral biases that are present. Consistent with the latter view, I find that funds managed by teams exhibit a stronger tendency to disproportionately realize more gains than losses than funds managed by a single portfolio manager.

Next, I examine the implications of the disposition effect for mutual fund portfolio investment style and performance. I hypothesize (style impact hypothesis) that disposition-driven behavior will affect the investment styles of the underlying portfolios along three dimensions: First, the preference of disposition-prone mutual funds for holding onto losses will lower the market risk exposure (Beta) of the affected portfolios over time. While the market portfolio will experience growing weights in past and current winner stocks, disposition-prone mutual fund portfolios will be tilted toward poor past performing stocks. The opposite movements in weights for the affected mutual fund portfolios versus the market portfolio will eventually create fund portfolios with large deviations from the weights of the market portfolio.

Second, disposition-driven behavior could tilt portfolios toward a value-oriented style. From Prospect Theory, investors use a reference point that is a function of past prices at which trades were executed to establish a stock position. A portfolio stock that currently trades at a price above the reference point is coded as a gain, whereas a stock that trades at a price below the reference point is coded as a loss. While the reference point is a historical, backward-looking measure of value, the current stock price is a forward looking measure of value. Since they are inclined to hold onto stocks

[3] Janis (1972, p. 9) was the first to define groupthink as "A mode of thinking that people engage in when they are deeply involved in a cohesive in-group, when the members' strivings for unanimity override their motivation to realistically appraise alternative courses of action."

trading at prices below the reference point, disposition-prone mutual funds will thus appear to be following active value-based investment strategies.

Finally, selling winners and holding onto losers will produce portfolios dominated by stocks that have experienced negative returns in the past, which, as shown by Jegadeesh and Titman (1993), will continue to underperform in the short term. Thus, disposition-prone funds will hold portfolios weighted heavily by negative momentum stocks, creating the appearance of an active pursuit of short-term contrarian style.

In my analysis of the "style impact" hypothesis I stratify the mutual fund portfolios by their inclination to sell more winners than losers and examine their subsequent style characteristics. Consistent with the "style impact" hypothesis, mutual funds with the strongest tendency to sell winners rather than losers exhibit: (1) lower market betas; (2) higher loadings on the book-to-market equity common risk factor, which is consistent with a value-oriented investment style; and (3) lower (negative) loadings on the momentum factor, which is consistent with a short-term contrarian investment style.

I hypothesize that the disposition effect could also have a negative effect on fund performance (performance impact hypothesis). Since a disposition-related sale is triggered by the stock price being above the reference point and not by fundamental information, disposition-prone fund managers could be acting as uninformed investors who sustain losses to informed parties.[4] Substantiating the real-world implications of the performance impact hypothesis, some fund companies are actively trying to reduce the influence of behavioral biases on their fund managers. To this end, fund companies can now hire external consultants to run diagnostics on the trades of

[4] Grossman and Stiglitz (1980) show that in equilibrium, uninformed investors sustain losses to informed investors who are compensated for the cost of becoming informed. However, this view does not take into account the possibility that investors subject to behavioral biases could impact asset prices in certain ways.

portfolio managers that are intended to detect behavioral biases and to recommend ways for reducing the impact of such biases on fund performance.[5]

The analysis does not find support for the performance impact hypothesis. However, these results should be interpreted with a caveat: the power of tests to detect disposition-driven behavior is limited by the quarterly frequency of trading extrapolated from quarterly holdings. I believe that further research is warranted to assess the impact of behavioral biases on performance, perhaps when higher trading frequency data becomes available.

My study is related to O'Connell and Teo (2009) who show that institutional investors are not subject to the disposition effect in their currency trades. Similarly, I show that mutual fund equity trades are, on average, not subject to the disposition effect. My findings are also consistent with Hudart and Narayanan (2002) and Sialm and Stark (2010), both of which show that, consistent with optimal tax strategies, mutual funds prefer realizing capital losses to gains. Furthermore, my finding of a disposition effect among a *subset* of mutual funds is consistent with Jin and Scherbina's (2010) finding of a reluctance to realize losses also among a subset of their sample—portfolio managers that are eventually replaced. It is also consistent with Wermers' (2003) finding of a reluctance to sell losers among a subset of his sample—funds with poor past performance.

Beyond this main contribution, my paper reports three novel findings. First, I show that trading under pressure makes mutual funds more susceptible to the disposition effect. This introduces a new dimension in the behavioral finance literature that, to the best of my knowledge, has not been investigated before. Second, I document that rather than reducing the influence of behavioral biases, a team approach to organizational fund structure has the opposite effect of intensifying such biases. This finding represents a contribution to a recent strand of literature with mixed findings on the superiority of team-manager versus single-manager fund structures (see Massa et al. (2010); Han et

[5] See Appell 2006 and Knight (2008).

al. (2008); Chen et al. (2004); Qiu (2003); and Prather and Middleton (2002)). Finally, this study contributes to the body of knowledge on the determinants of mutual fund investment styles and their interaction with mutual fund performance (see Cooper et al. (2005), Wermers (2010)). Previous studies addressing these issues have analyzed strategic aspects related to style choices or style changes made by mutual funds. My study suggests that behavioral biases such as the disposition effect could cause unintentional investment style changes in a predictable direction.

The rest of the paper is organized in six sections. Section II describes data and sample characteristics. Section III tests for the presence of the disposition effect. Alternative explanations are explored in Section IV. Section V examines the relation between disposition-driven behavior and fund characteristics. The relation of the disposition effect to fund style and performance characteristics is examined in Section VI. Section VII concludes.

II. Data

A. Data Sources and Sample Construction

Portfolio holdings data for U.S. equity mutual funds from January 1980 to December 2009 came from Thomson/CDA. For a given date and fund, the database provides the name and identifier of each security and number of shares held. These data were supplemented with prices, volume, and other individual stock information from the CRSP Monthly and Daily Stock Data Series.

All fund characteristics other than portfolio holdings, such as returns, fees, and investment objectives came from the CRSP Mutual Fund (CRSP MF) Database. Since CRSP MF reports data by share class, I aggregate information at the portfolio level by taking a value-weighted average for each attribute across all share classes of the same portfolio.

I merge Thomson/CDA with the CRSP MF using WRDS' MFLINKS, a dataset which links Thomson/CDA fund identifiers with those of the CRSP MF Database. Both Thomson and CRSP

fund datasets are free of survivorship bias.[6] Given that CRSP MF Database has several investment objective classification schemes from different data providers that cover different time periods, I unify all the different investment objective classifications to come up with a single one.

To be included in the sample, a fund must: (1) be in the MFLINKS linked set; (2) have an investment objective indicating that the fund invests primarily in equity securities; and (3) have an average weight in common stocks of more than fifty percent. The resulting set of funds had their names manually checked, and any remaining balanced, flexible, retirement, international, tax-exempt, or fixed-income funds were excluded. The final sample includes 3,268 domestic equity funds in existence during the1980-2009 period.

I estimate quarterly fund trades for each fund by tracking changes in holdings over consecutive quarters. Mutual funds were required by the Securities and Exchange Commission to report their portfolio holdings semiannually prior to June 2005 and quarterly thereafter.[7] Although mutual funds were required to report their holdings only semiannually before June 2005, the majority reported holdings to Thomson's CDA/Spectrum on a quarterly basis.

B. Sample Characteristics

Table 1 presents summary characteristics for the 3,268 sample funds over the 1980-2009 period. Panel A reports characteristics for each year of the sample period. The sample starts with 214 funds in 1980 and ends with 1,976 funds in 2009, reflecting a dramatic increase in the popularity of

[6] Since MFLINKS provides links until 2008, the linking table was extended to 2009 using a procedure that updated existing links beyond 2008 and added new links obtained from an algorithm that compares the Thomson/CDA holdings with the more recently introduced mutual fund holdings from the CRSP MF Database.

