# Dressing for Style in the Mutual Fund Industry

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# Dressing for Style in the Mutual Fund Industry

**Abstract**

We use a holdings-based statistic to measure the style drift of a mutual fund relative to its self-selected benchmark, and document that style drift has a strong, adverse impact on mutual fund flows even for funds with superior return performance. Both external and internal governance mechanisms work to monitor style drift—funds with more institutional investment and in larger fund families manage style drift more carefully. We also document that style drift management has an economically more important role in how funds manage their portfolios throughout the year than the tournament-style behavior documented in prior literature.

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"If a fund manager who usually buys the stocks of small companies starts loading up on blue chips, the advisors object. In fact, they often fire you."

Mario Gabelli, CEO of Gabelli Asset Management Company (*New York Times,* May 26, 1996).

## 1. Introduction

Style investing, or implementing a preference for certain "styles" of stocks (e.g., growth versus value), is a common way to narrow investment choices. Even many institutional investors, despite the substantial resources they could apply to individual security analysis, prefer to allocate their investment budget across styles and attempt to select portfolio managers with style-specific skill and focus.[1] Indeed, Bernstein (1995) associates the increase in style-oriented portfolio managers to the rise in popularity of style investing among institutional investors during the 1980s. Maintaining style discipline is critical for style-oriented portfolio managers wishing to attract and retain institutional investment, and indeed that of any investors who rely on style investing to narrow their selections. As the opening quote suggests, a fund that strays from its promoted style may be less attractive to institutional investors, and we argue sophisticated investors more generally, who are concerned with meeting specific portfolio needs.

On the other hand, managers may have risk-based incentives to engage in "style drift." For example, stronger mutual fund performance leads to higher net fund flows. If net flows are convex in performance as in Chevalier and Ellison (1997), Sirri and Tufano (1998), and Huang, Wei, and Yan (2007), them fund mangers could have an incentive to drift from style

[1] Institutional style preferences may have asset pricing implications by affecting the comovement of asset prices (Barberis and Shleifer, 2003). There is also evidence of style preferences impacting the market for corporate control (Massa and Zhang 2009; Burch, Nanda, and Silveri 2012).

in order to alter their fund's risk profile and increase the odds of superior performance. This incentive often serves as the motivation for the mutual fund tournaments literature, most of which finds that funds alter their risk during the latter part of the calendar year in order to manage how their calendar-year performance will compare with that of their peers.[2] Although Spiegel and Zhang (2013) challenge the finding that flows are convex in performance on methodological grounds, they note that fund managers may still have career-based incentives (Qui 2003) or compensation-based incentives to alter their fund's risk.

In this paper we examine the impact of style drift on a mutual fund's net flows and portfolio management. To do so, we focus on a fund's beta with respect to its selected benchmark, that is, the fund's return sensitivity with respect to its benchmark's return. Our focus on benchmark beta, in contrast with style drift metrics used in Wermers (2012) and Brown, Harlow and Zhang (2014), is motivated by its simplicity, ease of interpretation, and visibility. For example, industry leaders such as Blackrock, Fidelity, and Vanguard all report benchmark betas in fact sheets, web sites, or annual reports. And style-oriented investors that lack the needed expertise to perform more complicated style analysis, or lack the bargaining power to obtain higher frequency portfolio holdings data from funds, can calculate (or often directly observe) benchmark beta to gauge how a fund's returns are expected to fluctuate with the fund's promoted benchmark.[3] Benchmark beta also helps investors understand whether positive excess returns above the benchmark could simply be due to the fund taking on higher degrees of risk.[4]

[2]See Brown, Harlow and Starks (1996), Chevalier and Ellision (1997), Koski and Pontiff (1999), Busse (2001), Taylor (2003), Qiu (2003), Kempf and Ruenzi (2008), Chen and Pennacchi (2009), Elton et al. (2010), Huang, Sialm and Zhang (2011), Aragon and Nanda (2012), and Schwarz (2012).

[3]Given the investment dollars at stake, it is common for funds to comply with a request by a major institutional investor or its consultant for relatively frequent portfolio holdings data. Retail investors, however, usually can only obtain detailed portfolio holdings through filings with the Securities Exchange Commission (SEC) made twice a year, or at most quarterly.

[4]See Barber, Huang, and Odean (2015) for evidence that mutual fund flows are sensitive to systematic risk as measured by market beta in the Capital Asset Pricing Model. Berk and van

We examine 1,498 actively-managed equity mutual funds over the years 1990-2012 and find that investors penalize funds with higher style drift, as measured by the absolute deviation of benchmark beta from one, through lower net flows. In terms of economic magnitude this effect is large, with a one-standard deviation (SD) increase in absolute beta deviation associated with a 2.3% reduction in net flows during the next six months. To put this magnitude into context, in the sample we examine this is approximately half as large as the effect on flows of a one-SD decrease in return over the benchmark's return. We also find the penalty for style drift is larger for funds with higher levels of institutional ownership, consistent with a governance mechanism. The flow rewards for stronger return performance is also significantly lower for funds with higher levels of style drift.

In light of these findings, not surprisingly we find that funds with more institutional ownership have lower levels of style drift. Perhaps because large fund families tend to target (or wish to maintain) institutional investment or strongly value their reputational capital, funds in larger fund families also have less style drift.

Next we examine the extent to which funds reduce style drift once it occurs. We track changes in beta deviation and find that funds with higher levels of beta deviation more strongly move their benchmark beta toward one. The methodology we use in this analysis ensures this effect is not caused by sorting bias or mean reversion in stock-level betas. In separate analysis we also examine actual trading, and again find that funds choose their trades in a way that reduces beta deviation.

As changing the portfolio's beta will change its risk, it is important to distinguish style drift behavior from tournament-style risk management. The tournament literature is premised on the desire to manage calendar-year-end performance. Thus, because our empirical work is based on measuring benchmark beta and portfolio composition each June and

Binsbergen (2015) use fund flows to show that the CAPM is the prefered asset pricing model among mutual fund investors.

December, one way to distinguish our findings from tournament behavior is to separately examine changes in benchmark beta from June to December and changes from December to June. If our findings our explained by tournament behavior, we would expect to observe strong beta management from June to December, but not December to June. Instead, we find that benchmark beta management is just as strong in a December to June adjustment sample as in the overall sample. We also find that the ability of style drift management to explain portfolio volatility is several times stronger in economic magnitude than that of risk management due to tournament behavior.

Our findings are consistent with anecdotal evidence that style drift management is an important issue in the mutual fund industry and has important implications for fund flows and portfolio management. As one senior executive as a well-known fund family notes, “drift can mean unexpected volatility that upset investors... we were always extremely conscious of making sure our funds stuck to their charters.”[5] On average, mutual fund managers seem well aware of the downside of style drift on fund flows, and action throughout the year to limit it. Mutual funds indeed dress for style, but unlike in the mutual fund tournaments literature in which strong calendar year effects are observed, window dressing for style appears to take place on a more continuous basis.

# 2. Sample, Variables, and Summary Statistics

## 2.1. Data sources and sample construction

To construct our sample of funds, we merge all U.S. equity mutual funds (life cycle and balanced funds are excluded) from the Morningstar Direct database (including its non-surviving funds) with the CRSP Survivorship Bias Free Mutual Fund Database on the basis of CUSIP,

[5] See "Style Sticklers: Pension Consultants Policing Fund Managers to See That They Invest as Advertised," by Jerry Morgan, *Los Angeles Times*, December 10, 1996, Business Section, Part D.

and hand-inspect fund names to ensure a match.[6] We then merge the combined dataset with the Thomson Financial CDA/Spectrum fund holdings database on the basis of name, dates, and total assets (we require asset sizes to differ by no more than 20%). These steps result in 1,604 funds

Index funds are identified on the basis of their name and excluded from the sample, so that we do not include funds whose sole objective is to minimize tracking error.[7] We also exclude tax-managed funds and leveraged funds due to the lack of appropriate benchmarks for the entirety of the sample period we examine. These exclusions reduce the sample to 1,498 funds. Finally, because an important part of our analysis draws conclusions relatives the mutual fund tournaments literature, for the sake of comparison with some studies funds must report holdings as of the end of June and December.[8]

A fund's benchmark choice is from Morningstar, and when a fund specifies both a primary and secondary benchmark we use its primary benchmark. As we will detail later, our analysis requires us to know how a benchmark is constructed in terms of the component assets and their weights. We are able to find accurate benchmark construction data from various sources back to 1990,[9] and thus our analysis covers the 1990-2012 period. Our final sample consists of 1,498 funds.

As is standard in the literature, when constructing fund returns we combine share classes to construct a single time series of return for each fund, and we use net-of-expense returns. CRSP is used to calculate fund flows (from total net assets and returns, following Sirri

[6] We are unable to match approximately 10% of funds in Morningstar to CRSP data—these funds are dropped from the sample.

[7] Including such fund would bias our results in favor of mutual funds, in general, managing their benchmark beta.

[8] Results are similar if all months are included in the analysis.

[9] Constituent information for the Standard and Poor's family of benchmarks from Compustat, and that for the Russell family of benchmarks were generously provided by Russell Investments. As shown in Sensoy (2009), S&P and Russell benchmarks cover over 90% of managed assets in the mutual fund industry.

and Tufano (1998)), obtain information on fees and fund characteristics, and to obtain the weight of fund assets in a fund's institutional share class (if such a class exists). As described below, we also require stock returns for the component assets in both funds and their chosen benchmarks, and here as well we obtain data from CRSP.

## 2.2. Benchmark Beta

*Benchmark Beta* is the main variable of interest in our study, and the most straightforward way to measure it is to regress historical fund returns against benchmark returns. In the context of our research agenda, however, this approach has two problems. First, it creates a potential survivorship bias by requiring funds to have a specified history of returns over which to estimate beta. Second, when measuring changes in benchmark beta, this method suffers from the sorting bias explored in Schwartz (2012). Funds with more positive returns during the first part of the year will tend to have higher contemporaneously measured risk (benchmark beta in our context), so that mean reversion in risk would spuriously imply that such funds had lowered their levels of risk over the second half of the year.

