Style and Skill: Hedge Funds, Mutual Funds, and Momentum

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Abstract

Institutional investors' 13F stockholdings reveal stark differences between the investment philosophy and skill of hedge funds and mutual funds. Hedge funds tend to buy stocks with low past returns, while mutual funds tend to be trend followers. The nearly two-thirds of hedge funds that follow contrarian strategies outperform their risk- and characteristic-adjusted benchmarks by 2.4% per year. Hedge funds that follow momentum strategies do not outperform their benchmarks, irrespective of whether these benchmarks control for momentum. By contrast, most mutual funds follow momentum strategies; their managers exploit the momentum anomaly but lack trading skill once we control for the effect of momentum on stock returns. The most profitable trades of contrarian hedge funds are purchases of stocks sold by momentum mutual funds. The superior performance of contrarian hedge funds is persistent and arises from strategies that are more complex than purchasing stocks with low past returns.

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The high returns from buying assets that are past winners and selling past losers is perhaps the premier asset pricing anomaly in the literature.[1] "Momentum," as it is frequently called, has persisted since its discovery,[2] and is present across multiple asset classes[3] and in most countries.[4] Notably, the strategy is particularly simple to implement and quite popular, particularly among institutional investors. For example, Grinblatt, Titman, and Wermers (1995) and Carhart (1997) show that mutual funds tend to follow momentum. Grinblatt and Keloharju (2000) find that Finnish institutions, mostly mutual funds, also follow momentum.

Momentum's popularity with investors has been attributed to the strategy's profitability and to fund managers' incentives to trade with the crowd.[5] However, little evidence exists on whether momentum is also favored by hedge funds—a $2.5 trillion industry run by what many regard as the most sophisticated and most incentivized managers.

Using 13F institutional stockholdings, we analyze the style and performance of 589 mutual fund, 1,342 hedge fund, and 2,894 other institutional fund managers from 1998 to 2012.

We document that hedge fund managers are not momentum investors. For almost 2/3 of hedge fund managers, stock purchases tend to be contrarian, although their tendency to sell recent winners is less pronounced. The invesment style of contrarian hedge funds is persistent and highly profitable. About 80% of hedge funds that are contrarian in the first half of the sample period are also contrarian in the second half. Despite the documented profitability of momentum, contrarian hedge funds exhibit the best performance. Their quarterly portfolio rebalancing generates a significantly positive alpha, outperforming both mutual funds and the approximately 1/3 of hedge fund managers that can be classified

[1] See Jegadeesh and Titman (1993), Fama and French (2008), and Avramov, Chordia, Jostova, and Philipov (2013).

[2] See Jegadeesh and Titman (2001).

[3] The existence of momentum has been documented among equities, bonds, currencies, commodities, and residential real estate by Asness, Moskowitz, and Pedersen (2013), Beracha and Skiba (2011), Chan, Hameed, and Tong (2000), Gorton, Hayashi, and Rouwenhorst (2008), Jostova, Nikolova, Philipov, and Stahel (2013), Miffre and Rallis (2007) and Okunev and White (2003).

[4] See Rouwenhorst (1998).

[5] See Scharfstein and Stein (1990) and Falkenstein (1996).

as having momentum-driven strategies. Contrarian hedge funds' success derives from their managers' superior stock-picking skills—the ability to pick the *right* losers among stocks with similar characteristics. We find performance persistence only among outperforming hedge funds—there is no evidence of performance persistence among underperforming hedge funds and outperforming or underperforming mutual funds and other institutional investors.

Consistent with prior studies, we find that about 2/3 of mutual fund managers follow momentum strategies, both for purchases and sales. The investment style of these funds is persistent: Conditional on their survival, 76% of mutual funds that follow momentum strategies in the first half of the sample period also follow the same strategies in the second half. In contrast to hedge funds, momentum mutual funds outperform contrarian mutual funds. However, once we control for the return enhancing effects of momentum, differences in performance between the two styles of mutual fund management disappear.

The style measure we use, first proposed by Grinblatt, Titman, and Wermers (1995) [GTW], is based on the vector product of the fund's portfolio weight changes with past stock returns. When stocks with relatively high past returns witness portfolio weight increases and those with relatively low past returns generate portfolio weight decreases, this product is positive—indicating a momentum strategy. Our measure of fund performance is the analogous product, but with future returns replacing past returns. Performance thus measures the ability of the fund's portfolio weight changes to predict future returns, following Grinblatt and Titman (1993) [GT]. An equivalent perspective is that the GT measure evaluates active management by comparing fund returns to a benchmark return that would be earned if the fund maintained its prior stockholdings.

We further adjust the GT performance measure for the impact of stock characteristics. In particular, the performance measure uses returns that are size- and book-to-market-adjusted as in Daniel, Grinblatt, Titman, and Wermers (1997) [DGTW]. Where appropriate, we also adjust for momentum with the same DGTW procedure. The adjusted performance measure

tests for true stock-picking skills by adding an extra measure of assurance that a managed portfolio is not beating its benchmark (the passive portfolio it replaced) in a given month because it deviates from that portfolio in its size, book-to-market, and momentum attributes.

Our holdings-based evaluation of fund investment style and performance has several advantages over comparable analyses of reported fund returns. First, holdings-based hedge fund evaluation avoids well-known biases in hedge fund return databases—including survivorship, backfill, and self-selection biases (see Fung and Hsieh, 1997, 2002b), and possible misreporting (see Patton, Ramadorai, and Streatfield, 2015). These biases arise because reporting to a hedge fund return database is voluntary and hedge funds can choose to report (or stop reporting) following strong (poor) performance, or revise their reports in a self-serving manner. Our sample does not suffer from these biases because we estimate fund performance using quarterly holdings reported in *mandatory* 13F SEC filings and stock returns from CRSP. Second, the granularity of fund holdings allows us to distinguish active investment decisions (changes in quantities held) from passive momentum investing (due to changes in prices) when evaluating a fund's strategy and performance. Third, we can compute holdings-based measures of style and performance without the contaminating effects of incentive fees and high-water marks, which can introduce non-linearity and path dependence in hedge funds' returns (see Getmansky, Lo, and Makarov, 2004). Finally, the fund's prior quarter holdings offers a benchmark for style and performance evaluation. Choosing the right benchmark is especially important for hedge funds, which hold stocks with different characteristics than other institutional investors (Griffin and Xu, 2009) and follow strategies with option-like payoffs (e.g. Fung and Hsieh, 1997, 2001, 2002a,b). While we are not the first to use fund

holdings data, even for hedge funds,[6] our analysis uses a much larger cross-section and longer time-series to provide novel findings on hedge funds' investment style and performance.

The GT performance measures reveal that mutual funds do not beat benchmarks that adjust for momentum, whereas hedge funds overall outperform their benchmarks irrespective of whether they contain a momentum control. The superior performance of hedge funds is persistent and entirely attributable to the subset of hedge funds that follow contrarian strategies. Contrarian hedge funds beat their passive benchmark by 2.4% per year based on size, book-to market, and momentum-adjusted returns, with two-thirds of this average fund performance coming from the purchases of stocks. Indeed, the stocks that are net purchases of contrarian hedge funds have an average DGTW-adjusted alpha of 2.2% per year and outperform the stocks sold by these funds (excluding short sales) by an average alpha of 3.2% per year.[7] In sum, contrarian hedge funds exhibit superior stock-picking ability that goes beyond a naïve style-based strategy.

Previous papers on hedge fund performance mostly rely on self-reported fund returns and find mixed results. One camp finds that hedge funds with greater managerial incentives earn superior returns (Agarwal, Daniel, and Naik 2009) and that the performance of top hedge fund managers persists and cannot be explained by luck (Kosowski, Naik, and Teo 2007; Jagannathan, Malakhov, and Novikov 2010). The other camp documents that less that 20% of long/short equity hedge funds consistently deliver alpha (Fung and Hsieh 2001) and hedge funds on average outperform mutual funds, but not the market, while being more volatile

[6] Brunnermeier and Nagel (2004) analyze the 13F holdings of 53 hedge funds during the 1998-2000 technology bubble. Griffin and Xu (2009) find that their sample of 306 hedge funds outperforms mutual funds at stock picking, but exhibits no ability to time sectors or pick better stock styles. Ben-David, Franzoni, and Moussawi (2012) study drivers of the drastic decrease in hedge fund holdings in 2008. Agarwal, Jiang, Tang, and Yang (2013) study the "confidential holdings" of hedge funds (permitted for certain information-sensitive holdings and reported with delay) and show that these have superior performance. Finally, Reca, Sias, and Turtle (2014) find that the trades of 350 large hedge funds do not destabilize prices by crowding out equity trades, but rather drive prices toward fundamental values.