[7] Each mutual fund is currently required to report its holdings every quarter: A mutual fund has to file a N-CSR and N-CSRS form at the end of the second and fourth quarter and two N-Q forms at the end of the first and third quarter (see http://www.sec.gov/info/edgar/certinvco.htm).

mutual funds among investors. In terms of assets, my sample reached its peak in 2007 with 3.8 trillion dollars under management, steadily declining thereafter as a result of the recession in the US.

Panel B breaks down the sample funds into active and index funds. It also breaks down all active funds into various investment objectives. Some index funds were identified using a categorization variable from the CRSP MF Database introduced in the later years and others were identified by inspecting fund names. My sample includes 262 index funds, which represent roughly eight percent of my sample funds. Among actively managed funds, growth funds represent the most numerous group with roughly 32 percent of the active fund subgroup.

III. Disposition Effect and the Decisions of Mutual Funds

A. Methodology

A.1. Detection of Disposition-Driven Behavior

As a first step, to assess the extent to which funds are affected by the disposition effect, I calculate, for each fund and quarter, the difference between the proportion of realized capital gains and the proportion of realized capital losses in the portfolio. I refer to this measure as the "disposition spread". A fund that is prone to the disposition effect will disproportionately realize more gains than losses, and will thus have a positive disposition spread.

As in Odean (1998), I compute the proportion of realized capital gains, *PGR*, and the proportion of realized capital losses, *PLR*, for each fund and each quarter in which at least one stock sale took place, respectively, as follows:

$$(1) \qquad PGR_t^i = \frac{RG_t^i}{RG_t^i + UNRG_t^i}, \qquad PLR_t^i = \frac{RL_t^i}{RL_t^i + UNRL_t^i}$$

where RG_t^i is the number of realized capital gains by fund *i* in quarter *t*, $UNRG_t^i$ is the number of unrealized gains, RL_t^i is the number of realized losses, and $UNRL_t^i$ is the number of unrealized

losses. The disposition spread, *DISP*, is then defined as the difference of the two proportions, $DISP_t^i = PGR_t^i - PLR_t^i$.

Crucial to the computation of *PGR* and *PLR* statistics is the cost basis of each position. The cost basis serves as a proxy for the reference point, which investors compare against the current stock price to determine whether a stock position represents a gain or a loss. Odean (1998), Grinblatt and Keloharju (2001), and Huddart and Narayanan (2002) calculate the cost basis as the average of the prices at which the contributing stock purchases took place, weighted by the number of purchased shares. In contrast, Frazzini (2006) uses a first in, first out accounting method. Given the methodological differences from previous studies and absence of any theories supporting one particular method, for robustness I use four methods to compute the cost basis: (1) average price; (2) first in, first out (FIFO); (3) high in, first out (HIFO); and (4) low in, first out (LIFO).

I assess robustness along two additional dimensions. First, not knowing the exact day when a trade takes place during the quarter, I report one set of results assuming that trades occur at the end of the quarter and another set of results assuming that trades occur sometime during the quarter. Second, I also show one set of results based on the dollar value of transactions and another set of results based on the number of gains and losses.

A.2. Metric Used for Cross-Fund Comparisons

The disposition spread is useful for documenting whether funds realize more gains than losses. However, this metric is not appropriate for cross-fund comparisons since a mechanical relationship exists between portfolio size and disposition spread (see Odean (1998, p. 1,785)). This is best illustrated with the following example. Suppose that half of the stocks in the portfolios of both fund A and fund B represent gains and the other half losses. Assume that fund A has 12 winner and 12 loser stocks in its portfolio, whereas fund B has only three winner and three loser stocks.

Furthermore, assume that both funds are equally affected by the disposition effect, both being twice as likely to realize any given gain as any given loss. Accordingly, both funds sell 2 winner and 1 loser stocks. Fund A will have a *PGR* of 2/12, a *PLR* of 1/12, and a *DISP* of 1/12, while fund B will have a *PGR* of 2/3, a *PLR* of 1/3, and a *DISP* of 1/3. Thus, fund B's *DISP* will be four times greater than fund A's even though they have the same propensity for selling winners rather than losers.[8]

An alternative measure gets around this problem. The measure, which I refer to as the disposition ratio, *DISP RATIO*, calculates the ratio of *PGR* to *PLR* rather than the difference of *PGR* and *PLR*. In the above example, the disposition ratio for both funds will equal two, thus correctly estimating the propensity to realize more gains than losses for both funds to be the same. Therefore, I use *DISP RATIO* rather than *DISP* in any cross-sectional analysis.

B. Results

B.1. Overall Results

Table 2 reflects all the methodological variations employed to compute *PGR*, *PLR*, and *DISP* statistics. The *t*-statistic associated with *DISP* is also reported along with the fraction of funds with positive disposition spreads. Results based on each of the four accounting methods are reported in separate columns. The *PGR*, *PLR*, and *DISP* statistics are computed using the dollar value of transactions in Panel A and the number of transactions in Panel B. In Panels A.1 and B.1 trades are assumed to happen at the end of quarter. In Panels A.2 and B.2 trades are assumed to happen at prices that are averages of daily stock prices during the quarter, i.e., trades are assumed to occur sometime during the quarter.

[8] As the relationship between portfolio size and *DISP* is non-linear, the number of stocks held is not an adequate control variable. Also, this relationship is so strong that it is likely to affect *DISP* even within subgroups of stocks formed based on the number of stocks held. I thank Terry Odean for pointing this out.

The *PGR*, *PLR*, and *DISP* measures are first computed for each fund in each quarter. Next, for each fund, I calculate the time-series mean of each measure. A key statistic is the fraction of funds with positive average disposition spreads, calculated by weighting each fund equally or by its average assets under management. Regardless of the method used, the sample funds, on average, do not appear to realize gains more readily than losses. Thus, these results contrast the findings of a disposition effect among retail investors. The fraction of funds with positive disposition spreads is slightly higher than 50 percent only in two out of the 16 methodological scenarios — when the FIFO inventory method and the number of transactions are used and funds are weighted by their assets.

The result for equity mutual funds to realize, on average, more losses than gains is consistent with similar findings by Hudart and Narayanan (2002) and Sialm and Stark (2010), both of which study equity mutual funds in the context of optimal tax strategies. In sum I observe that, on average, mutual funds have a stronger preference for realizing losses rather than gains. Nevertheless, I observe a great deal of cross-sectional heterogeneity among mutual funds with respect to their realization of gains and losses, as 22 to 55 percent of the sample exhibit positive disposition spreads.

B.2. Results Stratified by Subperiod

Has the behavior of mutual funds with respect to the realization of gains and losses changed through time? Recent advances in investment technologies could have brought about more structure and discipline and less reliance on behavioral heuristics. Table 3 reports subperiod results for 1980-1989, 1990-1999, and 2000-2009. In the interest of brevity, here and in all subsequent tables the average price method is used to compute the cost basis and the proportions of gains and losses are computed using the dollar value of trades and assuming that all trades happened at the end of the quarter. Results are qualitatively similar if I use the other methods. Mutual funds do not show a tendency to realize more gains than losses in any of the subperiods. The fraction of funds with positive disposition spreads has significantly declined from roughly 46 percent during 1980-1989 to

roughly 28-36 percent in the later two subperiods. This pattern is consistent with increased awareness of behavioral finance theories among finance practitioners. Recognize that some of the pioneering research documenting the disposition effect was first released in working paper format during the second sample subperiod (e.g., Odean (1998); Weber and Camerer (1998); Genesove and Mayer (2001); and Grinblatt and Keloharju (2001)). Furthermore, in 1995 the CFA Institute held its first conference on the application of behavioral studies to financial markets, which incorporated presentations by academics actively involved in behavioral research.[9] Thus, consistent with finance practitioners first being introduced to evidence of cognitive biases during the 1990-1999 period and consequently reacting to such evidence, I observe that the fraction of funds with positive disposition spreads sharply declined by roughly more than ten percentage points from the first to the second subperiod, while it remained almost unchanged from the second to the third subperiod.[10]

Anecdotal evidence suggests that large fund families are more likely to hire staff with Ph.D. degrees and are more attentive to academic research. Thus, larger fund families might have been introduced to behavioral finance theories sooner than smaller families. Figure 1 shows that for larger families the fraction of funds with positive disposition spreads experienced a sharp decline from the first to the second subperiod and remained unchanged thereafter. In contrast, for smaller families the fraction of funds with positive disposition spreads did not decline from the first to the second subperiod (it slightly increased instead), but it declined significantly from the second to the third subperiod. This evidence suggests that large fund families became aware of and incorporated lessons from behavioral theories in their investment process sooner than small families.