To avoid these problems, we measure benchmark beta using holdings-based methodology, and when measuring the change in benchmark beta, hold constant the period of returns over which beta is measured. At each holdings reporting period t, we use the relative dollar amounts invested to assign a portfolio weight to each stock owned as of the holdings report date. Holding the portfolio weights constant, we then use stock returns over the 36-month period *t-1* to *t-37* to construct 36 hypothetical monthly returns. The same methodology is used to construct 36 months of prior hypothetical returns for the benchmark's portfolio, where the component assets and their weights are based on the benchmark's construction as of the same reporting date. Asset weights within benchmark portfolios are from Compustat for the S&P family of benchmarks, and from Russell Investments for the Russell family of benchmarks.

To calculate benchmark beta as of a given holdings reporting date for the fund we then estimate the following OLS regression:

$$RF_t = \alpha \ + \ \beta(RB_t) \ + \ \varepsilon_t,$$

where $\mathrm{RF}_t$ and $\mathrm{RB}_t$ are the 36 prior hypothetical monthly fund and benchmark portfolio returns, respectively. Thus, $\beta$ is the fund's benchmark beta as of the holdings reporting period, and is the return sensitivity of fund current holdings to the current benchmark, estimated using three years of prior monthly hypothetical returns.

When measuring the change in a fund's benchmark beta from, say, June to December, we first apply the above methodology above to measure $\beta$ based on December holdings. Then, when measuring benchmark beta for June, we construct the hypothetical portfolios using the same 36 calendar months that were used to measure December's benchmark beta. Thus, the measured change in benchmark beta from June to December will only be due to stock-level weight changes in the fund's portfolio from June to December, and not to mean reversion in risk. We acknowledge that stock-level weights will change due to stock-level performance, which may also be a source of concern. Therefore, in additional analysis we describe later in the paper, we examine the impact on benchmark beta of the actual trading decisions that funds make.

Table 1 describes our sample over time. The sample is considerably larger during the middle and later part of the period we study. Interestingly, the number of funds benchmarked to a particular style (the bottom five groups) as opposed to the broader market (the S&P 500 benchmark group) increased dramatically from 1990 to 2010. As of 1990, 44.4% (56 of 126) of funds in the sample were benchmarked against a style, compared to 64.7% (413 of 638) in 2010.

Benchmark betas show a material amount of variation. For example, for funds benchmarked to the S&P 500, in 2010 the 25th percentile is 0.94 and the 75th percentile is 1.13. As we document later, some of this variation is correlated with fund characteristics in predictable ways. The allocation of value funds experiences the largest growth on a relative basis, growing from 10.3% of the sample in 1990 to 24.6% in 2010. For completeness in describing changes in the sample over time we also report fund and family dollar size. *Fund Assets* are obtained from CRSP by aggregating up TNA across all fund share classes. *Family Assets* are obtained by aggregating all assets for a given manager code in Thomson Financial. We use both of these mainly as control variables in our analysis and do not put them in constant dollars, because our results are cross-sectional (not time series) in nature and we also include time fixed effects.

## 2.3. Other Variables and Summary Statistics

To measure style drift, we use the absolute value of beta deviation, *Abs(Beta Deviation)*, where beta deviation is the fund's benchmark beta minus one (note that a fund with no style drift would have benchmark beta equal to one). Thus, funds with smaller values of *Abs(Beta Deviation)* have portfolios that more closely track their chosen benchmark style. A fund with a benchmark beta greater (less) than one can reduce style drift by reducing (increasing) its benchmark beta towards one.

One issue we investigate is the extent to which changes in benchmark beta correlate with recent prior performance, similar to the tournaments analysis examined in prior literature. The tournaments literature focuses on change in total risk, but one way to change a fund's total volatility will be to increase or decrease its benchmark beta, which will also alter its market beta (given that benchmarks are positively correlated with the market). Most of our analysis incorporates recent prior performance by including *Excess Return*, where *Excess Return* is the fund's prior six month return net of fees minus its benchmark return over the same period. Monthly fund returns are from Morningstar, returns for S&P family benchmarks are from Compustat, and returns for Russell family benchmarks are provided by Russell.

Part of our analysis investigates whether fund flows are affected by higher levels of beta deviation. Using data in the CRSP mutual fund database, we follow Sirri and Tufano (1998) and construct the variable *Flow* as:

$$Flow = \frac{TNA_{i,t} - (TNA_{i,t-1})(1 + R_{i,t})}{TNA_{i,t-1}},$$

where $\mathrm{TNA}_{i,t}$ is the total net assets for fund $i$ at time $t$, and $\mathrm{R}_{i,t}$ is the fund's return over the prior period.

*Institutional Ownership* is constructed by aggregating CRSP *TNA* across all share classes with the Morningstar Direct code "Inst" and then dividing by *Fund Assets* (funds without an institutional share class have Institutional Ownership set to zero). The fund's *Expense Ratio*, *12b-1 Fee*, and *Turnover* are taken directly from CRSP.

Finally, to measure the total risk of the fund's portfolio we construct *Imputed Volatility*, which is the standard deviation of the fund's 36 hypothetical monthly returns used in the calculation of benchmark beta. Part of our analysis focuses on the change in total fund volatility so we can compare and contrast changes in benchmark beta to changes in fund risk as in the tournament-style literature. For such analysis, similar to measuring changes in benchmark beta, we use same 36 calendar-months of hypothetical portfolio returns in measuring volatility at two points in time. This results in the change in imputed volatility being due to changes in portfolio composition, not stock-level returns, and thus avoids the sorting bias discussed earlier.

Table 2 provides summary statistics of our variables. The 25th and 75th percentiles in Panel A show that half of the fund observations in our sample have a benchmark beta that deviates from one by no more than 10%. Panels B through D show statistics by sample subgroup, as part of the empirical analysis employs similar subsample splits. These panels show beta deviation does vary somewhat across these subsamples.

## 3. Style Drift and Fund Flows

Chan, Chen and Lakonishok (2002) find that style drift occurs more often among poor performing managers of value funds who shift style to be more growth orientated in response to agency considerations. How investors respond in terms of fund flows, however, is an open question. As highlighted in the financial press, portfolio construction considerations suggests that style drift, will harm fund flows, particularly from institutions.[10] However, given the relationship between flow and performance documented by others (e.g., Chevalier and Ellison 1997; Sirri and Tufano 1998; Huang, Wei and Yan 2007) it is possible that investors do not penalize funds with style drift if such drive has resulted in stronger performance. Wermers (2012) finds that funds that chase hot styles enhance their return performance.

To investigate how investors respond to style drift, in Table 3 we regress *Flow* against *Abs(Beta Deviation)*, our measure of style drift, and the interaction between *Abs(Beta Deviation)* and Excess Return. In untabulated results we have also used four-factor Fama-French alphas in place of *Excess Return*, and find similar results. To make clear the timing of the key variables in this regression, consider a fund with *Flow* measured at June 2000. In this example, *Flow* is measured from December 1999 to June 2000, *Abs(Beta Deviation)* is mea-

[10] For example, see "Fidelity's Managers: Freewheeling No More" in the May 26, 1996 edition of *The New York Times*, and "Style Sticklers: Pension Consultants Policing Fund Managers to See That They Invest as Advertised" from the December 10, 1996 edition of the *Los Angeles Times*.

sured at December 1999, and *Excess Return* is measured over the June 1999 to December 1999 period.

The first three columns of results in the table report regressions on the entire sample, using panel regressions with fixed effects for fund, choice of benchmark, month, and year, and clustered standard errors by fund. These regressions show that style drift results in lower fund flows, even after controlling for a variety of factors. In model (2), a one-standard deviation increase in *Abs(Beta Deviation)* results in 1.5% decrease in fund flows over the subsequent 6 months, and the p-value for *Abs(Beta Deviation)* is 0.010.

In model (3) we investigate whether style drift is actually rewarded if it results in stronger return performance. Investors x may perceive better performance through style drift as an indication of skill, for example. We find, however, that the interaction term *Abs(Beta Deviation)* x *Excess Return* is negative. It seems investors are skeptical of funds with strong performance achieved alongside a higher degree of style drift.

Models (4)-(6) investigate whether the sensitivity of flow to style drift is stronger in funds that have greater institutional investment. Our measure of institutional investment, *Institutional Ownership*, assumes there is no institutional ownership for funds without an institutional share class. This is likely an conservative assumption, so that we are biasing against finding institutional ownership matters. Despite this, the results hold. Model (4) shows *Abs(Beta Deviation)* is not significant in the sample in which *Institutional Ownership* is zero, but in model (5) the coefficient and p-value are -0.179 and 0.011, respectively, when *Institutional Ownership* is positive. The standard deviation of *Abs(Beta Deviation)* in the subsample used to estimate model (5) implies that a one-standard deviation in *Abs(Beta Deviation)* is associated with a 1.9% reduction in flows.

It is likely that the causality of this result works in both directions: institutional investors punish funds with higher levels of style drift with lower levels of investment, and funds that wish to attract higher levels of institutional investment are careful to not let their portfolios deviate too far from their promoted style. In subsequent analysis we explicitly investigate the factors associated with style drift. Model (6), however, suggests there is some degree of proactivity on the part of institutional investors, however, as *Abs(Beta Deviation)* x *Excess Return* is highly significant both economically and statistically. Institutional investors are particularly skeptical of funds that achieve stronger performance alongside higher levels of style drift. Overall, the results with respect to institutional ownership are consistent with an external governance channel in which style drift is noticed and punished by outside investors.

In modes (7)-(9) we investigate whether fund investors respond differently to style drift in fund within small versus large families in terms of assets under management. It is possible, for example, that investors believe larger fund families provide stronger internal governance, and that any style drift tolerated will be well justified. Model (7) shows that funds in the largest quartile of fund families do not suffer a flow penalty for greater style drift, while models (8) and (9) show the opposite for funds in the remaining families. Note that these models do control for *Institutional Ownership*, because larger families tend to attract greater institutional investment.