[7] Contrarian hedge funds may also short-sell borrowed shares. Although data limitations prevent observation of funds' short sales, these limitations do not affect our conclusions if fund strategies in borrowed shares are similar to those applied to existing portfolio holdings.

than both mutual funds and the market. Furthermore, questions remain about the reliability of self-reported returns: Patton, Ramadorai, and Streatfield (2015) provide recent evidence that returns in hedge fund databases are frequently revised; the revisions are predictable and tend to increase average monthly returns by 0.62% per month.[8]

We find that hedge funds' success as contrarian investors comes at the expense of mutual funds: the highest alpha to contrarian hedge fund buys comes from stocks that mutual funds sell. Mutual funds are subject to a number of regulations that constrain their trading behavior, offering profitable trading opportunities for their less constrained counterparts. For example, U.S. mutual funds are required to provide daily liquidity to their shareholders, which may lead to "fire sales" driven by large investor redemptions. Chen, Hanson, Hong, and Stein (2008) show that hedge fund returns are higher in months when the mutual fund sector is in distress and conclude that hedge funds engage in front-running to exploit the predictable trades of mutual funds. We also find that hedge funds' contrarian trading (buying of losers) increased during 2008-2009, while mutual funds' selling of losers intensified. Moreover, mutual funds cater to retail investors' demand for 'fashionable' stocks, which may provide trading opportunities for contrarian hedge funds (Massa, Simonov, and Yan 2012).[9]

The paper contributes to the literature in several ways. First, it offers novel evidence that hedge funds tend to be contrarian, using a large cross-section of institutional holdings, and second, that contrarian hedge funds are the only class of funds exhibiting stock-picking skills. The latter finding helps investors identify which fund managers have talent. It also supports the predictions of theoretical models of investor behavior. For example, in the rational expectations model of Watanabe (2008), investors with more precise private signals are contrarians, relying more on their private signals to detect when stock prices overshoot

[8]Although Agarwal, Jiang, Tang, and Yang (2013) observe that SEC filings may also be revised, the revisions—being infrequent and motivated by private information—cannot be viewed as attempts to manipulate performance.

[9]Massa, Simonov, and Yan (2012) find international evidence that hedge funds perform better where mutual funds ownership is higher and argue that hedge funds take advantage of mutual funds' constraints.

fair value, while less informed agents are trend followers, relying more on the public signal of price movements to form trades. In Makarov and Plantin (2015), unskilled managers use strategies (like momentum) that generate 'fake' alpha to temporarily manipulate investors' perception of their skills. Third, we identify performance persistence among outperforming hedge funds. Finally, our holdings data empirically confirm previous predictions that hedge funds profitably exploit the poor trades of mutual funds.

The remainder of the paper is organized as follows. Sections 1 and 2 describe the data and methodology. Section 3 discusses the results and some robustness tests. Section 4 concludes.

1. Data

Institutional stock ownership is computed from the mandatory quarterly 13F filings of investment advisors.[10] We obtain the holdings data from Thomson Reuters. We classify each 13F filing as belonging to a mutual fund advisor, hedge fund advisor, or other advisor. Mutual fund advisors are identified from the Thomson Reuters mutual fund database, which provides their corresponding number on the 13F tape. The remaining 13F filers are manually identified as hedge fund or non-hedge fund managers by matching their names with a comprehensive list of hedge fund manager names obtained from various sources.[11] In addition, we cross-check the registration documents (Form ADV) of all firms registered under the Investment Advisers Act.[12] A firm is classified as a hedge fund advisor only if the form indicates that more than 50% of its regulatory assets under management belong

[10]Since 1980, all institutional investment advisors managing $100 million or more must report their stock-holdings on Form 13F to the Securities and Exchange Commission. Reporting is required for all long stock positions of 10,000 or more shares and positions valued at $200,000 or more.

[11]Sources include Lipper TASS, Hedge Fund Research (HFR), Center for International Securities and Derivatives Markets (CISDM), Morningstar, Bloomberg, and Businessweek Private Company List.

[12]Prior to 2011, many hedge fund advisers relied on the private fund adviser exemption to avoid registration under the Advisers Act. We classify all unregistered advisers matched with a hedge fund manager name as hedge fund managers because they were only allowed to manage private funds. The Dodd-Frank Act eliminated the private adviser exemption for all hedge fund advisers with regulatory assets of $150 million or more.

to pooled investment vehicles other than investment companies (a category that contains hedge funds and other private funds).[13]

Over our 1998-2012 sample period, we identify 589 unique mutual fund advisors, 1,342 hedge fund advisors, and the remaining 2,894 advisors as "others."[14] Plot A of Figure 1 presents the number of mutual and hedge fund advisors in each quarter. The number of mutual fund advisors is fairly stable, ranging between 299 and 379; the number of hedge fund advisors, by contrast, increases over the sample period, starting at 165 in March 1998, reaching a maximum of 804 in June 2008, and finishing at 650 hedge fund advisors in December 2012. The number of "other" advisors also increases over the sample period. Overall, the sample contains 21,219 mutual fund 13F filings, 29,050 hedge fund 13Fs, and 73,821 other 13F fund-quarter observations (see Panel A of Table 1).

Mutual funds hold larger and more diversified portfolios—on average 374 stocks, compared to 128 for hedge funds and 233 for other advisors (see Panel B of Table 1 and Plot B of Figure 1). The average dollar value of stockholdings is $11.29 billion per mutual fund advisor with $30.42 million per stock. This compares to $864 million per hedge fund with $6.80 million per stock, and $3.1 billion for others with $13.23 million per stock. Hedge funds have twice the turnover of mutual funds—39.2% versus 19.7% (see also Plot C of Figure 1).[15]

Mutual and hedge funds fundamentally differ in the types of stocks they hold (see Panel C of Table 1). Relative to mutual funds, hedge funds hold stocks with lower prices ($26.95 vs. $33.84), higher returns (0.90% vs. 0.65% per month), smaller market capitalizations ($22 vs. $41 billion), higher book-to-market ratios (0.68 vs. 0.57), lower trading volumes ($1.59

[13]Since the ADV form does not provide information on the percentage of assets attributable to each type of client prior to 2011, we use instead the information on the percentage of clients of each type.

[14]Prior to 1998, we cannot reliably identify hedge fund managers, because the databases used to identify hedge fund managers do not retain dead funds until 1998.

[15]Turnover is the average dollar values of buys and sells over the quarter relative to the initial holdings [i.e. turnover=($\$buys_q$+$\$sells_q$)/(2×$\$holdings_{q-1}$)].

vs. \$2 million per month), similar bid-ask spreads[16] (0.38% vs. 0.36%), higher credit risk (rated BBB vs. A−), higher volatility, lower analyst coverage (14 vs. 18 analysts), higher analyst EPS forecasts dispersion (0.21 vs. 0.14), earnings surprises (SUE of 0.61 vs 0.85), and lower dividends (\$0.38 vs. \$0.62 per share). Panel D of Table 1 displays the overlap between mutual and hedge fund holdings. Of the stocks that hedge funds hold, 99% are also held by mutual funds. Yet, only 76% of the stocks held by mutual funds are also held by (seemingly less-diversified) hedge funds.

2. Methodology

2.1. Measuring Style

Following GTW, we assess whether an advisor follows a momentum strategy from Lag 0 Momentum (L0M), the vector product of (active) portfolio weight changes (observed quarterly) and past returns (observed monthly):

$$\text{L0M}_{iq} = \sum_{m=1}^{3} \sum_{j=1}^{N(q)} (w_{i,j,q} - w_{i,j,q-1}) R_{j,q-1,m} \tag{1}$$

where L0M_{iq} is the L0M measure of fund i in quarter q, $w_{i,j,q}$ is fund i's quarter-q ending weight on stock j,[17] m identifies the month following the end of quarter $q-1$, $N(q)$ is the number of stocks in quarter q, and $R_{j,q,m}$ is stock j's return in the m^{th} month of quarter q. A positive L0M indicates a tendency towards momentum investing—the fund is buying stocks

[16] Bid-Ask spreads are computed using the monthly CRSP stock files as the difference between the ask and the bid prices divided by the price, which is an average of the two.