[9] See AIMR Conference Proceedings (December 1995). The academic presentations in this conference included De Bondt (1995), Statman (1995), and Tversky (1995).

[10] Topics from behavioral finance have now become an integral part of the CFA curriculum.

B.3. Results Stratified by Fund Categories

Table 4 reports statistics for fund subgroups based on two categorizations. The first two columns compare index funds versus actively-managed mutual funds. Given the passive nature of index funds, their trades ought to reflect only the reconstitution rules of the underlying indices that they follow and not be affected by any behavioral heuristics. This attractive feature makes index funds a useful benchmark for evaluating the behavior of actively-managed funds.

Index funds exhibit an average disposition spread that is not statistically different from zero, suggesting that they are equally as likely to realize gains as to realize losses. On the other hand, actively-managed funds exhibit a significant negative disposition spread and, relative to index funds, have a smaller fraction of funds with positive disposition spreads. Overall, the behavior of active funds is consistent with an optimal tax strategy of harvesting losses to increase the present value of tax savings (Constantinides (1984)). Moreover, such a strategy reduces taxable distributions to investors (Gibson et al. (2000)) and could help funds attract investor clienteles that are sensitive to taxes (see Bergstresser and Poterba (2002)).

The remaining columns from Table 4 compare actively-managed funds across different investment objectives. The mean disposition spread is negative and statistically significant for each investment objective. Furthermore, growth funds exhibit the smallest and small cap funds exhibit the largest disposition spreads.

B.4. Controlling for Past Stock Returns and Comparability to Previous Research

Pertaining to stock trading by institutional investors, my findings are consistent with Huddart and Narayanan (2002) and Sialm and Starks (2010). Huddart and Narayanan (2002) show that, consistent with efficient tax strategies, mutual funds are more likely to realize capital losses than capital gains. Sialm and Starks (2010), using a more recent sample, document a similar finding, which holds for both short-term and long-term gains and losses. Pertaining to trading of other types

of assets, my findings are consistent with O'Connell and Teo (2009) who show that global institutional money managers are more likely to get out of currency positions in which they have experienced losses and hold onto positions where they have experienced gains.

Grinblatt and Keloharju (2001) document the presence of the disposition effect among Finnish institutional investors. To reconcile my results with Grinblatt and Keloharju (2001), I apply their methodology to my sample. I specify the relationship between the sell versus hold decision using a logit model. The dependent variable equals one when a mutual fund sells a stock and zero when it does not sell but holds the stock. As in Grinblatt and Keloharju (2001), the two key independent variables are a large capital loss dummy and a small capital loss dummy. Similar to O'Connell and Teo (2009), for each fund I define a large (small) loss as a loss that is larger (smaller) in magnitude than the median loss for that fund. Results are qualitatively similar if I use the 30% cutoff used in Grinblatt and Keloharju (2001).

In this framework it is important to control for how investors react to past returns. The overall tendency for funds to realize capital losses more readily than capital gains could be because they actively follow momentum strategies. Past returns could also trigger other kinds of behavior such as contrarian investing or rebalancing. Furthermore, past returns could be related to transaction costs considerations. For example, a fund that has to sell for liquidity reasons might prefer to sell stocks that have recently experienced a price run-up rather than those that have experienced a price run-down and have become lower priced and less liquid (see Odean (p. 1,779, 1998)). For all these reasons, it is important to assess whether the preference for mutual funds to realize capital losses rather than capital gains persists even after controlling for how investors react to past returns.

Controlling for past returns is important for yet another reason: Such an exercise will help reconcile my results with Wermers (2003) and Jin and Scherbina (2010). Unlike most of the related literature, both Wermers (2003) and Jin and Scherbina (2010) define winner and loser stocks in mutual fund portfolios based on the past 12 month returns of each stock. In contrast, my paper

defines a winner and loser relative to a reference point that is specific to each mutual fund portfolio and reflects the cost of establishing the underlying position.[11] Thus, to control for investor behavior in response to past returns and to reconcile my results with Wermers (2003) and Jin and Scherbina (2010), I include two additional independent variables in the logit regression that capture past market-adjusted stock returns compounded over the last 6 or 12 months. The two return variables are *Positive Return,* defined as [max (return, 0)], and *Negative Return,* defined as [min (return, 0)].

Results from the logit regression are reported in Table 5. Results in this and all subsequent tables exclude index funds from the analysis. Even after controlling for past stock returns, mutual funds are more likely to sell when facing capital losses than when facing capital gains. This reinforces previous findings from Tables 2 through 4 and suggests that the difference between my findings and those of Grinblatt and Keloharju (2001) cannot be attributed to methodological differences. The coefficients on the past return variables suggest that mutual funds are more likely to sell stocks that have experienced larger positive market-adjusted returns and are less likely to sell stocks that have experienced more negative market-adjusted returns. This specific finding of how mutual funds respond to past stock returns is consistent with Grinblatt and Keloharju (2001). The finding that mutual funds are less likely to sell stocks that have experienced more negative market-adjusted returns is consistent with both Wermers (2003) and Jin and Scherbina (2010)[12]. However, realize that the two latter papers do not relate mutual fund selling decisions to capital gains or losses per se. Rather, these papers examine trading in response to past stock returns, which serve as trading signals for investors that follow momentum or contrarian trading strategies. Nonetheless, even after

[11] A stock characterized as a winner based on its past 12 month returns might not necessarily be a winner in a fund portfolio if you consider the price paid for it. Such a stock might represent a capital loss if its purchase price is above the current price.

[12] In unreported results I further explore comparability of my findings with those of Jin and Scherbina (2010). Specifically, I explore what happens to disposition spreads following portfolio manager replacements. Interestingly, funds that displayed behavior consistent with the disposition effect before a manager's replacement show no such behavior after the replacement.

controlling for such considerations, mutual funds appear to prefer selling stocks from positions with capital losses rather than capital gains, suggesting that mutual funds are not affected by the disposition effect, on average.

IV. Does Disposition Effect Cause the Positive Disposition Spreads of Some Funds?

The previous section showed that a sizable fraction of the sample funds have positive average disposition spreads. Although the disposition effect could be a plausible explanation for these funds' positive disposition spreads, random variation in the empirical distribution could also be responsible. In what follows, I explore this possibility.

A. Persistence

The subset consisting of 48% to 55% of the index funds with positive disposition spreads, documented in Table 4, is most likely due to random variation in the disposition spread, as index funds are passive investment vehicles. Randomness could also be responsible for the fraction of actively-managed funds with positive disposition spreads that I observe in Table 4. If that was the case, I should observe a lack of persistence in these funds' tendency to realize more gains than losses. To test this, I examine whether funds preserve their disposition ratio ranks over time. I construct a contingency table of initial and subsequent fund ranks based on the disposition ratio. Every quarter, I classify funds as High or Low disposition funds if their disposition ratio is respectively above or below the median disposition ratio.