In Appendix Table 1 we show our results are robust to the inclusion of other measures of style drift. Specifically, we include the momentum, size, and book-to-market total style drift (TSD) measures in Wermers (2012) and the HSV measure in Brown, Harlow, and Zhang (2014).[11] Our results for *Abs(Beta Deviation)* are qualitatively unaffected, and thus is appears that the style drift captured by benchmark beta plays a distinct role in how investors evaluate funds.

[11] Wermers (2012) examines the relationship between manager characteristics, style drift and performance. In Brown, Harlow, and Zhang (2014), the main focus is on how style drift volatility impacts performance.

## 4. Style Drift and Fund Characteristics

We now turn to understanding which funds tend to have greater style drift. The results discussed above establish that institutions, in particular, invest less in funds with greater style drift. Moreover, institutions punish funds that experience stronger return performance if such performance occurs alongside larger degrees of style drift. This leads us to predict that funds with greater institutional ownership will have less style drift in the first place. We also conjecture that funds in larger fund families will have less style drift, because families with more assets under management should have very strong reputational concerns with institutional and retail investors alike.

To test these predictions, in Table 4 we regress our main measure of style drift, *Abs(Beta Deviation)*, against *Institutional Ownership* and *Ln(Family Assets)*. Models (1)-(3) use a probit model in which the dependent variable is set to one for funds in the top sample quartile for *Abs(Beta Deviation)*, and models (4)-(6) estimate a Tobit model in which the dependent model is simply *Abs(Beta Deviation)*. All models have standard errors clustered by fund. There is strong support for both predictions, as greater institutional ownership and belonging to a larger fund family are both are associated with lower values of *Abs(Beta Deviation)*.

## 5. Regressions Explaining Overall Benchmark Beta Adjustment

In Table 5 we turn to how style drift affects a fund's portfolio management. Given the earlier results showing that fund flows are adversely affected by style drift, we expect mutual funds to manage their portfolios in a way that mitigates such drift. In this section we examine this issue in detail by investigating the conditions under which we observe greater changes in *Benchmark Beta*.

Table 5 reports panel regressions that explain the log change in beta deviation, which is *Ln[(Abs(Beta Deviation*$_{t+1}$*)/Abs(Beta Deviation*$_t$*)]*. All models include fixed effects for fund, choice of benchmark, month, and year, and standard errors are clustered by fund. We find that the current level of a fund's style drift has a large impact on the extent to which the fund's style drift changes during the next six-month period. Specifically, a one-standard deviation increase in *Abs(Beta Deviation)* in the current period is associated with a 37% lower level of *Abs(Beta Deviation)* in the next period.

An important question is whether our results are due to tournament-style behavior in which fund managers with poorer performance during the first half of the year increase risk during the second half. Of course, whether this has the potential to explain the results in model (1) rests on whether the average fund's mid-year benchmark beta is above or below one, and whether June to December tournament-style rebalancing behavior is sufficiently strong in the data to drive the regression estimate of our key covariate. We address the tournament question more directly later, but model (2) does offer one piece of evidence. When we restrict the sample to only include portfolio adjustments from December to June, the coefficient for *Abs(Beta Deviation)* is very similar to that in model (1). As tournament-style behavior would manifest itself in June to December portfolio adjustments (as opposed to in December to June adjustments), observing results that are just as strong in the December to June sample seems inconsistent with tournament behavior explaining our results.

Our key result is also robust to other subsamples. It is possible that some funds naturally choose to have higher levels of style drift due to their portfolio strategies, such that they do not worry about style drift. This would predict that our results only appear in funds with lower levels of style drift. We find, however, that the main result also holds in model (3), in which we limit the sample to funds with above-median style drift (we note the smaller coefficient is a function of a much higher base in Abs(Beta Deviation)).

Categorizing the sample based on the value of *Benchmark Beta* is also an interesting exercise. Given positive market performance in most years, and that the market is correlated with any of the benchmarks used by the funds in our sample, funds with smaller values of *Benchmark Beta* may have weaker return performance overall and thus have stronger incentives to increase their *Benchmark Beta* (which would also reduce style drift).[12] Indeed we find that adjustment in Benchmark Beta as a function of *Abs(Beta Deviation)* is stronger in the sample of funds with *Benchmark Beta* less than one. However, we continue to find strong results model (5), which is restricted to funds with *Benchmark Beta* greater than one.

Yet another possibility is that funds manage their CAPM betas, and because equity benchmarks will be correlated with a market benchmark, our results with respect to *Benchmark Beta* are spurious. Given that the S&P 500 is more relevant as a market proxy (both in theory and in practice), this would predict that our results are stronger for funds that use the S&P 500 as their benchmark due a much higher correlation between their chosen benchmark and the market as a whole. Models (6) and (7), however, actually show that results are stronger in funds that do *not* use the S&P 500 as their benchmark.

## 6. Regressions Explaining Trade-Based Adjustment in Benchmark Beta

Examining a fund's change in *Benchmark Beta* has the advantage of providing a comprehensive view of how funds manage style drift. However, some of the adjustment in *Benchmark Beta* will be due to stock-level price changes. Although fund managers are obviously aware that stock-level price movements alter the asset weights in their portfolios, and one could argue this is a perfectly viable way for managers to purposefully manage style drift, in the

[12]Increasing *Benchmark Beta* will result in stronger return performance in years with positive market performance, and multiple studies document that fund flows positively correlate with fund performance (e.g., Chevalier and Ellison 1997; Sirri and Tufano 1998; and Huang, Wei and Yan 2007).

context of our study there may nonetheless be a concern that passive changes in the portfolio's asset weights drive our results. Depending on one's views on whether such passive changes style drift should be attributed to managerial decisions, this may suggest the need for more direct evidence of active style drive management. Therefore, we also include an analysis of active trading behavior, that is, the actual trades that fund make and how such trades affect style drift.

In Table 6, the dependent variable is $\beta_{trade}$, which is the weighted average of stock-level *Benchmark Beta* for each stock the fund trades, net of the fund's current portfolio *Benchmark Beta*. The weighting in each trade reflects the size of a trade compared to the total dollar value of all trades that a mutual fund made in a period. In essence, $\beta_{trade}$ captures whether a fund's overall trades increase or decrease the portfolio's *Benchmark Beta* relative its current level. As usual, we cluster standard errors by fund and estimate a panel regression that includes fixed effects.

Panel A reports regressions on samples that align with those used in Table 5. Trades include partial sales and purchases of stocks already in the portfolio, complete liquidations of stocks, and stocks newly purchased by the fund. Note that our key variable is *Beta Deviation*, without taking the absolute value. This is to maintain clear directional predictions given that the dependent variable can be positive (for trades that increase *Benchmark Beta*) or negative (for trades that decrease *Benchmark Beta*). Note that funds with negative *Beta Deviation* that wish to manage (reduce) style drift should make trading decisions that have a positive value of $\beta_{trade}$. Similarly, funds with positive values of *Beta Deviation* should trade with negative $\beta_{trade}$ if they wish to reduce style drift. Thus, active management to mitigate style drift predicts a negative coefficient on *Beta Deviation*, and this is what we observe in all models.

A potential objection to this evidence is that it could be explained by random purchasing behavior. Consider a fund with new assets to invest, and suppose it chooses new stocks at random from those that fit within its objective. Such stocks will have an average beta with respect to the benchmark of one, so that results in Panel A could result from purposeful trades that are in randomly selected stocks from within the benchmark portfolio.

Panel B addresses this concern in a straightforward manner, by limiting the purchases used in the measurement of $\beta_{trade}$ to those of additional shares in stocks that the fund already owns (for symmetry we also include partial liquidations only, i.e., complete liquidations are excluded). The idea for purchases is that the fund is not making a random purchase of a new stock, but is instead making an additional investment in stock that it already owns. If the fund's *Benchmark Beta* is not equal to one, then a random purchase (more accurately, a purchase chosen randomly on a value-weighted basis) from among the fund's current portfolio will not reduce its style drift. As Panel B shows, we again observe negative, statistically and economically significant coefficients on *Beta Deviation* in all models.

In Table 7 we control for stock-level style dimensions that could influence how managers trade, using the stock style assignments from Daniel, Grinblatt, Titman and Wermers (1997).[13] For this analysis we estimate pooled OLS regressions at the fund-stock-time period level that explain $\varphi(\beta_{stock} - \beta_{fund})$. Any particular stock will appear more than once in the sample if a fund trades the stock multiple times during the sample period or if multiple funds trade the stock. Standard errors are clustered at the fund level. For a given trade in a given stock, $\varphi$ takes the value of one if the stock trade was a partial purchase and a value of minus one if the stock trade was a partial sale. Thus, $\varphi(\beta_{stock} - \beta_{fund})$ measures whether the trade increases or decreases the fund's *Benchmark Beta*. As in Table 6, we predict the coefficient on *Beta Deviation* will be negative, and find indeed this is the case in all models.

[13] We are grateful to the authors for providing DGTW data at http://www.smith.umd.edu/faculty/rwermers/ftpsite/Dgtw/coverpage.htm.

## 7. Regressions Explaining Mutual Fund Volatility Adjustment

Following the work on strategic portfolio management (tournament behavior) by mutual fund managers in Brown, Harlow and Starks (1996), numerous papers examine how managers respond to performance-related incentives by managing fund volatility (e.g., Chevalier and Ellison 1997; Koski and Pontiff 1999; Busse 2001; Taylor 2003; Qiu 2003; Kempf and Ruenzi 2008; Chen and Pennacchi 2009; Elton et al. 2010; Huang, Sialm and Zhang 2011; Aragon and Nanda 2012; Schwarz 2012). The main conclusion is that a convex relationship between flows and fund performance induces fund managers to strategically alter the fund's overall risk in the second half of the year in response to fund performance through the first half of the year. Given that will be positive correlation between *Benchmark Beta* and a fund's performance (as years have positive market returns), a possible concern is that our main results are driven by such tournament behavior.