[17] To insure that the measure captures only "active" (i.e. discretionary) weight changes caused by changes in quantities rather than prices, we use the prior quarter price, $p_{j,q-1}$, when computing weight changes:

$$w_{j,q} - w_{j,q-1} = \frac{shares\ held_{j,q} \times p_{j,q-1}}{\sum_{j=1}^{N} shares\ held_{j,q} \times p_{j,q-1}} - \frac{shares\ held_{j,q-1} \times p_{j,q-1}}{\sum_{j=1}^{N}(q) shares\ held_{j,q-1} \times p_{j,q-1}} \tag{2}$$

with positive past returns and/or selling stocks with negative past returns. Conversely, a negative L0M points to contrarian investing.

Each quarter, we average the L0M_{iq} measures across funds to evaluate their aggregate tendency (L0M_q) to follow momentum. The average momentum investment measure (L0M) along with its sample t-statistic is obtained from the time-series of these aggregate tendencies:

$$\text{L0M}_q = \frac{1}{K(q)} \sum_{i=1}^{K(q)} \text{L0M}_{iq} \tag{3}$$

$$\text{L0M} = \frac{1}{Q} \sum_{q=1}^{Q} \text{L0M}_q \tag{4}$$

$$t\text{-stat(L0M)} = \frac{\text{L0M}}{s.e.(\text{L0M})} = \frac{\text{L0M}}{\sigma(\text{L0M}_q)/\sqrt{Q}} \tag{5}$$

where $K(q)$ is the number of fund managers of a given type (hedge, mutual, or other) in quarter q and Q is the number of quarters in the sample.

We also compute a related L0M using a cross-sectional average in lieu of a time-series average. In this case, we first obtain an average L0M_i measure for each fund i over the number of quarters, $Q(i)$, for which it exists, and then average across the total number, K, of fund managers of a given type in the sample period:

$$\text{L0M}_i = \frac{1}{Q(i)} \sum_{q=1}^{Q(i)} \text{L0M}_{iq} \tag{6}$$

$$\text{L0M} = \frac{1}{K} \sum_{i=1}^{K} \text{L0M}_i \tag{7}$$

$$t\text{-stat(L0M)} = \frac{\text{L0M}}{s.e.(\text{L0M})} = \frac{\text{L0M}}{\sigma(\text{L0M}_i)/\sqrt{K}} \tag{8}$$

Compared to the time-series average, the cross-sectional average gives relatively more weight to funds with shorter tenures and those operating in months with greater numbers of funds.

A fund's investment style may differ on the buy and sell sides or may be influenced more

by one side than the other. To capture this difference, we measure an advisor's buy and sell momentum style, respectively L0Mb and L0Ms, from quarterly measures of the style as follows:

$$\text{L0Mb}_{iq} = \sum_{m=1}^{3} \sum_{w_{i,j,q} > w_{j,q-1}} (w_{i,j,q} - w_{i,j,q-1})(R_{j,q-1,m} - R^{B}_{i,q-1,m}) \tag{9}$$

$$\text{L0Ms}_{iq} = \sum_{m=1}^{3} \sum_{w_{i,j,q} < w_{j,q-1}} (w_{i,j,q} - w_{i,j,q-1})(R_{j,q-1,m} - R^{B}_{i,q-1,m}), \tag{10}$$

where

$$R^{B}_{i,q-1,m} = \sum_{j=1}^{N(q)} w_{i,j,q-1} R^{SzBm}_{j,q-1,m}. \tag{11}$$

While the measure of momentum investing in equation (1) is zero under the null hypothesis of no momentum investing, the partial buy and sell measures based on raw returns are not. Therefore, the partial buy and sell measures in equations (9)-(10) subtract a *fund-specific* benchmark return in each quarter. In the absence of this adjustment, the buy measure will have a positive bias because weight changes and returns tend to be positive—spuriously indicating momentum—whereas the sell measure will have a negative bias. Since weight changes add to zero across purchases and sales, subtracting that fund-specific benchmark has no effect on the overall measure. It is purely designed to ensure that the buy and sell versions of the measure estimate the covariance between weight changes and past returns.

The benchmark return in equation (11) is a proxy for the *fund's* expected return that month based on the size and book-to-market characteristics of the fund's beginning-of-quarter portfolio. For each stock j in that fund's portfolio, $R^{SzBm}_{j,q-1,m}$ is the return of the value-weighted month-t return of stocks with similar size and book-to-market ratio. Specifically, each month, NYSE, AMEX, and Nasdaq stocks are sorted into value-weighted portfolios based on a sequential 5×5 sort on size and book-to-market, using NYSE breakpoints.[18]

[18]Size is measured as of the end of the prior June and BM is as of the end of the prior fiscal year.

The size and book-to-market portfolios to which the stock belongs are based on its past rankings on the two characteristics.

In addition to aggregating the L0M measure, we use quarterly Fama-MacBeth cross-sectional regressions of fund-level measures, L0M_{iq} on dummy variables indicating whether the fund is a mutual (MF) or hedge fund (HF):

$$\text{L0M}_{iq} = a_q + d_{MF,q}\,\text{MF}_i + d_{HF,q}\,\text{HF}_i + e_{iq} \tag{12}$$

Since these regressions are based on the entire cross-section of funds, the coefficients on the dummy variables measure the momentum behavior and performance of mutual and hedge funds *relative* to the "other" advisor category.

2.2. Measuring Performance

We evaluate fund performance as the vector product of the fund's (active) weight changes and future risk-adjusted returns. This performance measure, adapted from Grinblatt and Titman (1993), employs the portfolio held by the fund at the end of the previous quarter as its benchmark,

$$\text{F1M}^*_{iq} = \sum_{m=1}^{3}\sum_{j=1}^{N}(w_{i,j,q} - w_{i,j,q-1})R^*_{j,q,m}, \tag{13}$$

where $R^*_{j,q,m}$ is the risk-adjusted return for stock j in month m of quarter q. A measure greater than zero indicates that purchases outperform sales. Thus, the performance measure is much like the L0M style measure except that a) it uses next quarter's future returns rather than lagged returns and b) adjusts each of those returns for risk.[19]

Following DGTW, the stock-by-stock risk adjustment for F1M* matches each stock in a given month to a value-weighted portfolio of stocks in the same quintiles for both size and

[19]We also examine how the fund's holdings changes perform over periods beyond the next three months.

book-to-market ($* = size, bm$) or for size, book-to-market, and momentum ($* = DGTW$). The risk adjustment consists of subtracting the return of the matched portfolio from the return of the stock. The stock-level adjustment for size and book-to-market was described in the prior subsection. The stock-by-stock adjustments that includes momentum is similar and described in DGTW.

Even without a risk adjustment for the return of each stock held, the expected value of the F1M measure is zero under the null hypothesis of no investment skill, provided that, over the next quarter, the portfolio of stocks recently purchased by the manager tend to have the same priced risk as the stocks sold. We risk adjust returns because the priced risk of a stock may be dynamic and funds may dispose of stocks when their risk has declined in favor of stocks with higher priced risk. Hedge funds, for example, tend to hold smaller stocks with higher book-to-market ratios (see Table 1 Panel C). Such stocks tend to have positive market-adjusted returns due to the size and value effects, but the size and value attributes of a stock tend to change over time.[20]

Unlike L0M, there is no need for further adjustment to F1M* if we want to separately compute the performance contribution from purchases or sales of assets. Returns are already risk adjusted. However, in contrast to L0Mb and L0Ms, this adjustment takes place at the stock level rather than the fund level. To obtain the separate performance contributions of buys and sells, referred to as F1Mb^*_{iq} and F1Ms^*_{iq}, we simply sum the terms of equation (13) separately for weight changes that are positive and negative, respectively. We compute time-series and cross-sectional averages of this performance measure with the same aggregation sequences used for L0M. As with L0M, we use quarterly Fama-MacBeth cross-sectional regressions of fund-level measures, F1M_{iq}, on dummy variables indicating whether the fund is a mutual (MF) or hedge fund (HF).

[20] A comparison with measures based on raw returns is provided in the Robustness section.

3. Results

We proceed to examine the investment styles of mutual and hedge fund advisors and the relation between these styles and fund performance.