Cell frequencies from the two-way classification table are reported in Table 6. A Chi-Square test rejects the null hypothesis that the disposition ratio ranks are independent from one quarter to the next. This result suggests that the tendency for some funds to disproportionally realize more gains than losses is persistent though time.

B. Another Form of Gambling with Losses

An integral part of the disposition effect is a particular form of gambling with losses, whereby investors hold onto losing investments. However, this is not the only way of gambling with losses. Another way of gambling with losses arises when investors add additional shares to their losses. This doubling of sorts was documented for Australian mutual funds by Brown et al. (2005). Most important, this second form of gambling with losses can be measured independently from the disposition-related tendency of holding onto losses. Thus, if random variation in the disposition spread gives rise to a subset of funds with positive disposition spreads, these two manifestations of gambling with losses should not be related to each other. I next explore this possibility.

To capture the tendency for funds to add additional shares to their losses, I construct what I refer to as the doubling measure (*DB*), computed as the difference of the proportion of losses added, *PLA*, and proportion of gains added, *PGA*. More specifically, *PLA* is computed as the dollar value of shares added to stocks representing capital losses divided by the dollar value of all stock positions representing capital losses in the portfolio at the beginning of the quarter. Similarly, *PGA* is computed as the dollar value of shares added to stocks representing capital gains divided by the dollar value of all stock positions representing capital gains in the portfolio at the beginning of the quarter. A mutual fund that gambles with losses by adding shares to his losses more readily than to his gains should exhibit a positive *DB*.

Table 7 reports the average *DB* for each of the decile portfolios formed based on disposition ratios. I rank all funds every quarter into deciles based on their disposition ratios. Funds with the highest disposition ratios are in the top decile and funds with the lowest disposition ratios are in the bottom decile. Results show a monotonic relation between *DISP RATIO* and *DB*. Furthermore, funds in the top four disposition ratio deciles exhibit positive *DB*, which is consistent with doubling strategies. The *DB* differential between the top and bottom deciles is statistically significant. Taken

altogether, these findings suggest a strong relation between the tendency for some funds to realize gains rather than losses and their tendency to add additional shares to their losses rather than gains.

In sum, the propensity documented for some of my sample funds to realize gains rather than losses is persistent through time and is accompanied by another form of gambling with losses. Such evidence makes the disposition effect a likely explanation why a subset of the sample funds exhibit positive disposition spreads.

V. Selling Preference and Characteristics

So far I have presented a somewhat isolated view of mutual fund preferences for realizing capital gains and losses whereby two categories of funds exist: The majority of funds prefer to realize losses more readily than gains, while a substantial minority prefers the opposite pattern of realizing capital gains rather than capital losses. But mutual funds operate in a constantly changing environment, where some conditions might give rise to certain behavioral tendencies and other conditions might give rise to other tendencies. In what follows, I start with a discussion of other factors that might influence mutual fund preferences for realizing capital gains and losses and proceed with a multivariate analysis.

A. Tax Motivation

The propensity for the majority of funds to realize more capital losses than gains could be driven by tax considerations. Tax selling works in the opposite direction with the disposition effect; mutual funds offset capital gains realized in the earlier part of the year to reduce the tax liability of their clients. A rationale for this type of trading activity is that, since mutual fund investors follow after-tax returns (see Bergstresser and Poterba (2002)), mutual fund managers, competing for investment cash flows, try to increase the after-tax returns of their clients by minimizing net realized capital gains, 98 percent of which has to be distributed to investors. Indeed, Gibson et al. (2000)

show that mutual funds accelerate their sale of "losers" before the common tax-year end. Thus, if tax selling plays a role, I would expect funds to display a stronger tendency for realizing capital losses rather than gains towards the end of the calendar year.

B. Dynamic Loss Aversion

Extending Kahneman and Tversky's (1979) framework, Barberis et al. (2001) show that loss aversion dynamically changes over time as a function of prior investment performance. More specifically, after good prior performance investors become less loss averse because prior gains cushion the negative effects of future losses. On the other hand, after poor prior performance they become more loss averse, wanting to avoid additional setbacks. O'Connell and Teo (2009) argue that "institutional fund managers are prone to dynamic loss aversion precisely because a large part of their self esteem and industry standing is tied to their portfolios' past performance." Under this framework, poor prior performance should lead to a pattern that runs contrary to the disposition effect. Specifically, poor prior performance should lead to a greater propensity for mutual funds to realize capital losses rather than gains.

C. Trading Under Pressure

My mutual fund setting presents a unique opportunity to examine research questions that cannot be addressed with retail investor data. Studies from cognitive psychology suggest that decisions made under time pressure might exacerbate behavioral biases. For example, Dror et al. (1999) show that, when placed under time pressure, participants in their experiment were even more likely to take a gamble in high risk scenarios, but less likely to do so in low risk scenarios. Another study by Raymond and O'Brien (2009) shows that, under pressure, experiment participants were more likely to recognize information predicting rewarding outcomes and to overlook information predicting negative outcomes. In the financial markets investors often trade under pressure because

of liquidity shocks, which might amplify the influence of behavioral biases such as the disposition effect. While trading-under-pressure scenarios cannot be identified for retail investors, such scenarios can be easily identified for mutual funds, as they are often pressured to trade in response to redemption demands made by their investors. By distinguishing situations when mutual funds are under pressure to act on their portfolios from situations when they are not under such pressure, I thus examine whether time pressure exacerbates behavioral biases such as the disposition effect.

D. Team Effects

My mutual fund setting makes it possible to distinguish decisions that were made as part of a team from those made by a single individual. One view is that the presumed objectivity of other team members might help break possible attachments to portfolio stocks that portfolio managers could develop. Conversely, members of a portfolio management team might gravitate toward a decision making pattern known as "groupthink". Janis (1972, p. 9) was the first to define groupthink as "A mode of thinking that people engage in when they are deeply involved in a cohesive in-group, when the members' strivings for unanimity override their motivation to realistically appraise alternative courses of action." More recently Benabou (2009) argues that groupthink might have been a contributing factor to corporate fiascos such as Enron, WorldCom, and the mortgage-related financial crisis. Groupthink in the investment management process has long been acknowledged (see Forrestal (1988); Zeikel (1988); Fabozzi (1997, p. 41); and Benabou (2009)).[13] In light of this discussion as

[13] As an example of how fund families try to avoid groupthink, Emspak (2007) discusses the approach taken by Eileen Rominger, Chief Investment Officer of Goldman Sachs Asset Management, to structure her team interaction:

> "Beyond that, Rominger sets up a meeting with her team, with one person serving as the designated contrarian. Before the meeting she asks other team members to submit anonymous evaluations to both her and the person who generated the idea. The designated contrarian's job is to poke holes in the new idea, drawing on what the other team members have submitted. The structure guards against groupthink. It also helps separate the really good ideas from the merely least objectionable. Left alone, groups tend to gravitate to ideas that nobody dislikes rather than those that anyone thinks are really good, Rominger says."

applied to my mutual fund setting, I examine whether team-based decision making reduces the influence of behavioral biases.

E. Logit Regression Methodology

I employ a logit regression to model the funds' differential selling propensities in response to gains vs. losses. The dependent variable, *Positive DISP*, is an indicator variable that equals one for fund-quarter observations with positive disposition spreads (when funds sell more winners than losers) and zero otherwise. Each fund in a given quarter represents a distinct unit of observation.

To examine whether tax loss selling affects selling preferences, I include, *Last Quarter*, a dummy variable that equals one for observations in the last calendar quarter and zero otherwise, as one of the independent variables. I introduce a fund performance variable, *Past Fund Performance*, to detect behavior possibly affected by dynamic loss aversion. This variable is measured as the past 12-month risk-adjusted fund performance from the Carhart (1997) model.