Although the subsample results in Tables 5 and 6 on December to June adjustments in Benchmark Beta go against the notion that tournament behavior drives our results, in Table 8 we provide further evidence in a more traditional empirical tournament framework. In these regressions, the dependent variable is $\text{Ln}(\sigma_{t+1}/\sigma_t)$, which is a holdings-based metric that captures the relative change in total fund volatility over the period measured. As described earlier in motivating how we measure changes in *Benchmark Beta*, here too we avoid the sorting bias by holding constant the calendar months used to measure volatility in both periods.

The first result of note is that our data is consistent with the overall conclusion in the tournaments literature–we do find evidence of tournament behavior in our sample. Models (1)-(4), which measure changes in fund volatility from June to December only, shows that whether we measure performance over the first half the year by the fund's performance percentile rank (within its style objective group as defined by choice of benchmark), or by excess return over benchmark, first-half year performance is significantly and negatively related to changes in volatility in the second half of the year. Moreover, if we estimate the same regressions but using only December to June data, note that the coefficients are no longer significant (see models (5)-(8), just as tournament behavior predicts.

The second result of note is that *Beta Deviation* is negative and significant in all models even after controlling for performance metrics. As documented earlier, style drift causes funds to adjust their *Benchmark Beta* toward one, and because such an adjustment is positively correlated with $Ln(\sigma_{t+1}/\sigma_t)$, we thus observe that the coefficient on *Beta Deviation* is negative as expected.

Finally, even though *Beta Deviation* will be a stronger predictor of adjustment in *Beta Deviation* (the left-hand side variable in Table 5) than $Ln(\sigma_{t+1}/\sigma_t)$, it is worth commenting on the economic significance we observe. In both models (2) and (4), a one-standard deviation increase in *Beta Deviation* is associated with a 0.0474 lower value for $Ln(\sigma_{t+1}/\sigma_t)$. This is significantly larger than the economic impact on the change in volatility associated with stronger return performance. In model (2), a one-standard deviation increase in *Percentile Rank* is associated with a 0.0061 lower value of $Ln(\sigma_{t+1}/\sigma_t)$, and the analogous effect of higher *Excess Return* in model (4) is 0.0087. These results show that style drift management plays an economically more significant role in the how funds manage their portfolios over time.

## 8. Conclusion

Style investing has become increasingly popular, and with it the importance to portfolio managers of maintaining style discipline. We use a holding-based approach to examine impact of style drift on a mutual fund's net flows and portfolio management. Specifically, we measure a fund's beta with respect to its selected benchmark in a way that avoids the type of sorting bias inherent in early mutual fund tournaments literature. Using the simple metric we construct, we document that investors (particularly institutional investors) penalize funds with higher degrees of style drift, even when such style drift takes place alongside strong return performance. Institutional monitoring thus provides a strong incentive for fund managers to limit style drift, and we also document that there is less style drift in funds belonging to large fund families. This could be due to larger fund families targeting institutional investors or wanting to maintain strong brand reputations.

We show that higher degrees of style drift in one period results in a larger reduction in style drift in the next period. This result is not due to tournament-style behavior, is observed in funds regardless of whether their beta with respect to benchmark is greater or less than one, and does not appear to be due to funds managing their CAPM betas. We additionally find that the impact of style drift management has greater impact on portfolio changes throughout the year than does tournament incentives in which funds alter overall portfolio risk in the second half of the year based on performance in the first half of the year.

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## Table 1. Sample characteristics

This table reports snapshots of the characteristics of our sample over time and across benchmarks. The sample consists of 1498 mutual funds, observed over the period from December 1990 to December 2012 in the Thomson Financial holdings database. *Benchmark Beta* is relative to the mutual fund's benchmark and is calculated from holdings in the Thomson Financial holdings database as described in section 2.2 of the paper. Fund *Assets* is the aggregate value of all stock holdings in the Thomson Financial holdings database for a mutual fund at the specified observation date. *Family Assets* is the aggregate value of all holdings in the Thomson Financial holdings database for a mutual fund's family at the specified observation date. The subsample S&P 500 Funds examines mutual funds which are benchmarked to the S&P 500 index. The subsample Large Cap Funds examines mutual funds which are benchmarked to the S&P 500, S&P 500 Value, S&P 500 Growth, Russell 3000, Russell 3000 Growth, Russell 3000 Value, Russell 1000, Russell 1000 Value, or Russell 1000 Growth indices. The subsample Mid-Cap Funds examines mutual funds which are benchmarked to the S&P 400 Midcap index. The subsample Small-Cap Funds examines mutual funds which are benchmarked to the S&P 600 Small Cap, Russell 2000, Russell 2000 Value, or Russell 2000 Growth indices. The subsample Value Funds examines mutual funds which are benchmarked to the S&P 500 Value, Russell 1000 Value, Russell 2000 Value, or Russell 3000 Value indices. The Subsample Growth Funds examines mutual funds which are benchmarked to the S&P 500 Growth, Russell 1000 Growth, Russell 2000 Growth, or Russell 3000 Growth indices.

| | | December 1990 | | | | December 2000 | | | | December 2010 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subsample | Variable | N | 25% | 50% | 75% | N | 25% | 50% | 75% | N | 25% | 50% | 75% |
| All Funds | | | | | | | | | | | | | |
| | Benchmark Beta | 126 | 0.98 | 1.04 | 1.14 | 651 | 0.83 | 0.95 | 1.03 | 638 | 0.92 | 1.01 | 1.11 |
| | Fund Assets (millions) | 126 | 44 | 166 | 407 | 651 | 47 | 194 | 621 | 638 | 81 | 332 | 1,120 |
| | Family Assets (millions) | 126 | 204 | 1,290 | 2,530 | 651 | 374 | 3,080 | 9,940 | 638 | 961 | 7,800 | 40,800 |
| S&P 500 Funds | | | | | | | | | | | | | |
| | Benchmark Beta | 79 | 1.00 | 1.07 | 1.18 | 267 | 0.89 | 0.99 | 1.07 | 225 | 0.94 | 1.02 | 1.13 |
| | Fund Assets (millions) | 79 | 49 | 166 | 400 | 267 | 58 | 257 | 869 | 225 | 59 | 272 | 1,460 |
| | Family Assets (millions) | 79 | 149 | 1,220 | 2,530 | 267 | 291 | 2,870 | 14,000 | 225 | 435 | 6,700 | 40,800 |
| Large Cap Funds | | | | | | | | | | | | | |
| | Benchmark Beta | 111 | 1.00 | 1.06 | 1.18 | 459 | 0.85 | 0.96 | 1.03 | 466 | 0.95 | 1.04 | 1.13 |
| | Fund Assets (millions) | 111 | 50 | 178 | 448 | 459 | 58 | 245 | 916 | 466 | 81 | 337 | 1,230 |
| | Family Assets (millions) | 111 | 184 | 1,300 | 2,880 | 459 | 396 | 4,130 | 13,500 | 466 | 1,040 | 9,340 | 42,500 |
| Mid-Cap Funds | | | | | | | | | | | | | |
| | Benchmark Beta | 2 | 0.33 | 0.37 | 0.41 | 23 | 0.82 | 0.98 | 1.01 | 15 | 0.96 | 1.00 | 1.11 |
| | Fund Assets (millions) | 2 | 144 | 216 | 288 | 23 | 30 | 114 | 253 | 15 | 27 | 1,020 | 4,350 |
| | Family Assets (millions) | 2 | 634 | 1,830 | 3,020 | 23 | 285 | 2,770 | 11,900 | 15 | 699 | 21,100 | 175,000 |
| Small-Cap Funds | | | | | | | | | | | | | |
| | Benchmark Beta | 13 | 0.88 | 0.98 | 1.01 | 169 | 0.76 | 0.93 | 1.05 | 157 | 0.83 | 0.93 | 1.00 |
| | Fund Assets (millions) | 13 | 16 | 47 | 141 | 169 | 30 | 128 | 321 | 157 | 86 | 326 | 864 |
| | Family Assets (millions) | 13 | 352 | 890 | 2,070 | 169 | 326 | 2,760 | 6,260 | 157 | 833 | 5,280 | 28,100 |
| Value Funds | | | | | | | | | | | | | |
| | Benchmark Beta | 15 | 0.98 | 1.00 | 1.05 | 91 | 0.93 | 0.98 | 1.03 | 136 | 0.89 | 0.97 | 1.06 |
| | Fund Assets (millions) | 15 | 24 | 71 | 407 | 91 | 50 | 157 | 459 | 136 | 101 | 337 | 949 |
| | Family Assets (millions) | 15 | 266 | 1,300 | 2,530 | 91 | 623 | 4,450 | 11,900 | 136 | 2,060 | 13,000 | 46,600 |
| Growth Funds | | | | | | | | | | | | | |
| | Benchmark Beta | 19 | 0.98 | 1.06 | 1.14 | 159 | 0.67 | 0.84 | 0.94 | 154 | 0.95 | 1.05 | 1.15 |
| | Fund Assets (millions) | 19 | 64 | 178 | 446 | 159 | 53 | 233 | 750 | 154 | 103 | 338 | 1,000 |
| | Family Assets (millions) | 19 | 226 | 1,660 | 2,880 | 159 | 623 | 4,480 | 8,350 | 154 | 1,940 | 13,400 | 42,500 |

## Table 2. Summary statistics

This table reports summary statistics for the main variables in the study. The sample consists of 1498 mutual funds, observed July and December over the period from December 1990 to December 2012. All variables are expressed as either natural logarithms or winsorized at the 1% level. *Benchmark Beta* is a measure of risk relative to a mutual fund's benchmark and is calculated from holdings in the Thomson Financial holdings database as described in section 2.2 of the paper. *Abs(Beta Deviation)* is a measure of the style drift of a mutual fund to its benchmark and is equal to the absolute value of *Benchmark Beta* -1. *Ln(Abs(Beta Deviation*$_{t+1}$*)/Abs(Beta Deviation))* is the logarithm of the ratio of *Abs(Beta Deviation)* over two subsequent periods for a mutual fund and is a measure of the change in the style drift. *Excess Return* is equal to the net of fees return of a mutual fund minus the fund's benchmark return measured over a 6-month period. *Ln(Family Assets)* is the logarithm of the aggregate value of all holdings in the Thomson Financial holdings database for a mutual fund's family at an observation date. *Ln(Fund Assets)* is the logarithm of the aggregate stock holdings of a mutual fund in the Thomson Financial holdings database at an observation date. *Institutional Ownership (%)* is constructed by aggregating CRSP total net assets across all share classes with the Morningstar Direct code "Inst" and then dividing by *Fund Assets*. *Flow* is measured over a 6-month period, defined as in Sirri and Tufano (1998), and is constructed using data from the CRSP Survivorship Bias Free Mutual Fund Database. *Expense Ratio, 12b-1 Fees and Turnover* are all obtained directly from the CRSP Survivorship Bias Free Mutual Fund Database at the share class level and aggregated up to the fund level. *Imputed Volatility* is the annualized volatility of a mutual fund imputed from its holdings. Panel A presents summary statistics for our whole sample while Panel B, C and D examine our summary statistics on subsamples based on *Benchmark Beta*, fund benchmark and *Family Assets* respectively.