3.1. Hedge Fund and Mutual Fund Styles

The results reported in Table 2 reveal that hedge funds are contrarians, in contrast to mutual funds who are momentum investors. The latter finding is consistent with Grinblatt, Titman, and Wermers (1995). For each type of advisor, Panel A presents the time-series mean of the cross-sectional average L0M (as in equation (4)) with t-statistics in parentheses (as in equation (5)). Square-bracketed numbers represent the fraction of quarters with positive momentum measures. Mutual funds' quarterly L0M measures average 0.71 (t-statistic of 14.88), that is, the returns of stocks bought by mutual funds exceed the returns of the stocks sold by mutual funds by 71 basis points over the previous quarter. The measure is positive in every quarter of the sample period. Mutual funds follow momentum both in their buys and sells. Their buys have an average L0Mb measure of 0.39 (positive in 87% of the quarters) and their sell measure, L0Ms, averages 0.32 (positive in 82% of the quarters). By contrast, hedge fund advisors tend to be contrarians. Their L0M measure averages -0.34 (t-statistic of -3.62) and is negative in 70% of the sample quarters. Interestingly, hedge funds are contrarian only in their buys, having an average L0Mb of -0.37, indicating a strong tendency to buy past losers. Hedge funds' sells seem unaffected by past returns, as shown by their insignificant L0Ms measure of 0.03.

Panel B of Table 2 computes the cross-sectional average of L0M, L0Mb, and L0Ms. It first averages the measures across all quarters for each advisor, and then across all advisors of the same type. These averages confirm that mutual fund managers have a strong tendency to buy recent winners and sell losers whereas hedge funds tend to buy recent losers. Differences

from the time-series averages shown in Panel A are due to the different weighting schemes: Panel B weights all funds equally; Panel A's time-series average places relatively greater weight on advisors with longer tenures in the sample period.

Figure 2 illustrates how the mutual and hedge funds' momentum style measures evolve over time. Plot A demonstrates that mutual fund advisors consistently trade on momentum throughout the sample period, while hedge fund advisors exhibit contrarianism, particularly from the year 2000 on. Indeed, hedge fund advisors are relatively more contrarian than mutual funds in all but one quarter. Interestingly, hedge funds' contrarian trading was particularly prescient just before and during stock market meltdowns—for example, the dot-com bubble burst in 2001 and the 2008 financial crisis. Hedge funds' switched from a fairly neutral to a strong contrarian stance in the second half of 2000 and became far more contrarian between the end of 2006 and the end of 2008. By contrast, mutual funds intensified their momentum trading between mid-2007 and mid-2008, but there is little evidence of other time-related complementarities in style between mutual and hedge funds. Indeed, over the whole sample period, the correlation between mutual and hedge fund average trading styles is weakly and insignificantly positive (0.29, unreported). The low correlation suggests that mutual fund trading is not a major determinant of variation in hedge funds' trading style over time. Later in the paper, we shall examine the relation between mutual and hedge fund trades in the cross-section of stocks.

Plots B and C of Figure 2 separately show the buy and sell L0M measures for the two advisor types. During the 2008-2009 financial crisis and the 2001-2002 dot-com bubble burst, hedge fund advisors intensified their interest in losing stocks, both in their buys and sells. However, the increased buying of losers outweighed the increased selling of these stocks, making hedge funds' overall strategy more contrarian during the two meltdown periods. Mutual fund advisors' buy and sell L0M measures are typically both positive, indicating a persistent tendency to buy winners and sell losers.

Panel C of Table 2 shows the number of momentum and contrarian advisors by fund type. About two-thirds of hedge fund advisors are contrarian and two-thirds of mutual fund advisors are momentum traders. While more than two-thirds of the hedge fund advisors are contrarian in their buys, only about half are contrarian in their sells. In contrast, most mutual fund advisors follow momentum in both their buys and sells.

Panel D of Table 2 documents that most advisors demonstrate persistent investment styles. After sorting fund advisors into momentum and contrarian investors based on their L0M_i measure in the first half of the period (from January 1998 to June 2005), Panel D of Table 2 reports the average L0M_i and proportion of contrarian advisors (negative L0M_i) during the second sub-period (July 2005 to December 2012) for various fund types, conditional on their continued existence in both sub-periods. As can be seen in Panel D, 79% of hedge fund advisors that are contrarian in the first subperiod remain contrarian in the second; 64% (=100%−36%) of the momentum hedge funds from the first half also follow momentum in the second half. Similarly, 78% (=100%−22%) of the momentum mutual fund advisors from the first half also follow momentum in the second, and 71% of the contrarian mutual fund advisors from the first half are also contrarian in the second half.

We further examine the relation between fund type and investment strategy through Fama-MacBeth quarterly cross-sectional regressions of L0M on a constant and dummy variables indicating whether the advisor is a mutual or a hedge fund advisor (see equation (12)). Table 3 reports the time-series average of the estimated coefficients with their sample t-statistics. The results confirm that, *relative* to 'other' institutional advisors (the omitted dummy), mutual fund advisors tend to follow momentum strategies, while hedge fund advisors are contrarians. The positive intercept shows that 'other' institutional advisors are also momentum investors, but to a lesser extent than mutual fund advisors.

3.2. Performance of Mutual and Hedge funds

We now examine the F1M performance measure (equation (13)), which is based on the covariance between active weight changes and subsequent stock returns. Specifically, we compute two versions of the performance measure that control for changing risk premia in individual stocks by using risk-adjusted returns. The first, F1M_{iq}^{SzBm}, controls for size- and book-to-market and the second, F1M_{iq}^{DGTW}, controls for size, book-to-market, and momentum. These two versions of F1M are described below equation (13). Table 4 Panel A reports time-series averages of the cross-sectional means of the F1M measures of mutual and hedge funds with t-statistics in parentheses. The fraction of months in which the cross-sectional means are positive is reported in square brackets below the t-statistics.

Given the profitability of momentum strategies, one would expect to see mutual funds, which tend to follow momentum strategies, outperform hedge funds, which tend to follow contrarian strategies, all else equal. The evidence presented in Panel A shows a different pattern. Mutual funds generate 13 basis points per quarter [bpq] (t-statistic of 2.67) from active changes in their holdings based on size- and BM-adjusted returns. In contrast, active changes in hedge funds' holdings earn 27 basis points (t-statistic of 3.61) more over the subsequent quarter than stocks with similar size and book-to-market ratios (F1M^{SzBm}).

The comparison is even less favorable to mutual funds once we control for momentum: the F1M^{DGTW} measure shows that mutual funds generate an insignificant 2 bpq after adjusting performance for the return-enhancing effects of their momentum investment style. In other words, mutual funds perform as well as a naïve momentum investor. Mutual funds' buy and sell performance measures are also insignificant, irrespective of controls, and quite negligible in magnitude (below 4 basis points per quarter) once we control for momentum. By contrast, controlling for the contrarian style has little effect on hedge fund performance: their F1M^{DGTW} measure of 25 bpq (t-statistic of 3.72) negligibly differs from the 27 bpq

performance metric that lacks the past return control.

The superior performance of hedge funds in Panel A derives entirely from stock purchases, which earn 28 bpq (SzBm-adjusted) and 26 bpq (DGTW-adjusted), respectively, both significant at the 1% level. Since the performance measures are based on characteristic-adjusted returns, hedge fund performance derives from their advisors' stock-picking ability rather than from following a strategy based on the size, value, or momentum anomalies. While hedge funds' buys are contrarian, their advisors earn alpha by picking the 'right' losers, in that these stocks outperform other past losers with similar size and book-to-market attributes.

The performance measures in Panel B—calculated as the cross-sectional average of the fund-specific F1M measures—give equal weight to each fund advisor, regardless of the advisor's longevity during the sample period. Panel B shows even stronger stock-picking skills for hedge fund advisors than Panel A's time-series averages. For example, Panel B's F1M^{SzBm} measure shows performance of 46 bpq (t-statistic of 6.54)—compared to the 27 bpq in Panel A. The difference from Panel A is driven by the significant hedge fund performance observed in the "sells" column. Thus, at least for Panel B's equal weighting of advisors, hedge funds derive a small portion of their performance from selling stocks in their portfolio that will soon earn inferior returns. Generally, the mutual fund alphas in Table 4 Panel B are smaller than in Panel A and all are statistically insignificant.

Overall, the performance measures in Panels A and B of Table 4 show that mutual funds' quarterly portfolio revisions yield about 13 bpq, while hedge funds' portfolio revisions return 27 to 46 bpq, without considering effect of the funds' different styles. An important question is whether the portfolio revisions remain profitable after taking into account transaction costs. A back-of-the-envelope calculation using the funds' turnover and the share holdings-weighted average bid-ask spread (see Panels A and B of Table 1) to measure transaction costs shows that the net returns are also positive. Our hedge funds turn over 39.2% of their portfolio holdings per quarter at an average round-trip cost of 0.38%, resulting in total

transaction costs of 15 bpq. Mutual funds turn over only 19.7% of their portfolio each quarter at a cost of 0.36%, implying total transaction costs of 7 bpq. These estimates are conservative because we assume that sophisticated institutions such as mutual and hedge funds pay the entire quoted spread. In practice, many transactions occur at prices inside the quotes, and the effective cost of trading is therefore likely lower (see Hasbrouck (2009)).