To examine whether outflow-induced pressure and team-based fund structure affect selling preferences, I include two key independent variables: *Outflow*, an indicator variable that equals one if a fund experienced net outflows in a given quarter and *Team*, an indicator variable that equals one if a fund is managed by a team of portfolio managers.

Presumably funds holding a smaller number of stocks or portfolios that are highly concentrated on a few stocks are more likely to create an attachment to their portfolio losers, leading to a stronger tendency to sell winners rather than losers. To examine this possibility, as additional independent variables, I include *Number of Stocks*, defined as the natural log of the number of stocks held in the fund portfolio, and *Herfindahl Index*, defined as the sum of the squared portfolio weights in each stock, multiplied by 100.

Another factor I control for is related to transaction cost considerations. Consider a fund which holds some stocks that experienced a price run-down over a period of time. These stocks have

become lower-priced and less liquid. If the fund is forced to sell to meet redemptions caused by fund outflows, the fund will be more likely to sell portfolio winners, which have become more liquid and have lower transaction costs (see Odean (p. 1,779, 1998)). To control for this possible effect, I include two additional control variables: *Amihud Ratio*, defined as the ratio of absolute return to dollar volume, averaged (value-weighted) across all stocks sold in a mutual fund portfolio in a given quarter and *Past Stock Performance*, defined as the value-weighted average of past 12-month returns of all the stocks sold in a mutual fund portfolio in a given quarter.

Additional control variables include *Fund Assets*, *Family Assets, Portfolio Turnover*, *Expense Ratio*, *Load*. *Fund Assets* and *Family Assets* represent, respectively, the log of the total net assets of the fund and of the family to which the fund belongs. *Portfolio Turnover* is the fund's turnover rate in percentage terms. *Expense Ratio* is the fund's expense ratio. *Load* equals one if the fund charges a load and zero if it does not. All independent variables are lagged by one quarter. Regressions are run with and without investment objective dummies. The marginal probabilities for the independent variables are reported along with the associated t-statistics in parentheses.

F. Results

Table 8 presents results. The negative coefficient on *Last Quarter* dummy is consistent with tax selling taking place in the last quarter of the year. That is, mutual funds are even more likely to realize capital losses than capital gains in the last quarter. Such behavior is consistent with a desire to reduce taxable distributions in an effort to make the fund more attractive to potential investors.

The lack of significance for the coefficient on *Past Fund Performance* does not support the prediction of the dynamic loss aversion theory of Barberis et al. (2001). The lack of significance persisted even when I tried other measures of performance not reported here. O'Connell and Teo (2009) show that, when trading currencies, mutual funds appear keener to respond to past performance at the end of calendar year. Along the same vein, I interact *Past Fund Performance* with

Last Quarter to examine whether gain vs. loss realization preferences become more responsive to past performance towards the end of the calendar year. Again, the insignificant coefficient on the interaction term does not follow predictions from dynamic loss aversion. This result should be interpreted with two caveats: (1) The inconsistency of my results with those of O'Connell and Teo (2009) could be because our studies examine trades in different types of securities—currencies in their paper and equities in mine. (2) Unlike the high frequency of O'Connell and Teo's (2009) data, the quarterly frequency of my data could limit the power of my tests.

Consistent with time pressure intensifying the influence of the disposition effect, I find a positive and significant relation between *Positive DISP*, the tendency to sell winners rather than losers, and *Outflow*. Note that outflows introduce liquidity shocks that could trigger transaction cost considerations as proposed by Odean (1998). Nonetheless, I controlled for such effects by including *Amihud Ratio* and *Past Stock Performance* as additional independent variables. Taken together, this evidence suggests that a when fund is forced to sell securities to meet redemptions, the probability that he is likely to exhibit disposition-driven behavior increases. Although *Outflow* is positively related to *Positive Disp*, recognize that investor outflows do not completely explain the propensity for some funds to realize more gains than losses as shown by the fact that the magnitude of the Pseudo R^2 and the coefficient on *Outflow* are not that large.

The relation between *Team* and *Positive DISP* is positive and significant. This finding suggests that a team approach to portfolio management is not effective in reducing the influence of behavioral biases. This finding is consistent with the broader concern that team-based decision making processes in investment management are susceptible to groupthink, which can lead to suboptimal investment decisions, as argued in Forrestal (1988), Zeikel (1988), and Fabozzi (1997, p. 41). In this context, future research that looks at how intra-team interactions are structured across

different mutual fund families and their impact on the quality of investment decisions is warranted, perhaps when better data becomes available.[14]

The coefficients on *Number of Stocks* and *Herfindahl Index* suggest that funds holding a small number of stocks or holding highly concentrated portfolios show a stronger tendency for realizing gains rather than losses. This is consistent with the idea that such funds are perhaps more likely to create an attachment to portfolio "loser" stocks. However, this finding could also be consistent with an alternative explanation: Funds holding a small number of stocks face higher reputational costs when selling losers, which makes it rational for them to avoid selling losers. Such an explanation is in line with Jin and Scherbina's (2010) conjecture that the reluctance of managers "to sell losers may be caused by the fear that they will suffer reputational costs for having made an investment mistake. As a result, they choose not to sell their underperforming stocks, thus not admitting their mistakes publicly (p. 29)." To differentiate between the behavioral and reputational explanations, I explored the interaction between fund past performance and *Number of Stocks* and *Herfindahl Index*. Brown, Harlow, and Starks (1996) and Brown, Goetzmann, and Park (2001) show that reputational concerns are more pronounced for funds with poor past performance who respond by altering portfolio risk. If reputational concerns are behind the tendency for funds that hold a small number of stocks or hold highly concentrated portfolios to sell more winners rather than losers, then such funds should show an even stronger tendency to sell winners than losers when they face poor past performance. Results not reported here show the interaction effects to be insignificant and therefore inconsistent with a reputational effect.

Further results show that the coefficient on *Amihud Ratio* is significant for only one specification. The coefficient on *Past Stock Performance* is positive and significant for both

[14] Limited evidence suggests that there is some variation in the intra-team interactions across mutual fund families. Specifically, some fund families structure their portfolio management teams so that the investment decisions are made by committee. Other mutual fund companies such as American Funds use an approach that combines teamwork with individual accountability.

regressions models, suggesting that mutual funds prefer to sell stocks that have experienced a price run-up in the near past. This result is consistent with evidence from Table 5. Also, my finding of a negative relation between *Portfolio Turnover* and *Positive DISP* is consistent with Seru et al. (2010) finding that investors learn to avoid the disposition effect as they gain experience through trading.

VI. Impact on Style and Performance

A. Methodology

To examine the relation between disposition-driven behavior and portfolio style and performance, I employ the following procedure. At the beginning of each quarter *t*, I rank funds into deciles based on their *DISP RATIO* in quarter *t-1*. Funds with the highest *DISP RATIO* are placed in the top decile and funds with the lowest *DISP RATIO* are placed in the bottom decile. Funds in each decile are placed into portfolios and held for the three months, with the same ranking procedure and portfolio updating repeated every quarter. A time-series of monthly returns (weighted by fund assets at the beginning of the quarter) is created for each of the decile portfolios and their style characteristics and performance are evaluated using the Fama and French (1993) and the Carhart (1997) models specified below,

(2) $$R_t = a + \beta_{MKT} RMRF_t + \beta_{SMB} SMB_t + \beta_{HML} HML_t + \varepsilon_t$$

(3) $$R_t = a + \beta_{MKT} RMRF_t + \beta_{SMB} SMB_t + \beta_{HML} HML_t + \beta_{UMD} UMD_t + \varepsilon_t ,$$

where R_t is the return in month *t* in excess of the risk-free rate. The common factor variables $RMRF_t$, SMB_t, HML_t, and UMD_t are the month-*t* return differentials between the market portfolio and risk-free rate, small cap and large cap stocks, high and low book-to-market stocks, and positive and negative return-momentum stocks, respectively.