**Panel A: Complete Sample**

| | Statistic | | | | |
|---|---|---|---|---|---|
| **Variable** | **N** | **sd** | **p25** | **p50** | **p75** |
| Benchmark Beta | 21,372 | 0.19 | 0.90 | 1.00 | 1.10 |
| Abs(Beta Deviation) | 21,372 | 0.13 | 0.05 | 0.10 | 0.19 |
| Ln(Abs(Beta Deviation$_{t+1}$)/Abs(Beta Deviation$_t$)) | 17,026 | 1.16 | -0.47 | -0.01 | 0.44 |
| Excess Return | 21,069 | 0.06 | -0.03 | 0.00 | 0.02 |
| Ln(Family Assets) | 21,246 | 2.53 | 19.68 | 21.68 | 23.28 |
| Ln(Fund Assets) | 21,246 | 1.99 | 17.67 | 19.06 | 20.39 |
| Institutional Ownership (%) | 21,372 | 0.33 | 0.00 | 0.00 | 0.17 |
| Flow | 19,303 | 0.49 | -0.07 | -0.01 | 0.09 |
| Expense Ratio | 15,808 | 0.00 | 0.01 | 0.01 | 0.02 |
| 12b-1 Fee | 15,808 | 0.00 | 0.00 | 0.00 | 0.00 |
| Turnover | 15,808 | 0.69 | 0.33 | 0.61 | 1.04 |
| Imputed Volatility | 21,372 | 0.06 | 0.14 | 0.18 | 0.22 |

**Panel B: High versus Low Benchmark Beta Categories**

| Subsample | Benchmark Beta >1 | | | | | Benchmark Beta ≤ 1 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Statistic | | | | | Statistic | | | | |
| Variable | N | sd | p25 | p50 | p75 | N | sd | p25 | p50 | p75 |
| Benchmark Beta | 10,413 | 0.14 | 1.05 | 1.10 | 1.20 | 10,959 | 0.11 | 0.81 | 0.90 | 0.95 |
| Abs(Beta Deviation) | 10,413 | 0.14 | 0.05 | 0.10 | 0.20 | 10,959 | 0.12 | 0.05 | 0.10 | 0.19 |
| Ln(Abs(Beta Deviation$_{t+1}$)/Abs(Beta Deviation$_t$)) | 8,226 | 1.19 | -0.50 | -0.03 | 0.44 | 8,800 | 1.13 | -0.44 | 0.00 | 0.43 |
| Excess Return | 10,272 | 0.06 | -0.03 | 0.00 | 0.02 | 10,797 | 0.06 | -0.03 | 0.00 | 0.02 |
| Ln(Family Assets) | 10,322 | 2.60 | 19.88 | 21.93 | 23.53 | 10,924 | 2.44 | 19.56 | 21.50 | 23.04 |
| Ln(Fund Assets) | 10,322 | 2.05 | 17.72 | 19.15 | 20.49 | 10,924 | 1.93 | 17.63 | 18.96 | 20.27 |
| Institutional Ownership (%) | 10,413 | 0.33 | 0.00 | 0.00 | 0.15 | 10,959 | 0.34 | 0.00 | 0.00 | 0.21 |
| Flow | 9,202 | 0.51 | -0.09 | -0.02 | 0.08 | 10,101 | 0.47 | -0.06 | 0.00 | 0.11 |
| Expense Ratio | 7,665 | 0.00 | 0.01 | 0.01 | 0.02 | 8,143 | 0.00 | 0.01 | 0.01 | 0.01 |
| 12b-1 Fee | 7,665 | 0.00 | 0.00 | 0.00 | 0.00 | 8,143 | 0.00 | 0.00 | 0.00 | 0.00 |
| Turnover | 7,665 | 0.72 | 0.40 | 0.68 | 1.14 | 8,143 | 0.66 | 0.29 | 0.54 | 0.95 |
| Imputed Volatility | 10,413 | 0.07 | 0.15 | 0.20 | 0.24 | 10,959 | 0.05 | 0.13 | 0.17 | 0.20 |

**Panel C: Benchmark Choice Categories**

| Subsample | S&P 500 Benchmark | | | | | Other Benchmark | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Statistic | | | | | Statistic | | | | |
| Variable | N | sd | p25 | p50 | p75 | N | sd | p25 | p50 | p75 |
| Benchmark Beta | 8,590 | 0.20 | 0.92 | 1.01 | 1.12 | 10,677 | 0.06 | 0.95 | 1.00 | 1.04 |
| Abs(Beta Deviation) | 8,590 | 0.14 | 0.05 | 0.10 | 0.20 | 10,677 | 0.03 | 0.02 | 0.05 | 0.07 |
| Ln(Abs(Beta Deviation$_{t+1}$)/Abs(Beta Deviation$_t$)) | 6,907 | 1.09 | -0.45 | 0.00 | 0.40 | 8,521 | 1.37 | -0.40 | 0.27 | 0.98 |
| Excess Return | 8,481 | 0.06 | -0.03 | 0.00 | 0.02 | 10,519 | 0.05 | -0.03 | 0.00 | 0.02 |
| Ln(Family Assets) | 8,512 | 2.83 | 19.12 | 21.39 | 23.28 | 10,614 | 2.48 | 19.86 | 21.84 | 23.39 |
| Ln(Fund Assets) | 8,512 | 2.16 | 17.53 | 19.05 | 20.60 | 10,614 | 1.94 | 17.80 | 19.13 | 20.45 |
| Institutional Ownership (%) | 8,590 | 0.30 | 0.00 | 0.00 | 0.02 | 10,677 | 0.34 | 0.00 | 0.00 | 0.24 |
| Flow | 7,782 | 0.43 | -0.07 | -0.01 | 0.08 | 9,665 | 0.51 | -0.07 | -0.01 | 0.09 |
| Expense Ratio | 6,066 | 0.00 | 0.01 | 0.01 | 0.02 | 7,844 | 0.00 | 0.01 | 0.01 | 0.01 |
| 12b-1 Fee | 6,066 | 0.00 | 0.00 | 0.00 | 0.00 | 7,844 | 0.00 | 0.00 | 0.00 | 0.00 |
| Turnover | 6,066 | 0.72 | 0.28 | 0.54 | 0.92 | 7,844 | 0.65 | 0.34 | 0.61 | 1.00 |
| Imputed Volatility | 8,590 | 0.06 | 0.13 | 0.17 | 0.20 | 10,677 | 0.06 | 0.14 | 0.17 | 0.21 |

**Panel D: Large versus Small Fund Families**

| Subsample | Above Median Family Assets | | | | | Below Median Family Assets | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Statistic | | | | | Statistic | | | | |
| **Variable** | **N** | **sd** | **p25** | **p50** | **p75** | **N** | **sd** | **p25** | **p50** | **p75** |
| Benchmark Beta | 10,570 | 0.18 | 0.91 | 1.00 | 1.10 | 10,802 | 0.20 | 0.89 | 0.99 | 1.10 |
| Abs(Beta Deviation) | 10,570 | 0.12 | 0.04 | 0.10 | 0.18 | 10,802 | 0.14 | 0.05 | 0.11 | 0.21 |
| Ln(Abs(Beta Deviation$_{t+1}$)/Abs(Beta Deviation$_t$)) | 8,553 | 1.16 | -0.47 | -0.01 | 0.44 | 8,473 | 1.16 | -0.47 | 0.00 | 0.43 |
| Excess Return | 10,424 | 0.06 | -0.03 | 0.00 | 0.02 | 10,645 | 0.06 | -0.03 | -0.01 | 0.03 |
| Ln(Family Assets) | 10,570 | 1.26 | 22.48 | 23.29 | 24.25 | 10,676 | 1.81 | 18.37 | 19.69 | 20.80 |
| Ln(Fund Assets) | 10,570 | 1.82 | 18.92 | 20.14 | 21.20 | 10,676 | 1.63 | 16.93 | 18.08 | 19.18 |
| Institutional Ownership (%) | 10,570 | 0.31 | 0.00 | 0.00 | 0.15 | 10,802 | 0.36 | 0.00 | 0.00 | 0.23 |
| Flow | 9,678 | 0.49 | -0.07 | -0.01 | 0.09 | 9,625 | 0.48 | -0.07 | -0.01 | 0.10 |
| Expense Ratio | 8,004 | 0.00 | 0.01 | 0.01 | 0.01 | 7,804 | 0.00 | 0.01 | 0.01 | 0.02 |
| 12b-1 Fee | 8,004 | 0.00 | 0.00 | 0.00 | 0.00 | 7,804 | 0.00 | 0.00 | 0.00 | 0.00 |
| Turnover | 8,004 | 0.67 | 0.35 | 0.63 | 1.05 | 7,804 | 0.72 | 0.31 | 0.59 | 1.03 |
| Imputed Volatility | 10,570 | 0.06 | 0.13 | 0.18 | 0.22 | 10,802 | 0.07 | 0.14 | 0.18 | 0.22 |