Figure 3 depicts a 3-year moving average of quarterly performance over time for mutual fund and hedge fund advisors. Plot A focuses on their F1M^{SzBm} measures, Plot B on the F1M^{DGTW} measures. In both panels, hedge funds earn abnormal style-adjusted returns and outperform mutual funds except for a brief period before the 2008 financial crisis. While mutual funds almost always perform well based on size- and BM-adjusted returns in Plot A, Plot B shows that this performance is entirely driven by their momentum style. Controlling for momentum, the F1M^{DGTW} measure reveals that mutual funds' performance is relatively flat and indistinguishable from zero. By contrast, controlling for past returns (Plot B) has virtually no effect on hedge funds' superior performance.

Figure 3 Plot C displays the separate DGTW-adjusted performance contributions of the stock purchases and sales of hedge funds. It confirms the results from Table 4 that hedge funds' superior performance is driven mostly by stock purchases. Interestingly, hedge funds' sales positively contributed to their performance during the second half of 2008, exactly when hedge funds' buy performance was at its weakest. The stocks sold by hedge funds during the 2008 crisis subsequently underperformed their size, book-to-market, and momentum benchmark, indicating some degree of sell-side stock-picking skill during the crisis.

Panel C of Table 4 examines performance persistence. Specifically, it sorts each of the three types of advisors into two groups—underperformers and outperformers—based on the sign of their F1M_i^{SzBm} or F1M_i^{DGTW} measures during the first half of the sample period. It then reports their performance measures during the second half of the sample period. We find performance persistence among successful hedge funds but not among other types of

fund advisors or poorly performing hedge funds. The hedge fund advisors that are successful in the first half of the sample period earn significant risk-adjusted returns of 43 bpq during the second half of the sample period based on F1M_i^{SzBm}, and 33 bpq based on F1M_i^{DGTW}.

Table 5's Fama-MacBeth cross-sectional regressions of performance on dummies for advisor type further examines the relative performance of the advisor types. The dummy coefficients of the regression equation (analogous to equation (12), but with a different dependent variable) confirm that hedge fund advisors have superior stock-picking ability. The insignificant intercept indicates that the performance of "other" institutional advisors is close to zero. Mutual fund advisors significantly outperform these other advisors by 10.6 bpq based on the F1M^{SzBm} measure, of which 7.6 bpq come from their purchases. However, all of this alpha is due to the tendency of mutual funds to follow momentum strategies; once we control for momentum, the performance difference drops to a negligible 1.1 bpq. By contrast, hedge fund managers significantly outperform "other" institutional managers by 24.4 bpq based on F1M^{SzBm} and 24.9 bpq based on F1M^{DGTW}. Virtually all of this performance can be attributed to hedge fund purchases. Moreover, the last column of Table 5, which reports the difference in the two slope coefficients, reveals a significant performance difference between mutual and hedge funds. The performance gap is driven by the purchases and is larger after accounting for mutual funds' momentum style. Using the F1M^{DGTW} measure, hedge fund buys outperform mutual fund buys by 22.5 bpq.

3.3. Performance and Investment Style

To assess whether investment style influences performance, Table 6 sorts fund advisors into contrarians and momentum subgroups based on the sign of their average L0M_i^{SzBm} measure over the sample period.[21] For each subgroup, we compute the F1M_i^{SzBm} and F1M_i^{DGTW}

[21] Our contrarian vs. momentum classification is based on the entire sample period. To verify that past performance does not drive later style choices, we also classified fund advisors into the two style-types using the first half of the sample period only, and the results are virtually the same.

performance measures for the entire sample. Panel A, reports the time-series average of the quarterly performance measures for each subgroup; Panel B the corresponding cross-sectional averages, as in Tables 2 and 4.

The sorts in Table 6 reveal a striking difference between the performance of contrarian and momentum hedge funds. Only contrarian hedge funds (the 867 funds with $\text{L0M}_i < 0$ in Table 2 Panel C) achieve significantly positive alpha. Contrarian hedge funds outperform their size-, BM-, and momentum-adjusted benchmarks by 34 bpq in Panel A and 60 bpq in Panel B. These figures significantly exceed the corresponding alpha of momentum hedge funds, which is close to zero (the difference, untabulated, is significant at the 5% level in both panels). The performance difference between contrarian and momentum hedge funds is driven mostly by buys. Contrarian hedge funds' buys beat their DGTW style-adjusted benchmark by 33 bpq (Panel A) and 41 bpq (Panel B), while their sells outperform by only 1 bpq (Panel A) and 19 bpq (Panel B), respectively. In contrast, the average alphas of the 475 momentum hedge funds are statistically indistinguishable from zero. Thus, the significant hedge fund performance observed in Table 4 is entirely driven by contrarian hedge funds. The latter group has the ability to pick superior stocks to buy, and, based on the cross-sectional results in Panel B, also appears to have some talent for selling the stocks they own.

Regardless of style, the results in Table 6 show no evidence of investment skills among mutual fund managers beyond the effect of momentum on stock returns.[22]

[22]To further test whether the intensity of momentum or contrarian behavior is rewarded, we study coefficients from Fama-McBeth regressions of a fund's quarter $q+1$ performance (both overall and for its buys and sells) on its quarter q L0M style measure (or the comparable L0M measure for its buys and sells). The results (unreported) are consistent with those reported in Table 6. These regressions, run separately for mutual and hedge funds, show a significant positive relation between the L0M style measure and subsequent returns for mutual funds, but only if the returns do not control for stock momentum. The intercepts from the regression are insignificant, confirming that mutual fund managers' returns are an artifact of their momentum investing. By contrast, hedge funds' significant intercepts and insignificant slope coefficients—regardless of the benchmark—confirm that their performance is due to superior stock-picking skills, and not driven by their investment style.

3.4. Evidence from Stock Returns

Up to this point, the paper focused its performance analysis at the fund level. An alternative perspective comes from looking at the abnormal returns of stocks that are favored or disfavored by various groups of fund advisors. This approach allows us to study the monthly abnormal returns of stocks sorted both by the trades of groups of advisors and by trades between groups of advisors.

We construct the buy (sell) portfolios for different types of advisers as follows: First, we classify advisors into groups based on their fund-type (mutual or hedge fund) and style (momentum or contrarian, according to their average L0M_i^{SzBm} over the sample period). We then compute the monthly DGTW-adjusted equally weighted portfolio returns of stocks for which the aggregate shareholdings of a given group of advisors increased (decreased) over the previous quarter. We also examine stock portfolios for which a pairing of two advisor groups saw one group increase (decrease) its shareholdings and the other group decrease (increase) its shareholdings. Table 7 reports the *monthly* alphas (here, DGTW-adjusted average monthly returns) of the buy, sell, and buy minus sell portfolios for each group of advisors or pairings of groups of advisors. Panel A shows the mutual and hedge fund portfolios without regard to style, Panel B portfolios based on subgroups sorted by style for each fund type, and Panel C based on pairs of subgroups.

Consistent with the paper's earlier fund-level results, Panels A and B show that a) the alphas of stocks bought by hedge fund advisors exceed those of the stocks they sell by 27 basis points *per month* [bpm], b) most of the 27 basis point difference stems from the buys of stocks that beat their DGTW benchmarks, and c) nearly all of this alpha difference is due to the trades of contrarian hedge fund advisors. By contrast, the stocks sold by the mutual fund advisor group tend to be good performers in the subsequent quarter, earning almost 20 basis points per month more than their DGTW benchmark.

Figure 4 shows that these findings are persistent. It graphs 36-month moving averages of the DGTW-adjusted returns for each of the four buy minus sell portfolios in Table 7 Panel B. Plot A shows the performance over time of the buy minus sell portfolio of the contrarian advisors, whereas Plot B shows the performance of momentum advisors. The solid line in Plot A confirms that the trades of contrarian hedge fund advisors consistently produce a positive alpha over the sample period, while the solid line in Plot B shows that the trades of momentum hedge funds do not. The dashed lines also show consistent negative alphas for the mutual fund advisors' buy-minus-sell portfolios, irrespective of whether their strategy is contrarian (Panel A) or trend following (Panel B).