B. Results

Table 9 reports statistics for decile portfolios created from ranking funds on *DISP RATIO*. Statistics include alphas and factor loadings from the performance regressions. The portfolios show a wide variation in their sensitivities to market, book-to-market equity, and momentum factors and a lower variation in their sensitivities to the size factor. Consistent with the style-impact hypothesis, there is a monotonic relation between the *DISP RATIO* ranks and market, book-to-market equity, and momentum factors in the hypothesized direction. More specifically, funds in the top decile have significantly lower loadings on the market factor, higher loadings on the book-to-market equity factor, and lower loadings on the momentum factor. In sum, funds in the top decile have a lower-than-average market risk exposure and display the characteristics of a value-oriented and short-term contrarian investment style.

The lack of a clear monotonic pattern in the alphas of decile portfolios together with the insignificant differential between the top and bottom deciles does not support the performance impact hypothesis.[15] This result is consistent with Locke and Mann's (2005) finding of no measurable costs associated with professional futures floor traders' aversion to realizing losses. However, this similarity of results should be interpreted with caution for two reasons: (1) Our studies examine trades in different types of securities—futures in their paper and equities in mine. (2) Their study uses high frequency data while mine employs data of quarterly frequency. Thus, it is possible that the quarterly frequency of the trades inferred from quarterly fund holdings presents a limitation for the power of my tests. Assessing the impact of behavioral biases on performance is worthy of future research, perhaps when equity trading data of a higher frequency becomes available.

[15] This result is further confirmed by unreported multivariate tests whereby quarterly fund alphas are regressed on the disposition ratio and other fund and family characteristics.

VII. Conclusion

As important players in the financial markets, mutual funds are supposed to be shrewd professional investors whose endless search for mispriced securities and market anomalies presumably makes the financial markets more efficient. Although, on average, mutual funds seem to realize losses more readily than gains, surprisingly, a sizable fraction of them are not exempt from the disposition effect, a behavioral effect that has been widely documented for individual investors. The tendency of this particular subset of funds to sell winners rather than losers is persistent through time. Interestingly, the affected funds do not only hold onto losses, but they also systematically add to their losses in what appears to be another form of gambling with losses.

My finding of a greater inclination toward the disposition effect for funds that are under time pressure to act on their portfolios due to investor redemptions has important implications. As economy-wide shocks cause capital outflows that are correlated across funds, systematic trading patterns among mutual funds could arise with implications for assets prices.

The documented stronger presence of the disposition effect in the trades of mutual funds that are run by teams of portfolio managers as opposed to those run by a single portfolio manager raises questions about the efficacy of the team approach to portfolio management. This finding also calls for more research to shed light on the approaches to team management employed by different fund complexes and their impact on portfolio decisions.

Finally, I document that disposition-driven behavior affects the investment styles of mutual funds, causing the affected portfolios to have lower market betas and characteristics of value-oriented and short-term contrarian styles. Such impacts on mutual fund investment styles, although unintentional, could hurt investors by altering their asset allocations.

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TABLE 1
Sample Characteristics

Panel A. Fund Characteristics

Year	Number	Total Assets (millions)	Average Assets (millions)	Portfolio Turnover (%/year)	Expense Ratio (%/year)	Stock Positions
1980	214	37,930	183	48.06%	0.94%	56
1981	228	37,802	178	56.43%	0.80%	59
1982	213	30,416	172	65.88%	0.78%	57
1983	234	50,599	252	58.25%	0.82%	68
1984	256	53,883	247	49.80%	0.83%	69
1985	268	68,518	292	62.20%	0.91%	73
1986	289	94,648	376	60.17%	0.99%	78
1987	310	126,767	453	68.56%	1.00%	82
1988	345	121,538	388	69.77%	1.00%	85
1989	358	128,281	417	57.98%	1.10%	90
1990	411	143,824	406	66.75%	1.23%	89
1991	474	224,962	478	81.69%	1.16%	92
1992	550	291,330	541	68.55%	1.07%	98
1993	632	408,461	659	71.05%	1.28%	108
1994	868	520,201	608	74.48%	1.27%	118
1995	1029	715,249	705	79.28%	1.34%	123
1996	1101	991,091	910	87.88%	1.39%	124
1997	1311	1,384,588	1,066	90.62%	1.39%	124
1998	1459	1,823,873	1,251	88.32%	1.38%	123
1999	1612	2,236,138	1,392	89.77%	1.41%	127
2000	1715	2,603,722	1,522	101.60%	1.39%	144
2001	1836	2,158,787	1,177	113.44%	1.43%	150
2002	2006	2,000,268	998	114.40%	1.50%	150
2003	2056	2,151,301	1,047	105.28%	1.53%	152
2004	2085	2,689,708	1,291	93.12%	1.53%	158
2005	2111	3,007,649	1,425	87.98%	1.48%	158
2006	2026	3,367,563	1,661	86.39%	1.46%	161
2007	2047	3,816,632	1,879	83.39%	1.44%	161
2008	2029	3,038,582	1,497	86.91%	1.38%	169
2009	1976	2,386,211	1,209	103.10%	1.39%	174

Panel B. Types of Funds

	Index vs. Active Classification		Investment Objective Classification for Active Funds						
	Index	Active	Growth	Growth & Income	Small Cap	Mid Cap	Aggressive Growth	Income	Missing Objective
Number	262	3,006	1,059	763	681	535	97	82	51
Frequency (%)	8.02	91.98	32.41	23.35	20.84	16.37	2.97	2.51	1.56

This table reports summary characteristics for my 3,268 U.S. equity sample funds during the 1980-2009 period. Panel A reports sample characteristics for each year of the sample period. Panel B reports information on the breakdown of the sample into various categories based on fund investment objectives.

TABLE 2
Proportion of Realized Gains and Losses

Panel A. Dollar Value of Transactions				
Panel A.1. End of Quarter Prices	Average Price	FIFO	HIFO	LIFO
PGR	0.335	0.344	0.320	0.329
PLR	0.384	0.391	0.402	0.381
DISP	-0.049	-0.048	-0.082	-0.052
t-statistic	*(-18.86)*	*(-18.71)*	*(-31.07)*	*(-19.23)*
% funds>0 (Equal-Weighted)	35.90%	36.15%	26.35%	35.38%
% funds>0 (Asset-Weighted)	33.83%	36.02%	22.00%	28.77%
Panel A.2. Average Quarter Prices				
PGR	0.331	0.345	0.314	0.319
PLR	0.382	0.388	0.401	0.382
DISP	-0.051	-0.042	-0.087	-0.064
t-statistic	*(-19.75)*	*(-16.84)*	*(-32.70)*	*(-23.66)*
% funds>0 (Equal-Weighted)	34.28%	36.18%	23.48%	30.36%
% funds>0 (Asset-Weighted)	32.83%	36.11%	18.25%	27.24%
Panel B. Number of Transactions				
Panel B.1. End of Quarter Prices				
PGR	0.413	0.414	0.399	0.413
PLR	0.428	0.428	0.446	0.430
DISP	-0.015	-0.015	-0.047	-0.016
t-statistic	*(-7.56)*	*(-7.60)*	*(-24.13)*	*(-8.03)*
% funds>0 (Equal-Weighted)	44.69%	45.09%	28.04%	43.07%
% funds>0 (Asset-Weighted)	49.59%	53.52%	22.22%	43.69%
Panel B.2. Average Quarter Prices				
PGR	0.418	0.420	0.404	0.414
PLR	0.419	0.418	0.441	0.426
DISP	-0.001	0.002	-0.037	-0.012
t-statistic	*(-0.44)*	*(1.05)*	*(-17.54)*	*(-5.85)*
% funds>0 (Equal-Weighted)	47.90%	50.29%	31.28%	42.42%
% funds>0 (Asset-Weighted)	49.78%	54.95%	22.95%	43.38%

This table reports the proportion of realized gains, *PGR,* proportion of realized losses, *PLR*, and the difference between the proportion of realized gains and losses, *DISP*. Each statistic is computed every quarter for each fund and its time-series mean is computed for each fund. The last two rows of each panel present the fraction of funds with a positive average disposition spread, where each fund is weighted equally or by its average assets. The *PGR, PLR*, and *DISP* statistics are computed using the dollar value of transactions in Panel A and the number of transactions in Panel B. In Panels A.1 and B.1 trades are assumed to happen at stock prices recorded at the end of quarter, i.e., trades are assumed to occur at the end of quarter. In Panels A.2 and B.2 trades are assumed to happen at prices that are averages of daily stock prices during the quarter, i.e., trades are assumed to occur sometime during the quarter.