## Table 3. Regressions explaining mutual fund net flow

This table reports panel fixed effect regressions that explain mutual fund *Flow*. The sample consists of 1498 mutual funds, observed July and December over the period from December 1990 to December 2012. All variables are expressed as either natural logarithms or winsorized at the 1% level. *Abs(Beta Deviation)* is a measure of the style drift of a mutual fund to its benchmark and is equal to the absolute value of *Benchmark Beta* -1. *Excess Return* is equal to the net of fees return of a mutual fund minus the fund's benchmark return measured over a 6-month period. *Ln(Family Assets)* is the logarithm of the aggregate value of all holdings in the Thomson Financial holdings database for a mutual fund's family at an observation date. *Ln(Fund Assets)* is the logarithm of the aggregate stock holdings of a mutual fund in the Thomson Financial holdings database at an observation date. *Institutional Ownership (%)* is constructed by aggregating CRSP total net assets across all share classes with the Morningstar Direct code "Inst" and then dividing by *Fund Assets*. *Flow* is measured over a 6-month period, defined as in Sirri and Tufano (1998), and is constructed using data from the CRSP Survivorship Bias Free Mutual Fund Database. *Expense Ratio, 12b-1 Fees and Turnover* are all obtained directly from the CRSP Survivorship Bias Free Mutual Fund Database at the share class level and aggregated up to the fund level. All specifications control for fund, month, year and benchmark fixed effects. We report p-values robust to intragroup correlation at the mutual fund level in parentheses beneath variable coefficients, **, and * denote statistical significance at the 1%, and 5% levels, respectively.

| Dependent Variable | $\mathbf{Flow_t}$ | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Subsample | All | All | All | Institutional Ownership (%) | | | Family Assets | | |
| | | | | Zero | Positive | Positive | Top 25% | Bottom 75% | Bottom 75% |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Abs (Beta Deviation)$_t$ | -0.108** | -0.113* | -0.102* | -0.0438 | -0.179* | -0.149* | 0.0273 | -0.156** | -0.144** |
| | (0.005) | (0.010) | (0.017) | (0.450) | (0.011) | (0.029) | (0.810) | (0.001) | (0.002) |
| Excess Return$_{t-1}$ | 0.989** | 0.774** | 0.993** | 0.754** | 0.815** | 1.320** | 0.677** | 0.785** | 1.061** |
| | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (0.001) | (<0.001) | (<0.001) |
| Abs(Beta Deviation)$_t$ x Excess Return$_{t-1}$ | | | -1.008* | | | -2.503** | | | -1.217** |
| | | | (0.023) | | | (<0.001) | | | (0.007) |
| Institutional Ownership$_t$ (%) | | -0.105 | -0.105 | | -0.241 | -0.242 | -0.601 | -0.0559 | -0.0568 |
| | | (0.261) | (0.260) | | (0.052) | (0.050) | (0.072) | (0.568) | (0.562) |
| Ln(Family Assets)$_t$ | | 0.016** | 0.016** | 0.011 | 0.017 | 0.017 | 0.092* | 0.011 | 0.011 |
| | | (0.006) | (0.006) | (0.147) | (0.093) | (0.078) | (0.020) | (0.125) | (0.128) |
| Ln(Fund Assets)$_t$ | | -0.097** | -0.096** | -0.092** | -0.119** | -0.118** | -0.117** | -0.092** | -0.091** |
| | | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) |
| Flow$_{t-1}$ | | 0.049** | 0.049** | 0.057* | 0.013 | 0.013 | 0.015 | 0.044 | 0.045* |
| | | (0.002) | (0.002) | (0.041) | (0.468) | (0.476) | (0.523) | (0.050) | (0.049) |
| Expense Ratio$_t$ | | -18.906** | -18.747** | -19.315* | -16.110** | -15.703** | -14.401 | -22.270** | -22.069** |
| | | (0.001) | (0.001) | (0.031) | (0.006) | (0.007) | (0.321) | (<0.001) | (<0.001) |
| 12b-1 Fees$_t$ | | -13.706 | -13.982 | 11.223 | -34.186* | -35.038* | -58.947 | -2.243 | -2.692 |
| | | (0.261) | (0.250) | (0.482) | (0.043) | (0.037) | (0.100) | (0.873) | (0.848) |
| Turnover$_t$ | | -0.011 | -0.011 | -0.026 | 0.011 | 0.012 | 0.021 | -0.021 | -0.022 |
| | | (0.352) | (0.344) | (0.110) | (0.562) | (0.547) | (0.443) | (0.134) | (0.127) |
| Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 19,005 | 12,308 | 12,308 | 6,729 | 5,573 | 5,573 | 3,103 | 9,205 | 9,205 |
| R-sq | 0.037 | 0.056 | 0.056 | 0.051 | 0.070 | 0.072 | 0.054 | 0.068 | 0.069 |

## Table 4. Regressions explaining style drift

This table reports Probit and Tobit regressions that explain mutual fund *Abs(Beta Deviation)*. The sample consists of 1498 mutual funds, observed July and December over the period from December 1990 to December 2012. All variables are expressed as either natural logarithms or winsorized at the 1% level. *Abs(Beta Deviation)* is a measure of the style drift of a mutual fund to its benchmark and is equal to the absolute value of *Benchmark Beta* -1. *Excess Return* is equal to the net of fees return of a mutual fund minus the fund's benchmark return measured over a 6-month period. *Ln(Family Assets)* is the logarithm of the aggregate value of all holdings in the Thomson Financial holdings database for a mutual fund's family at an observation date. *Ln(Fund Assets)* is the logarithm of the aggregate stock holdings of a mutual fund in the Thomson Financial holdings database at an observation date. *Institutional Ownership (%)* is constructed by aggregating CRSP total net assets across all share classes with the Morningstar Direct code "Inst" and then dividing by *Fund Assets*. Specifications 1-3 present Probit regressions where the dependent variable is a dummy that is equal to 1 if *Abs(Beta Deviation)* is in the top $25^{th}$ percentile in a period. Specifications 4-6 present Tobit regressions with a left-censoring limit of zero. Coefficients for the marginal effects are reported. We report p-values robust to intragroup correlation at the mutual fund level in parentheses beneath variable coefficients, **, and * denote statistical significance at the 1%, and 5% levels, respectively.

| Dependant Variable | **I(Top 25% Abs(Beta Deviation)$_t$)** | | | **Abs(Beta Deviation)$_t$** | | |
|---|---|---|---|---|---|---|
| Model | **Probit** | **Probit** | **Probit** | **Tobit** | **Tobit** | **Tobit** |
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Institutional Ownership$_t$ (%) | -0.298** | | -0.223* | -0.108** | | -0.077** |
| | (0.001) | | (0.016) | (<0.001) | | (0.008) |
| Institutional Ownership Squared$_t$ | 0.251* | | 0.168 | 0.092** | | 0.058 |
| | (0.017) | | (0.106) | (0.004) | | (0.071) |
| Ln(Family Assets)$_t$ | | -0.009** | -0.009** | | -0.004** | -0.004** |
| | | (0.005) | (0.009) | | (<0.001) | (0.001) |
| Excess Return$_{t-1}$ | 0.116* | 0.142** | 0.137* | 0.105** | 0.116** | 0.114** |
| | (0.033) | (0.008) | (0.010) | (<0.001) | (<0.001) | (<0.001) |
| Ln(Fund Assets)$_t$ | | -0.007 | -0.007 | | -0.003 | -0.003 |
| | | (0.089) | (0.099) | | (0.062) | (0.066) |
| N | 20,946 | 20,946 | 20,946 | 20,946 | 20,946 | 20,946 |
| Pseudo-R Squared | 0.004 | 0.006 | 0.009 | | | |
| F Statistic | | | | 18.37 | 29.33 | 19.98 |

**Table 5. Regressions explaining mutual fund beta adjustment**

This table reports panel fixed effect regressions that explain mutual fund *Ln(Abs(Beta Deviation$_{t+1}$)/Abs(Beta Deviation$_t$))*. The sample consists of 1498 mutual funds, observed July and December over the period from December 1990 to December 2012. All variables are expressed as either natural logarithms or winsorized at the 1% level. *Abs(Beta Deviation)* is a measure of the style drift of a mutual fund to its benchmark and is equal to the absolute value of *Benchmark Beta* -1. *Ln(Abs(Beta Deviation$_{t+1}$)/Abs(Beta Deviation$_t$))* is the logarithm of the ratio of *Abs(Beta Deviation)* over two subsequent periods for a mutual fund and is a measure of the change in the style drift. *Excess Return* is equal to the net of fees return of a mutual fund minus the fund's benchmark return measured over a 6-month period. *Ln(Fund Assets)* is the logarithm of the aggregate stock holdings of a mutual fund in the Thomson Financial holdings database at an observation date. *Flow* is measured over a 6-month period, defined as in Sirri and Tufano (1998), and is constructed using data from the CRSP Survivorship Bias Free Mutual Fund Database. *Expense Ratio, 12b-1 Fees and Turnover* are all obtained directly from the CRSP Survivorship Bias Free Mutual Fund Database at the share class level and aggregated up to the fund level. All specifications control for fund, month, year and benchmark fixed effects. We report p-values robust to intragroup correlation at the mutual fund level in parentheses beneath variable coefficients, **, and * denote statistical significance at the 1%, and 5% levels, respectively.