Table 7 Panel C examines whether stock returns are influenced by concordance or disagreement between the groups of funds in Panel B. Eight of the sixteen cells in the panel represent stocks for which the two fund advisor types trade in opposite directions; eight represent stocks with the same trade directions. Among the eight cases of disagreement, hedge fund advisors are on the profitable side of the trade in all but one case (momentum hedge fund sells, contrarian mutual fund buys). Moreover, in seven of the eight "concordance" cells, the stocks with mutual funds on the same side of the trade contribute less to hedge fund performance than stocks with mutual funds on the opposite side of the trade. For example, of the stocks that contrarian hedge funds buy, those that momentum mutual funds sell subsequently earn 28.2 bpm, while those that momentum mutual funds also buy earn 7.2 bpm.

Stocks that contrarian hedge funds buy and momentum mutual funds sell exhibit the highest portfolio alphas (28.2 bpm), while the lowest alphas (-11.9 bpm) belong to stocks that contrarian hedge funds sell and contrarian mutual funds buy. Besides the latter case, contrarian hedge fund sells lack a significant negative alpha. Contrarian hedge fund buys are generally more successful. They have a significantly positive alpha unless momentum mutual funds also buy the stock. Irrespective of style, mutual fund trades generally do

not earn abnormal returns: the stocks that mutual funds buy (the first and third column) lack a significant positive alpha (except when contrarian hedge funds are also buying), and the stocks that they sell (the second and fourth columns) lack a significant negative alpha. Overall, these findings show that hedge funds (especially those that are contrarian) benefit from mutual fund sells.

3.5. Robustness tests

Our results are robust to alternative weight calculations, alternative formation and holding periods, and alternative return adjustments.

Alternative weights The weight of a stock may change even when the *number* of shares remains unchanged if the size of the equity portfolio changes. To address concerns that some weight changes may not represent discretionary buy and sell decisions, we also compute 'real' buy ('real' sell) L0M and F1M measures as partial sums only over the stocks for which there is an increase (decrease) in *both* portfolio weight and number of shares held. These 'real' momentum and performance measures, presented in Panel A of Table 8, are virtually identical to the baseline case in Panels A of Tables 2 and 4.

Alternative formation period The baseline L0M measure examines whether funds' trades are influenced by most recent returns as it relates current quarter weight changes to *current quarter returns*.[23] To assess whether funds' trades are also influenced by more distant returns, we compute an L1M measure (Lag 1 Momentum), which relates current

[23]Since fund holdings are observed at quarter-ends while the actual trading occurs throughout the quarter, some trades may take place before the returns in the L0M measure are observed. As GTW (1995, p. 1091) argue, this would not bias the momentum measure, except in the unlikely case when portfolio revisions occur predominantly at the beginning of the quarter and are informative about subsequent returns. In that case, the hedge fund L0M measure would be biased upwards—weighing against our finding that hedge funds are contrarian investors.

quarter weight changes to *past quarter returns*.[24] Panel B of Table 8 shows that the L1M momentum measures are consistent in sign but are smaller in absolute value than the L0M measures, indicating that the styles of both mutual and hedge funds are influenced by more recent returns. The L0M (L1M) measures are 0.71 (0.18) for mutual funds and −0.34 (−0.18) for hedge funds, all statistically significant.

Alternative holding period The F1M measure from equation (13) reported in Table 4 examines the performance of stocks in the immediate 3 months following rebalancing. Panel C of Table 8 reports how these stocks perform over the remainder of the year through a performance measure, F1M^{4-12}, which is based on returns over months $m = 4, ..., 12$ following portfolio rebalancing. Similar to the first three months, mutual fund rebalancing does not produce superior returns for the remainder of the year. In contrast, hedge fund buys continue to outperform although most profits come during the first quarter. For example, hedge fund buys generate a DGTW-alpha of 26 basis points over the immediate quarter following the trade (Table 4 Panel A), followed by an additional 14 basis points over the subsequent three quarters (Table 8 Panel C).

Alternative return adjustments Our main performance measures include two types of risk-adjustment: 1) *self-benchmarking*—using the returns the fund would have realized if it did not rebalance its holdings over the quarter, and 2) *characteristics-benchmarking*—using the returns of stocks with similar characteristics as a benchmark, thus comparing the returns of the fund's trades with the returns on a 'naïve' style-based trading strategy. Characteristics-benchmarking allows us to interpret the performance measures as true alpha derived from the manager's stock-picking skills, as well as to examine the performance of

[24]This measure is the same as GTW's L1M measure, except for an adjustment to the weights. The weights in L1M differ from the weights in L0M (see equation (2)) in that they use the price at the end of quarter $q-2$ instead of the price at the end of quarter $q-1$, to ensure that weights are unaffected by subsequent returns.

buys and sells separately. For robustness, Panel D of Table 8 also presents momentum (L0M) and performance (F1M) measures based on raw and excess returns (calculated by subtracting from each stock month-t return the month-t return of the CRSP value-weighted index). The alternative L0M and F1M measures produce very similar results to the baseline case for both mutual funds and hedge funds. For example, the raw, excess, SzBm-, and DGTW-adjusted L0M measures for hedge funds are -0.31, -0.30, -0.34, -0.34, respectively, while the corresponding F1M measures are 0.27, 0.25, 0.28, and 0.28.[25] This similarity indicates that the stocks bought by mutual and hedge funds have similar characteristics to the stocks sold by the same type of funds.

4. Conclusion

Prior literature documents that mutual fund managers tend to follow momentum strategies, and their style accounts for any abnormal returns they generate. This paper examines whether the same momentum strategy is widely deployed by hedge fund managers, and whether the investment style affects performance. Using a database constructed from mandatory reporting of advisors' holdings of stocks, we find that the style and performance of hedge fund managers are remarkably different from those of mutual funds.

Most hedge funds are contrarian, largely due to a strong tendency to buy recent losers. The losing stocks acquired by hedge funds do well over the subsequent quarter—earning significant alphas that seem unaffected by whether alpha controls for the return-depressing effects of being a losing stock. Despite the headwinds from lower expected returns faced by simple contrarian strategies, it is only contrarian hedge funds who exhibit superior performance, outperforming both momentum hedge funds and risk-adjusted benchmarks. This

[25]For further assurance that this performance is indeed abnormal, in unreported results, we have further regressed the time-series of the raw and characteristic-adjusted F1M performance measures in Panel D on quarterly returns of the Fama and French (1993) and Carhart (1997) factors. The resulting time-series alphas are of similar magnitude and significance as the ones reported in Panel D.

finding is not influenced by survivorship bias (the database does not suffer from it), transaction costs, or any other expenses associated with a fund (our performance measures are based solely on the underlying portfolio). We conclude that the superior performance of contrarian hedge funds is due to their managers' ability to identify underpriced stocks among losers that other investors avoid. Neither momentum hedge funds, nor mutual funds exhibit stock-picking talent.

In addition to fund-level analysis, our findings are confirmed by a stock-level analysis. In particular, we sort stocks into categories based on aggregate net buys or sells of various categories of fund advisors, namely whether the advisor is a hedge fund or mutual fund manager. We find that the highest alpha stocks are sold to contrarian hedge funds by momentum mutual funds. Thus, contrarian hedge funds profit to a great extent from fleecing mutual funds out of their undervalued stocks. Uninformed momentum mutual funds that blindly sell losing stocks face an adverse selection problem when selling to hedge funds that can distinguish undervalued from overvalued stocks. Why mutual funds do this is not readily apparent, but portfolio liquidity requirements and the need to cater to retail investors, suggested by Massa, Simonov, and Yan (2012), offer promising avenues for future research.

Exchange-traded funds (ETFs) and their relationship to hedge funds provides another interesting research arena. Unlike mutual funds, ETFs have the benefit of price adjustment to cushion the redemptions of retail investors. However, unlike mutual funds, ETFs tend to be passive holders of stocks. Because they have less discretion in the stock they sell in the face of shareholder redemptions, they may be more subject to adverse selection than mutual funds. The extent to which contrarian hedge funds profit from ETFs remains an open question.

Finally, it might be instructive to understand why hedge fund buys account for virtually all of their superior performance of contrarian hedge funds. On the one hand, this finding is consistent with theories of private information acquisition—it is easier to come across a gem

of a trade when scanning a broad universe of stocks. There are too few stocks in a hedge fund portfolio to identify one that is greatly overvalued. While the universe of stocks offers plenty of gems to short, the chance that the same stock will be in the hedge fund portfolio are relatively slim. Hedge funds, of course, often short stocks, despite short sale constraints, but are not required to report their equity short positions. If future reporting requirements include short positions, the asymmetry in the abnormal performance of purchases and sales of hedge funds could disappear—and be regarded as an artifact of data limitations.