TABLE 3
Proportion of Realized Gains and Losses by Subperiod

	Subperiods		
	1980-1989	1990-1999	2000-2009
PGR	0.282	0.345	0.337
PLR	0.302	0.414	0.384
DISP	-0.019	-0.069	-0.047
t-statistic	*(-2.48)*	*(-15.19)*	*(-16.76)*
% funds>0 (Equal-Weighted)	46.38%	34.32%	36.29%
% funds>0 (Asset-Weighted)	46.33%	28.27%	31.44%

This table reports *PGR, PLR*, and *DISP* statistics computed for each of the three sample subperiods: 1980-1989, 1990-1999, 2000-2009. Each statistic is computed every quarter for each fund and its time-series mean is computed for each fund. The last two rows present the fraction of funds with a positive average disposition spread where each fund is weighted equally or by its average assets.

TABLE 4
Proportion of Realized Gains and Losses by Type of Fund

	Index vs. Active Classification		Investment Objective Classification for Active Funds					
	Index	Active	Growth	Growth & Income	Small Cap	Mid Cap	Aggressive Growth	Income
PGR	0.244	0.343	0.325	0.304	0.399	0.361	0.394	0.249
PLR	0.253	0.395	0.407	0.341	0.422	0.415	0.463	0.310
DISP	-0.008	-0.053	-0.083	-0.037	-0.022	-0.054	-0.069	-0.061
t-statistic	*(-1.09)*	*(-19.22)*	*(-16.50)*	*(-7.04)*	*(-3.82)*	*(-8.12)*	*(-4.33)*	*(-3.37)*
% funds>0 (EW)	54.58%	34.28%	25.71%	36.18%	44.64%	35.64%	29.67%	36.84%
% funds>0 (AW)	48.23%	31.65%	18.84%	35.14%	48.99%	42.81%	11.19%	45.36%

This table reports *PGR, PLR*, and *DISP* statistics by type of mutual fund. In the first two columns, results are reported separately for index and actively-managed mutual funds. In the remaining columns, statistics are reported separately for actively-managed mutual funds categorized by investment objective. Each statistic is computed every quarter for each fund and its time-series mean is computed for each fund. The last two rows present the fraction of funds with a positive average disposition spread where each fund is weighted equally or by its average assets.

TABLE 5
Logit Regression on Sell versus Hold Decision

	Past Stock Returns Measured Over:	
Independent Variables	Last 12 Months	Last 6 Months
Extreme Loss	0.111	0.101
	(9.21)	*(8.11)*
Moderate Loss	0.047	0.044
	(6.29)	*(5.75)*
Positive Return	0.051	0.093
	(7.22)	*(6.29)*
Negative Return	0.125	0.062
	(3.26)	*(1.46)*

This table reports results from a logit regression that models the sell versus hold decision. The dependent variable equals one when a mutual fund sells a stock and zero when it does not sell but decides to hold the stock. The two key independent variables are a large capital loss dummy and a small capital loss dummy. A large (small) capital loss is defined as a loss that is larger (smaller) in magnitude than the median loss for that fund. I include two additional independent variables in the logit regression that capture past market-adjusted stock returns compounded over the last 6 or 12 months. The two return variables are Positive Return, defined as [max (return, 0)], and Negative Return, defined as [min (return, 0)]. Standard errors are clustered by fund and period. The marginal probabilities for the independent variables are reported along with the associated *t*-statistics in parentheses.

TABLE 6
Frequency Distributions of a 2 × 2 Classification
Based on the Disposition Ratio in Quarters *t-1* and *t*

	DISP RATIO Rank at *t*	
DISP RATIO Rank at *t-1*	High DISP RATIO	Low DISP RATIO
High DISP RATIO	31.37	18.93
Low DISP RATIO	18.77	30.93
		χ^2=4,509 (p-value=<0.0001)

Cell frequencies from a 2 × 2 classification of funds based on the rank-ordered *DISP RATIOS* in quarter *t-1* and *t* are reported. The *DISP RATIO* is calculated every quarter for each fund as the ratio of its *PGR* to its *PLR*. Every quarter, I classify funds as High or Low Disposition Funds if their *DISP RATIO* is respectively above or below the cross-sectional median for that quarter. The χ^2 statistic is calculated under the null hypothesis that each cell should get an equal distribution of 25% of the observations.

TABLE 7
Doubling Measure

DISP RATIO Portfolios	Doubling Measure
1	0.206
2	0.162
3	0.116
4	0.054
5	0.000
6	-0.041
7	-0.067
8	-0.085
9	-0.093
10	-0.067
1-10	0.273
t-stat	*(29.37)*

This table reports statistics on the Doubling Measure (*DB*) computed as the difference of the proportion of losses added, *PLA*, and proportion of gains added, *PGA*. *PLA* is computed as the dollar value of shares added to stocks representing capital losses in the portfolio at the beginning of the quarter, divided by the dollar value of all stock positions representing capital losses in the portfolio at the beginning of the quarter. Similarly, *PGA* is computed as the dollar value of shares added to stocks representing capital gains in the portfolio at the beginning of the quarter, divided by the dollar value of all stock positions representing capital gains in the portfolio at the beginning of the quarter. Every quarter I rank funds into deciles based on the DISP RATIO. Funds with the highest DISP RATIO are in the top decile (Portfolio 1) and funds with the lowest DISP RATIO are in the bottom decile (Portfolio 10). I compute the average DB across all the funds in each decile and each period, creating a time-series of cross-sectional *DB* averages, the mean of which is reported in this table for each decile.

TABLE 8
Relation between Fund Characteristics and Disposition Effect

Dependent Variable: Positive Dif (1 if DISP>0 and 0 otherwise)		
Independent Variables	Coefficients	
Last Quarter	-0.025	-0.025
	(-1.97)	*(-2.00)*
Past Fund Performance	0.038	0.039
	(1.16)	*(1.20)*
*Past Fund Performance *Last Quarter*	0.057	0.056
	(0.56)	*(0.56)*
Outflow	0.059	0.059
	(7.44)	*(7.79)*
Team	0.034	0.031
	(3.22)	*(2.95)*
Number Stocks	-0.047	-0.059
	(-4.09)	*(-5.11)*
Herfindahl Index	0.007	0.009
	(2.53)	*(2.76)*
Amihud Ratio	0.005	0.003
	(1.64)	*(1.38)*
Past Stock Performance	0.115	0.112
	(4.23)	*(4.16)*
Fund Assets	-0.001	0.000
	(-0.29)	*(-0.08)*
Family Assets	0.001	0.003
	(0.44)	*(1.33)*
Portfolio Turnover	0.000	0.000
	(-3.19)	*(-2.83)*
Expense Ratio	-0.004	-0.006
	(-0.55)	*(-0.76)*
Load	0.008	0.007
	(0.66)	*(0.56)*
Objective Fixed Effects	No	Yes
Pseudo R^2	1.49%	2.13%
Observations	52,382	52,382