| Dependent Variable | Ln(Abs(Beta Deviation)$_{t+1}$/Abs(Beta Deviation)$_t$) | | | | | | |
|---|---|---|---|---|---|---|---|
| Subsample | All | December to June | Above Median Deviation | Benchmark Beta ≤ 1 | Benchmark Beta > 1 | S&P 500 Benchmark | Non S&P 500 Benchmark |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Abs(Beta Deviation)$_t$ | -3.470** | -3.484** | -0.506** | -4.212** | -3.276** | -2.797** | -4.124** |
| | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) |
| Excess Return$_{t-1}$ | -0.0800 | -0.0750 | -0.136 | 0.198 | -0.110 | -0.244 | 0.124 |
| | (0.631) | (0.746) | (0.420) | (0.426) | (0.683) | (0.292) | (0.591) |
| Ln(Fund Assets)$_t$ | -0.035* | -0.027 | -0.006 | -0.035 | -0.000 | 0.016 | -0.055** |
| | (0.047) | (0.282) | (0.743) | (0.178) | (0.993) | (0.651) | (0.007) |
| Flow$_{t-1}$ | -0.035 | -0.005 | -0.013 | -0.048 | -0.004 | -0.065 | -0.026 |
| | (0.147) | (0.887) | (0.652) | (0.219) | (0.892) | (0.092) | (0.376) |
| Expense Ratio$_t$ | 4.436 | 9.539 | 2.301 | 6.315 | -2.641 | 0.875 | 10.51 |
| | (0.591) | (0.368) | (0.818) | (0.629) | (0.821) | (0.946) | (0.313) |
| 12b-1 Fees$_t$ | -31.815 | -14.829 | -55.654* | -21.145 | -29.824 | -19.069 | -40.843 |
| | (0.101) | (0.583) | (0.013) | (0.481) | (0.387) | (0.591) | (0.066) |
| Turnover$_t$ | 0.023 | 0.010 | -0.108** | 0.045 | 0.006 | 0.044 | 0.010 |
| | (0.477) | (0.821) | (0.008) | (0.425) | (0.898) | (0.337) | (0.829) |
| Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 12,858 | 6,367 | 6,463 | 6,611 | 6,247 | 4,959 | 7,899 |
| adj. R-sq | 0.089 | 0.095 | 0.027 | 0.100 | 0.088 | 0.080 | 0.103 |

## Table 6. Regressions explaining the beta of mutual fund trades

This table reports panel fixed effect regressions that explain mutual fund $\beta_{trade}$. The sample consists of 1498 mutual funds, observed July and December over the period from December 1990 to December 2012. All variables are expressed as either natural logarithms or winsorized at the 1% level. $\beta_{trade}$ is a measure of the weighted average benchmark beta of the stock a mutual fund trades relative to the overall fund *Benchmark Beta*. A positive (negative) value of $\beta_{trade}$ means a fund's trades are increasing (decreasing) it's overall *Benchmark Beta*. $\beta_{trade}$ is calculated as described in section 6 of the paper. *Beta Deviation* is a measure of the style drift of a mutual fund to its benchmark and is equal to *Benchmark Beta* -1. *Excess Return* is equal to the net of fees return of a mutual fund minus the fund's benchmark return measured over a 6-month period. *Ln(Fund Assets)* is the logarithm of the aggregate stock holdings of a mutual fund in the Thomson Financial holdings database at an observation date. *Flow* is measured over a 6-month period, defined as in Sirri and Tufano (1998), and is constructed using data from the CRSP Survivorship Bias Free Mutual Fund Database. *Expense Ratio, 12b-1 Fees and Turnover* are all obtained directly from the CRSP Survivorship Bias Free Mutual Fund Database at the share class level and aggregated up to the fund level. Panel A examines all mutual fund transactions including stock completely liquidated as well as purchased for the first time while Panel B examines only partial sales and purchases of existing stock. All specifications control for fund, month, year and benchmark fixed effects. We report p-values robust to intragroup correlation at the mutual fund level in parentheses beneath variable coefficients, **, and * denote statistical significance at the 1%, and 5% levels, respectively.

**Panel A: All mutual fund trades**

| Dependent Variable | $\beta_{trade}$= (\$Buy/\$Trade)($\beta_{Buy}$-$\beta_{Fund}$)-(\$Sell/\$Trade)($\beta_{Sell}$-$\beta_{Fund}$) | | | | | | |
|---|---|---|---|---|---|---|---|
| Subsample | All | December to June | Above Median Deviation | Benchmark Beta ≤ 1 | Benchmark Beta > 1 | S&P 500 Benchmark | Non S&P 500 Benchmark |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Beta Deviation$_t$ | -0.126** | -0.130** | -0.133** | -0.175** | -0.132** | -0.125** | -0.134** |
| | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) |
| Excess Return$_{t-1}$ | 0.002 | 0.041 | 0.028 | 0.054 | -0.083 | 0.041 | -0.032 |
| | (0.950) | (0.246) | (0.426) | (0.110) | (0.070) | (0.320) | (0.354) |
| Ln(Fund Assets)$_t$ | 0.003 | 0.002 | 0.004 | 0.005 | 0.005 | 0.003 | 0.004 |
| | (0.093) | (0.457) | (0.153) | (0.097) | (0.171) | (0.500) | (0.102) |
| Flow$_{t-1}$ | -0.005 | -0.001 | -0.011* | -0.009 | 0.000 | -0.006 | -0.004 |
| | (0.086) | (0.891) | (0.035) | (0.055) | (0.958) | (0.217) | (0.208) |
| Expense Ratio$_t$ | 0.211 | 0.655 | 0.729 | 1.360 | 0.405 | -0.307 | 0.661 |
| | (0.847) | (0.676) | (0.636) | (0.372) | (0.818) | (0.900) | (0.547) |
| 12b-1 Fees$_t$ | -1.170 | -1.262 | -3.530 | -1.948 | 0.103 | -0.009 | -1.743 |
| | (0.650) | (0.728) | (0.357) | (0.555) | (0.983) | (0.998) | (0.590) |
| Turnover$_t$ | -0.004 | -0.004 | -0.002 | -0.002 | -0.006 | -0.006 | -0.003 |
| | (0.229) | (0.404) | (0.644) | (0.597) | (0.222) | (0.272) | (0.498) |
| Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 12,293 | 6,139 | 6,180 | 6,335 | 5,958 | 4,719 | 7,574 |
| adj. R-sq | 0.025 | 0.028 | 0.033 | 0.033 | 0.017 | 0.033 | 0.024 |

**Panel B: All mutual fund trades except liquidations and initial purchases**

| Dependent Variable | $\beta_{trade}$= (\$Buy/\$Trade)($\beta_{Buy}$-$\beta_{Fund}$)-(\$Sell/\$Trade)($\beta_{Sell}$-$\beta_{Fund}$) | | | | | | |
|---|---|---|---|---|---|---|---|
| Subsample | All | December to June | Above Median Deviation | Benchmark Beta ≤ 1 | Benchmark Beta > 1 | S&P 500 Benchmark | Non S&P 500 Benchmark |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Beta Deviation$_t$ | -0.156** | -0.162** | -0.128** | -0.175** | -0.228** | -0.183** | -0.146** |
| | (<0.001) | (<0.001) | (<0.001) | (0.001) | (<0.001) | (<0.001) | (<0.001) |
| Excess Return$_{t-1}$ | 0.030 | 0.095 | 0.140 | 0.078 | 0.021 | 0.110 | -0.029 |
| | (0.591) | (0.217) | (0.051) | (0.274) | (0.832) | (0.253) | (0.674) |
| Ln(Fund Assets)$_t$ | 0.036** | 0.028** | 0.038** | 0.033** | 0.045** | 0.040** | 0.036** |
| | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) |
| Flow$_{t-1}$ | 0.035** | 0.042** | 0.043** | 0.047** | 0.039** | 0.054** | 0.027** |
| | (<0.001) | (0.001) | (0.001) | (<0.001) | (0.002) | (0.003) | (0.005) |
| Expense Ratio$_t$ | 7.941** | 6.330 | 6.939* | 7.261* | 7.323 | 8.092 | 7.970** |
| | (0.001) | (0.051) | (0.027) | (0.010) | (0.064) | (0.097) | (0.006) |
| 12b-1 Fees$_t$ | -6.090 | -1.617 | -7.935 | -6.269 | -7.332 | -2.345 | -9.698 |
| | (0.324) | (0.831) | (0.344) | (0.443) | (0.465) | (0.832) | (0.192) |
| Turnover$_t$ | 0.005 | -0.003 | 0.006 | 0.002 | 0.013 | 0.009 | 0.003 |
| | (0.585) | (0.819) | (0.649) | (0.850) | (0.294) | (0.544) | (0.800) |
| Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 12,201 | 6,100 | 6,118 | 6,282 | 5,919 | 4,661 | 7,540 |
| adj. R-sq | 0.021 | 0.033 | 0.021 | 0.023 | 0.021 | 0.021 | 0.022 |

## Table 7. Regressions explaining the beta of the stock a mutual fund trades

This table reports pooled OLS regressions that explain mutual fund $\varphi*(\beta_{Stock} - \beta_{Fund})$. The sample consists of 1498 mutual funds, observed July and December over the period from December 1990 to December 2012. All variables are expressed as either natural logarithms or winsorized at the 1% level. $\beta_{Stock}$ is the benchmark relative beta of the stock a mutual fund trades. Trades for the purposes of this table are partial sales or purchases of stock existing in the fund. $\varphi$ is a variable that takes a value of 1 when the transaction is a partial buy and a value of -1 when the transaction is a partial sale. A positive (negative) value of $\varphi*(\beta_{Stock} - \beta_{Fund})$ has the interpretation that the stock a fund is trading in are increasing (decreasing) it's overall $\beta_{Fund}$. $\beta_{Stock}$ is calculated as described in section 6 of the paper. *Beta Deviation* is a measure of the style drift of a mutual fund to its benchmark and is equal to *Benchmark Beta* -1. *DGTW Size, DGTW Book to Market* and *DGTW Momentum* are stock level characteristics defined as in Daniel, Grinblatt, Titman, and Wermers (1997). *Stock Return* is the return of the stock traded over the previous 6-month period. All specifications control for fund, month, year, benchmark and stock industry fixed effects. We report p-values robust to intragroup correlation at the mutual fund level in parentheses beneath variable coefficients, **, and * denote statistical significance at the 1%, and 5% levels, respectively.

| Dependent Variable | $\varphi*(\beta_{Stock}-\beta_{Fund})$ | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Beta Deviation$_t$ | -0.116** | -0.116** | -0.116** | -0.115** |
| | (<0.001) | (<0.001) | (<0.001) | (<0.001) |
| DGTW Size$_t$ | | -0.003 | | -0.003 |
| | | (0.478) | | (0.469) |
| DGTW Book to Market$_t$ | | 0.002 | | 0.002* |
| | | (0.056) | | (0.034) |
| DGTW Momentum$_t$ | | 0.003** | | |
| | | (0.002) | | |
| Stock Return$_{t-1}$ | | | -0.007 | -0.008 |
| | | | (0.239) | (0.196) |
| Fixed Effects | Yes | Yes | Yes | Yes |
| N | 871,934 | 871,934 | 871,934 | 871,934 |
| adj. R-sq | 0.007 | 0.007 | 0.007 | 0.007 |