References

Agarwal, Vikas, Naveen D. Daniel, and Narayan Y. Naik, 2009, Role of Managerial Incentives and Discretion in Hedge Fund Performance, *Journal of Finance* 64, 2221–2256.

Agarwal, Vikas, Wei Jiang, Yuehua Tang, and Baozhong Yang, 2013, Uncovering Hedge Fund Skill from the Portfolio Holdings They Hide, *Journal of Finance* 68, 739–783.

Asness, Clifford S., Tobias J. Moskowitz, and Lasse H. Pedersen, 2013, Value and Momentum Everywhere, *Journal of Finance* 68, 929–985.

Avramov, Doron, Tarun Chordia, Gergana Jostova, and Alexander Philipov, 2013, Anomalies and Financial Distress, *Journal of Financial Economics* 108, 139–159.

Ben-David, Itzhak, Francesco Franzoni, and Rabih Moussawi, 2012, Hedge Fund Stock Trading in the Financial Crisis of 2007-2009, *Review of Financial Studies* 25, 1–54.

Beracha, Eli, and Hilla Skiba, 2011, Momentum in Residential Real Estate, *The Journal of Real Estate Finance and Economics* 43, 299–320.

Brunnermeier, Markus K., and Stefan Nagel, 2004, Hedge Funds and the Technology Bubble, *Journal of Finance* 59, 2013–2040.

Carhart, Mark M., 1997, On Persistence in Mutual Fund Performance, *Journal of Finance* 52, 57–82.

Chan, Kalok, Allaudeen Hameed, and Wilson Tong, 2000, Profitability of Momentum Strategies in the International Equity Markets, *Journal of Financial and Quantitative Analysis* 35, 153–172.

Chen, Joseph, Samuel Hanson, Harrison Hong, and Jeremy Stein, 2008, Do Hedge Funds Profit from Mutual Fund Distress?, NBER Working Paper.

Daniel, Kent, Mark Grinblatt, Sheridan Titman, and Russ Wermers, 1997, Measuring Mutual Fund Performance with Characteristic-Based Benchmarks, *Journal of Finance* 52, 1035–1058.

Falkenstein, Eric G., 1996, Preferences for Stock Characteristics as Revealed by Mutual Fund Portfolio Holdings, *Journal of Finance* 51, 111–135.

Fama, Eugene F., and Kenneth R. French, 1993, Common Risk Factors in the Returns on Stocks and Bonds, *Journal of Financial Economics* 33, 3–56.

Fama, Eugene F., and Kenneth R. French, 2008, Dissecting Anomalies, *Journal of Finance* 63, 1653–1678.

Fama, Eugene F., and James D. MacBeth, 1973, Risk, Return, and Equilibrium: Empirical Tests, *Journal of Political Economy* 81, 607–636.

Fung, William, and David A. Hsieh, 1997, Empirical Characteristics of Dynamic Trading Strategies: The Case of Hedge Funds, *Review of Financial Studies* 10, 275–302.

Fung, William, and David A. Hsieh, 2001, The Risk in Hedge Fund Strategies: Theory and Evidence from Trend Followers, *Review of Financial Studies* 14, 313–341.

Fung, William, and David A. Hsieh, 2002a, Asset-Based Style Factors for Hedge Funds, *Financial Analysts Journal* 58, 16–27.

Fung, William, and David A. Hsieh, 2002b, Hedge-Fund Benchmarks: Information Content and Biases, *Financial Analysts Journal* 58, 22–34.

Getmansky, Mila, Andrew W. Lo, and Igor Makarov, 2004, An Econometric Model of Serial Correlation and Illiquidity in Hedge Fund Returns, *Journal of Financial Economics* 74, 529–609.

Gorton, Gary B., Fumio Hayashi, and Geert K. Rouwenhorst, 2008, The Fundamentals of Commodity Futures Returns, Yale ICF Working Paper No. 07-08.

Griffin, John M., and Jin Xu, 2009, How Smart Are the Smart Guys? A Unique View from Hedge Fund Stock Holdings, *Review of Financial Studies* 22, 2531–2570.

Grinblatt, Mark, and Matti Keloharju, 2000, The investment behavior and performance of various investor-type: a study of Finland's unique data set, *Journal of Financial Economics* 55, 43–67.

Grinblatt, Mark, and Sheridan Titman, 1993, Performance Measurement without Benchmarks: An Examination of Mutual Fund Returns, *The Journal of Business* 66, 47–68.

Grinblatt, Mark, Sheridan Titman, and Russ Wermers, 1995, Momentum Investment Strategies, Portfolio Performance, and Herding: A Study of Mutual Fund Behavior, *The American Economic Review* 85, 1088–1105.

Hasbrouck, Joel, 2009, Trading Costs and Returns for U.S. Equities: Estimating Effective Costs from Daily Data, *The Journal of Finance* 64, 1445–1477.

Jagannathan, Murali, Alexey Malakhov, and Dmitry Novikov, 2010, Do Hot Hands Exist among Hedge Fund Managers? An Empirical Evaluation, *Journal of Finance* 65, 217–255.

Jegadeesh, Narasimhan, and Sheridan Titman, 1993, Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency, *Journal of Finance* 48, 65–91.

Jegadeesh, Narasimhan, and Sheridan Titman, 2001, Profitability of Momentum Strategies: An Evaluation of Alternative Explanations, *Journal of Finance* 56, 699–720.

Jostova, Gergana, Stanislava Nikolova, Alexander Philipov, and Christof Stahel, 2013, Momentum in Corporate Bond Returns, *Review of Financial Studies* 26, 1649–1693.

Kosowski, Robert, Narayan Y. Naik, and Melvyn Teo, 2007, Do Hedge Funds Deliver Alpha? A Bayesian and Bootstrap Analysis, *Journal of Financial Economics* 84, 229–264.

Makarov, Igor, and Guillaume Plantin, 2015, Rewarding Trading Skills without Introducing Gambling, *Journal of Finance* 70, 925–962.

Massa, Massimo, Andrei Simonov, and Shan Yan, 2012, Contrarian Hedge Funds and Momentum Mutual Funds, Working Paper, INSEAD.

Miffre, Joelle, and Georgios Rallis, 2007, Momentum Strategies in Commodity Futures Markets, *Journal of Banking and Finance* 31, 1863–1886.

Okunev, John, and Derek White, 2003, Do Momentum-Based Strategies Still Work in Foreign Currency Markets?, *Journal of Financial and Quantitative Analysis* 38, 425–447.

Patton, Andrew J., Tarun Ramadorai, and Michael Streatfield, 2015, Change you Can Believe In? Hedge Fund Data Revisions, *Journal of Finance* 70, 963–999.

Reca, Blerina, Richard Sias, and H. J. Turtle, 2014, Hedge Fund Crowds and Mispricing, Working paper, University of Toledo.

Rouwenhorst, K. Geert, 1998, International Momentum Strategies, *Journal of Finance* 53, 267–284.

Scharfstein, David S., and Jeremy C. Stein, 1990, Herd Behavior and Investment, *American Economic Review* 80, 465–479.

Watanabe, Masahiro, 2008, Price Volatility and Investor Behavior in an Overlapping Generations Model with Information Asymmetry, *Journal of Finance* 63, 229–272.

Table 1. Descriptive statistics

Panels A and B report the number of observations (unique institutions and fund-quarter observations) and the average fund characteristics for mutual funds, hedge funds, and other institutional investors. Turnover is measured as the average of the dollar values of buys and sells over a quarter compared to the initial portfolio value: turnover=($buys$_q$+$sells$_q$)/(2×$holdings$_{q-1}$). Panel C reports the time series means of cross-sectional average characteristics of stocks held by the different types of institutional investors, weighted by the fraction of shares that the institution holds. Bid-ask spread is the difference between the ask and bid prices from the monthly CRSP files as a percentage of the closing mid-price; analysts' forecast dispersion is the standard deviation in analysts' EPS forecasts standardized by the absolute value of the consensus forecast; SUE (standardized unexpected earnings) is the current quarter reported EPS minus the EPS four quarters prior, divided by the standard deviation of EPS changes over the last eight quarters; S&P rating is the S&P long-term issuer credit rating. Panel D displays the percentage of stocks held by each type of investors that are also held by other investor types. The sample period is 60 quarters long—from January 1998 to December 2012.