This table presents results from a logit regression that relates the tendency for funds to disproportionately realize more gains than losses to fund characteristics. Analysis is done at the fund and quarter level, with each fund at a given quarter representing a distinct observation. The dependent variable, *Positive DISP*, is an indicator variable that equals one for fund-quarter observations with positive disposition spreads and zero for those with zero or negative disposition spreads. The main set of independent variables include: *Last Quarter*, a dummy variable that equals one for observations in the last calendar quarter and zero

otherwise; *Past Fund Performance,* the past 12-month risk-adjusted fund return from the Carhart 4-factor model; *Outflow*, an indicator variable that equals one if a fund experienced outflows in a given quarter and zero otherwise; *Team*, an indicator variable that equals one if a fund is managed by a team of portfolio managers and zero otherwise; *Number of Stocks,* the natural log of the number of stocks held in the fund portfolio; *Herfindahl Index*, sum of the squares of the portfolio weights in each stock, multiplied by 100; *Amihud Ratio*, the ratio of absolute return to dollar volume averaged (value-weighted) across all stocks sold in a mutual fund portfolio in a given quarter; and *Past Stock Performance*, the value-weighted average of past 12-month returns of all the stocks sold in a mutual fund portfolio in a given quarter. Additional independent variables include *Fund Assets, Family Assets, Portfolio Turnover, Expense Ratio,* and *Load. Fund* A*ssets* represent the log of total net assets of the fund. *Family* A*ssets* is the log of total net assets of the corresponding fund family. *Portfolio Turnover* is the fund's turnover rate in percentage terms. *Expense ratio* is the fund's expense ratio. *Load* equals one if a fund charges a load and zero if it does not. All independent variables are lagged by one quarter. Regressions are run with and without investment objective fixed effects. The marginal probabilities are reported along with the associated *t*-statistics in parentheses. Standard errors are clustered by fund and period.

TABLE 9
Characteristics of Decile Portfolios formed on *DISP RATIO*

DISP RATIO	Fama-French (1993) Model					Carhart (1997) Model					
Portfolios	ALPHA	RMRF	SMB	HML	R^2	ALPHA	RMRF	SMB	HML	UMD	R^2
1	-0.214%	0.928	0.020	0.249	94.69%	-0.133%	0.893	0.028	0.213	-0.087	95.81%
2	-0.165%	0.933	0.047	0.174	96.47%	-0.112%	0.911	0.053	0.151	-0.056	96.94%
3	-0.199%	0.936	0.022	0.073	96.02%	-0.164%	0.921	0.026	0.058	-0.038	96.23%
4	-0.103%	0.952	0.055	0.051	96.29%	-0.084%	0.944	0.057	0.043	-0.020	96.35%
5	-0.103%	0.945	0.107	-0.035	97.70%	-0.123%	0.954	0.105	-0.026	0.022	97.77%
6	-0.067%	0.943	0.090	-0.067	96.88%	-0.110%	0.961	0.086	-0.048	0.045	97.15%
7	0.020%	0.978	0.052	-0.086	97.27%	-0.018%	0.994	0.048	-0.069	0.041	97.47%
8	-0.094%	0.973	0.085	-0.105	95.98%	-0.128%	0.987	0.082	-0.090	0.036	96.13%
9	0.060%	0.962	0.112	-0.137	96.66%	-0.006%	0.990	0.106	-0.107	0.070	97.24%
10	-0.040%	1.028	-0.003	-0.152	95.92%	-0.075%	1.043	-0.006	-0.136	0.037	96.07%
1-10	-0.175%	-0.100	0.023	0.401	48.51%	-0.058%	-0.149	0.034	0.349	-0.124	56.89%
	(-1.52)	*(-3.80)*	*(0.64)*	*(10.97)*		*(-0.54)*	*(-5.88)*	*(1.06*	*(10.09)*	*(-6.10)*	

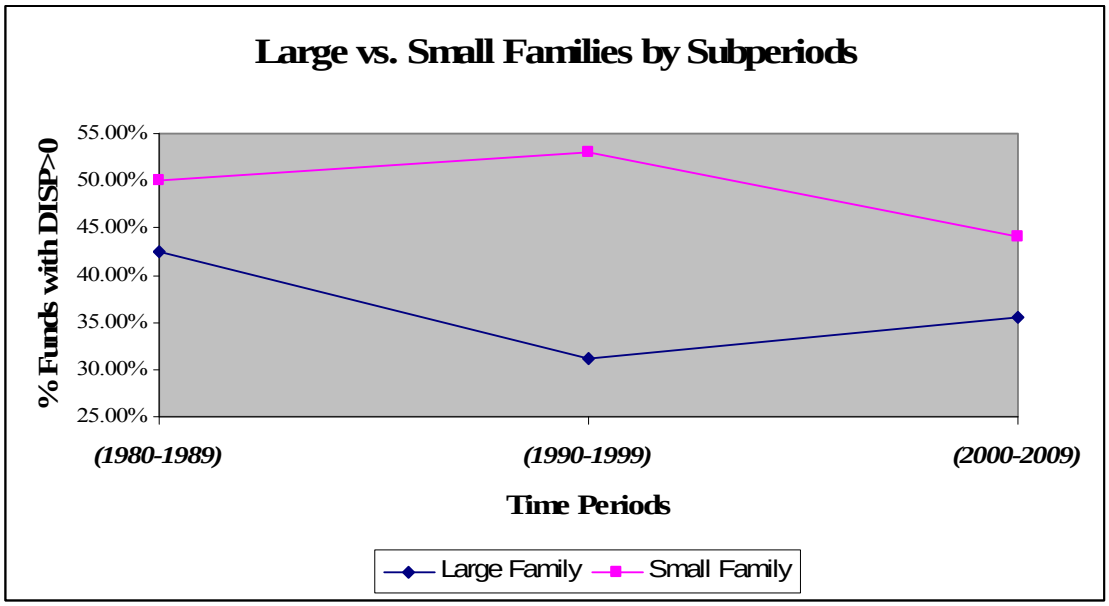
This table reports factor loadings and alphas from the return series of *DISP RATIO* deciles portfolios. At the beginning of each quarter *t*, funds are ranked into deciles based on their *DISP RATIO* at quarter *t-1*. Funds with the highest *DISP RATIO* are placed in the top decile and those with the lowest *DISP RATIO* are placed in the bottom decile. Funds in each decile are placed into value-weighted portfolios and held for three months, with the same ranking procedure and portfolio updating repeated every quarter. A series of monthly returns is created for each of the decile portfolios and their style characteristics and performance are evaluated using the Fama and French (1993) and the Carhart (1997) models specified below.

$$R_t = a + \beta_{MKT} RMRF_t + \beta_{SMB} SMB_t + \beta_{HML} HML_t + \varepsilon_t$$

$$R_t = a + \beta_{MKT} RMRF_t + \beta_{SMB} SMB_t + \beta_{HML} HML_t + \beta_{UMD} UMD_t + \varepsilon_t ,$$

where R_t is the return in month *t* in excess of the risk-free rate. $RMRF_t$, SMB_t, HML_t, and UMD_t are the month-*t* return differentials between the market portfolio and risk-free rate, small cap and large cap stocks, high and low book-to-market stocks, and positive and negative return-momentum stocks, respectively. The associated *t*-statistics are in parentheses.

Figure 1



Figures 1 plots the fraction of funds with positive disposition spreads among large and small fund families for each of the three sample subperiods, 1980-1989, 1990-1999, 2000-2009. Large and small fund families correspond to families that fall in the top and bottom deciles formed by rankings on family size.

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