**Table 8. Regressions explaining mutual fund volatility adjustment**

This table reports panel fixed effect regressions that explain *Ln*($\sigma_{t+1}$/ $\sigma_t$). The sample consists of 1498 mutual funds, observed July and December over the period from December 1990 to December 2012. All variables are expressed as either natural logarithms or winsorized at the 1% level. *Ln*($\sigma_{t+1}$/ $\sigma_t$) is the logarithm of the ratio of *Imputed Volatility* over two subsequent periods. *Imputed Volatility* is a holdings based measure of fund volatility. *Beta Deviation* is a measure of the style drift of a mutual fund to its benchmark and is equal to *Benchmark Beta* -1. *Percentile Rank* is a measure defined on the interval [0,1] where each fund following a benchmark are given a percentile rank based on *Excess Return* over the previous 6-month period. *Excess Return* is equal to the net of fees return of a mutual fund minus the fund's benchmark return measured over a 6-month period. *Ln(Fund Assets)* is the logarithm of the aggregate stock holdings of a mutual fund in the Thomson Financial holdings database at an observation date. *Flow* is measured over a 6-month period, defined as in Sirri and Tufano (1998), and is constructed using data from the CRSP Survivorship Bias Free Mutual Fund Database. *Expense Ratio, 12b-1 Fees and Turnover* are all obtained directly from the CRSP Survivorship Bias Free Mutual Fund Database at the share class level and aggregated up to the fund level. All specifications control for fund, year and benchmark fixed effects. We report p-values robust to intragroup correlation at the mutual fund level in parentheses beneath variable coefficients, **, and * denote statistical significance at the 1%, and 5% levels, respectively.

| | June to December | | | | December to June | | | |
|---|---|---|---|---|---|---|---|---|
| Dependent Variable | Ln($\sigma_{t+1}/\sigma_t$) | | | | Ln($\sigma_{t+1}/\sigma_t$) | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Percentile Rank (Winner=1)$_{t-1}$ | -0.029** | -0.021** | | | -0.010 | -0.003 | | |
| | (<0.001) | (<0.001) | | | (0.057) | (0.596) | | |
| Excess Return$_{t-1}$ | | | -0.175** | -0.154** | | | -0.028 | -0.004 |
| | | | (<0.001) | (<0.001) | | | (0.288) | (0.883) |
| Beta Deviation$_t$ | | -0.243** | | -0.243** | | -0.253** | | -0.253** |
| | | (<0.001) | | (<0.001) | | (<0.001) | | (<0.001) |
| Ln(Fund Assets)$_t$ | -0.005** | -0.003 | -0.005** | -0.003 | 0.002 | 0.004 | 0.002 | 0.004 |
| | (0.009) | (0.205) | (0.008) | (0.177) | (0.498) | (0.170) | (0.456) | (0.162) |
| Flow$_{t-1}$ | -0.008* | -0.009** | -0.007* | -0.008* | 0.005 | 0.004 | 0.004 | 0.004 |
| | (0.039) | (0.009) | (0.047) | (0.014) | (0.147) | (0.182) | (0.169) | (0.193) |
| Expense Ratio$_t$ | -0.931 | -0.077 | -0.885 | -0.013 | -0.188 | 0.222 | -0.175 | 0.223 |
| | (0.385) | (0.945) | (0.405) | (0.991) | (0.864) | (0.838) | (0.873) | (0.838) |
| 12b-1 Fees$_t$ | -4.017 | -2.773 | -3.929 | -2.745 | -2.484 | -0.656 | -2.381 | -0.615 |
| | (0.113) | (0.277) | (0.121) | (0.281) | (0.252) | (0.777) | (0.272) | (0.791) |
| Turnover$_t$ | -0.008 | -0.008 | -0.008 | -0.008 | -0.009 | -0.008 | -0.009 | -0.007 |
| | (0.079) | (0.081) | (0.094) | (0.087) | (0.053) | (0.093) | (0.059) | (0.096) |
| Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 6,491 | 6,491 | 6,491 | 6,491 | 6,367 | 6,367 | 6,367 | 6,367 |
| adj. R-sq | 0.152 | 0.236 | 0.154 | 0.239 | 0.153 | 0.256 | 0.153 | 0.256 |

## Appendix Table 1. Regressions explaining mutual fund net flow

This table reports panel fixed effect regressions that explain mutual fund *Flow*. The sample consists of 1498 mutual funds, observed July and December over the period from December 1990 to December 2012. All variables are expressed as either natural logarithms or winsorized at the 1% level. *Abs(Beta Deviation)* is a measure of the style drift of a mutual fund to its benchmark and is equal to the absolute value of *Benchmark Beta* -1. *Excess Return* is equal to the net of fees return of a mutual fund minus the fund's benchmark return measured over a 6-month period. *Ln(Family Assets)* is the logarithm of the aggregate value of all holdings in the Thomson Financial holdings database for a mutual fund's family at an observation date. *Ln(Fund Assets)* is the logarithm of the aggregate stock holdings of a mutual fund in the Thomson Financial holdings database at an observation date. *Institutional Ownership (%)* is constructed by aggregating CRSP total net assets across all share classes with the Morningstar Direct code "Inst" and then dividing by *Fund Assets*. *Flow* is measured over a 6-month period, defined as in Sirri and Tufano (1998), and is constructed using data from the CRSP Survivorship Bias Free Mutual Fund Database. *Expense Ratio, 12b-1 Fees and Turnover* are all obtained directly from the CRSP Survivorship Bias Free Mutual Fund Database at the share class level and aggregated up to the fund level. *HSV* is a holdings-based style volatility measure defined as in Brown, Harlow and Zhang (2015). *Momentum TSD, Size TSD* and *Book TSD* are measures of style drift in the momentum, size and book-to-market dimensions as defined in Wermers (2012). All specifications control for fund, month, year and benchmark fixed effects. We report p-values robust to intragroup correlation at the mutual fund level in parentheses beneath variable coefficients, **, and * denote statistical significance at the 1%, and 5% levels, respectively.

| Dependent Variable | | | | **$Flow_t$** | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Abs (Beta Deviation)$_t$ | -0.113* | -0.102* | | | | | -0.122** | -0.106* |
| | (0.010) | (0.017) | | | | | (0.010) | (0.013) |
| $HSV_t$ | | | -0.053* | -0.053* | | | -0.052 | |
| | | | (0.045) | (0.046) | | | (0.051) | |
| Momentum $TSD_t$ | | | | | -0.012 | -0.013 | | -0.011 |
| | | | | | (0.297) | (0.272) | | (0.359) |
| Size $TSD_t$ | | | | | -0.022 | -0.026 | | -0.025 |
| | | | | | (0.533) | (0.448) | | (0.475) |
| Book $TSD_t$ | | | | | -0.021 | -0.021 | | -0.022 |
| | | | | | (0.292) | (0.287) | | (0.286) |
| Excess $Return_{t-1}$ | 0.774** | 0.993** | 0.696** | 0.789** | 0.797** | 0.800** | 0.702** | 0.800** |
| | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) |
| Abs(Beta Deviation)$_t$ x Excess $Return_{t-1}$ | | -1.008* | | | | | | |
| | | (0.023) | | | | | | |
| $HSV_t$ x Excess $Return_{t-1}$ | | | | -0.115 | | | | |
| | | | | (0.510) | | | | |
| Momentum $TSD_t$ x Excess $Return_{t-1}$ | | | | | | 0.162 | | |
| | | | | | | (0.304) | | |
| Size $TSD_t$ x Excess $Return_{t-1}$ | | | | | | 0.544 | | |
| | | | | | | (0.119) | | |
| Book $TSD_t$ x Excess $Return_{t-1}$ | | | | | | -0.222 | | |
| | | | | | | (0.371) | | |
| Institutional $Ownership_t$ (%) | -0.105 | -0.105 | -0.173 | -0.172 | | -0.106 | -0.172 | -0.104 |
| | (0.261) | (0.260) | (0.137) | (0.140) | | (0.253) | (0.141) | (0.264) |
| Ln(Family Assets)$_t$ | 0.016** | 0.016** | 0.023** | 0.023** | 0.017** | 0.017** | 0.023** | 0.017** |
| | (0.006) | (0.006) | (0.001) | (0.001) | (0.003) | (0.004) | (0.001) | (0.003) |
| Ln(Fund Assets)$_t$ | -0.097** | -0.096** | -0.100** | -0.100** | -0.093** | -0.093** | -0.101** | -0.094** |
| | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) |
| $Flow_{t-1}$ | 0.049** | 0.049** | 0.046* | 0.046* | 0.049** | 0.049** | 0.044* | 0.048** |
| | (0.002) | (0.002) | (0.018) | (0.017) | (0.002) | (0.002) | (0.020) | (0.002) |
| Expense $Ratio_t$ | -18.906** | -18.747** | -20.509** | -20.474** | -18.390** | -18.254** | -20.256** | -18.155** |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| 12b-1 $Fees_t$ | -13.706 | -13.982 | -18.470 | -18.451 | -11.982 | -12.309 | -19.550 | -12.804 |
| | (0.261) | (0.250) | (0.230) | (0.231) | (0.321) | (0.308) | (0.204) | (0.290) |
| $Turnover_t$ | -0.011 | -0.011 | -0.008 | -0.008 | -0.014 | -0.014 | -0.008 | -0.014 |
| | (0.352) | (0.344) | (0.475) | (0.471) | (0.238) | (0.241) | (0.476) | (0.235) |
| Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 12,308 | 12,308 | 9,786 | 9,786 | 12,195 | 12,195 | 9,786 | 12,195 |
| R-sq | 0.056 | 0.056 | 0.056 | 0.056 | 0.053 | 0.054 | 0.057 | 0.054 |