Characteristic	Mutual funds	Hedge funds	Other
Panel A. Observations			
Total unique institutions	589	1,342	2,894
Average fund observations per quarter	354	484	1,230
Total fund-quarter observations	21,219	29,050	73,821
Average life in sample (in quarters)	36.0	21.6	25.5
Panel B. Average characteristics by fund			
Number of stocks per fund	374	128	233
Stock holdings ($millions)	11,288	864	3,103
Dollar holdings per stock ($millions)	30.42	6.80	13.23
Turnover (%/quarter)	19.7	39.2	15.7
Panel C. Share holdings-weighted average stock characteristics			
Shares held/shares outstanding (%)	23.12	4.85	17.23
Price ($)	33.84	26.95	35.61
Return (% per month)	0.65	0.90	0.60
Book-to-market ratio	0.57	0.68	0.54
Market capitalization ($billions)	41.02	22.15	51.93
Trading volume ($millions)	2.03	1.59	2.28
Bid-Ask Spread (%)	0.36	0.38	0.34
Common dividends ($/share)	0.62	0.38	0.73
S&P credit rating	A−	BBB	A−
Volatility (% per month, $\sqrt{\sum r_{daily}^2} \times 100$)	11.01	12.29	10.51
Analyst coverage (# of analysts)	17.53	14.18	18.22
Analyst dispersion	0.14	0.21	0.12
Institutional ownership (%)	69.96	72.18	67.43
SUE	0.85	0.61	0.92
Panel D. Stock holdings overlap across funds			
Mutual Funds	100.00	76.32	85.31
Hedge Funds	99.23	100.00	92.24
Other	99.09	82.40	100.00

Table 2. Momentum measures

We compute the momentum measure L0M_{iq} for each fund in each quarter as in equation (4), using benchmark-adjusted returns. Panel A presents the time-series mean of the quarterly average performance measures for each fund type over the January 1998 to December 2012 period. Time-series t-statistics, calculated as in equation (5), are presented in parentheses (bold if significant at the 5% level). The percentage of positive quarterly measures is provided in brackets. Panel B presents the cross-sectional mean of the fund-level average momentum measures along with the t-statistic for the cross-sectional mean. Panel C reports the number and the proportion of funds that are momentum ($\text{L0M}_i > 0$) and contrarian ($\text{L0M}_i < 0$) traders. For Panel D, we sort funds into momentum and contrarian groups based on the sign of their L0M_i momentum measure during the first half of the sample period (January 1998 to June 2005), and report for each group the average momentum measure L0M_i and the proportion of funds that are contrarian based on L0M_i during the second half of the sample period (July 2005 to December 2012).

Panel A: Time-series average of quarterly momentum measures

	Mutual Funds			Hedge Funds		
Measure	All	Buys	Sells	All	Buys	Sells
L0M	0.71	0.39	0.32	−0.34	−0.37	0.03
	(**14.88**)	(**5.94**)	(**5.66**)	(**−3.62**)	(**−2.43**)	(0.29)
	[1.00]	[0.87]	[0.82]	[0.30]	[0.45]	[0.48]

Panel B: Cross-sectional average of fund-level momentum measures

	Mutual Funds			Hedge Funds		
Measure	All	Buys	Sells	All	Buys	Sells
L0M	1.07	0.47	0.59	−0.70	−0.66	−0.04
	(**7.52**)	(**4.57**)	(**5.38**)	(**−5.28**)	(**−6.22**)	(−0.56)

Panel C: Distribution of momentum ($L0M_i > 0$) and contrarian ($L0M_i < 0$) traders

	Mutual Funds			Hedge Funds		
Style	All	Buys	Sells	All	Buys	Sells
Momentum traders (#)	396	352	406	475	444	644
Contrarians (#)	193	237	183	867	898	698
Proportion of contrarians	0.33	0.40	0.31	0.65	0.67	0.52

Panel D: Persistence of investment style

	Style during second subperiod					
	Average L0M_i			Proportion of contrarians ($\text{L0M}_i < 0$)		
Style during first subperiod	MF	HF	Other	MF	HF	Other
Contrarians ($\text{L0M}_i < 0$)	−0.33	−1.67	−0.37	0.71	0.79	0.63
	(**−4.31**)	(**−9.26**)	(**−7.25**)			
Momentum traders ($\text{L0M}_i > 0$)	1.04	1.06	0.61	0.22	0.36	0.22
	(**6.92**)	(**3.29**)	(**10.80**)			

Table 3. Momentum measures: Fama-MacBeth cross-sectional regressions
Each quarter, we run Fama-MacBeth cross-sectional regressions across all funds of L0M_{iq} measures on a constant and dummy variables indicating whether the fund is a mutual fund (MF) or a hedge fund (HF):

$$\text{L0M}_{iq} = c_q + d_{MF,q}\,\text{MF}_i + d_{HF,q}\,\text{HF}_i + e_{iq}$$

The table presents the time-series averages of the estimated coefficients with their sample t-statistics in parentheses (bold if significant at the 5% level). The last column provides a test for the difference between the estimated coefficients for hedge funds and mutual funds. The sample period is from January 1998 to December 2012.

	Intercept	Mutual Funds	Hedge Funds	Difference
Dependent variable	c	d_{MF}	d_{HF}	$d_{HF} - d_{MF}$
Overall				
L0M	0.261 (**5.45**)	0.454 (**13.30**)	−0.599 (**−6.88**)	−1.053 (**−11.26**)
Buys				
L0Mb	0.083 (1.50)	0.309 (**9.18**)	−0.453 (**−3.65**)	−0.763 (**−5.93**)
Sells				
L0Ms	0.177 (**4.92**)	0.145 (**4.89**)	−0.145 (−1.75)	−0.290 (**−3.29**)

Table 4. Performance measures

We compute F1M_{iq}^{SzBm} and F1M_{iq}^{DGTW} performance measures for each fund and each quarter as in equation (13) using size-, book-to-market (and momentum) adjusted returns. Panel A presents the time-series mean of the quarterly average performance measures for each fund type over the January 1998 to December 2012 period. Time-series t-statistics are presented in parentheses (bold if significant at the 5% level). The percentage of positive quarterly measures is provided in brackets. Panel B presents the cross-sectional mean of the fund-level average performance measures along with their associated t-statistics. For Panel C, we sort funds into underperformers/outperformers based on their average F1M_{i}^{SzBm} (F1M_{i}^{DGTW}) during the first half of the sample period (January 1998 to June 2005), and report their average F1M_{i}^{SzBm} (F1M_{i}^{DGTW}) performance during the second half of the sample period (July 2005 to December 2012).

Panel A: Time-series average of quarterly performance measures

	Mutual Funds			Hedge Funds		
Measure	All	Buys	Sells	All	Buys	Sells
F1M^{SzBm}	0.13	0.10	0.03	0.27	0.28	−0.01
	(**2.67**)	(1.71)	(0.82)	(**3.61**)	(**2.57**)	(−0.12)
	[0.65]	[0.62]	[0.52]	[0.65]	[0.62]	[0.45]
F1M^{DGTW}	0.02	0.04	−0.02	0.25	0.26	−0.01
	(0.51)	(0.99)	(−0.75)	(**3.72**)	(**3.17**)	(−0.15)
	[0.58]	[0.58]	[0.47]	[0.68]	[0.65]	[0.47]

Panel B: Cross-sectional average of fund-level performance measures

	Mutual Funds			Hedge Funds		
Measure	All	Buys	Sells	All	Buys	Sells
F1M^{SzBm}	0.12	−0.00	0.12	0.46	0.27	0.19
	(1.01)	(−0.02)	(1.38)	(**6.54**)	(**4.82**)	(**3.30**)
F1M^{DGTW}	−0.08	−0.06	−0.02	0.40	0.26	0.15
	(−0.86)	(−0.71)	(−0.35)	(**5.92**)	(**4.76**)	(**2.82**)

Panel C: Persistence of performance

	Performance during second subperiod					
	F1M_{i}^{SzBm}			F1M_{i}^{DGTW}		
Performance during first subperiod	MF	HF	Other	MF	HF	Other
Underperformers (F1M_i <0)	−0.02	0.05	0.02	−0.01	0.18	−0.00
	(−0.22)	(0.42)	(0.93)	(−0.08)	(1.78)	(−0.10)
Outperformers (F1M_i >0)	0.06	0.43	−0.02	−0.02	0.33	−0.04
	(1.54)	(**3.65**)	(−0.54)	(−0.70)	(**2.98**)	(−0.78)

Table 5. Performance measures: Fama-MacBeth cross-sectional regressions
Each quarter, we run Fama-MacBeth cross-sectional regressions across all funds of F1M_{iq} measures on a constant and dummies indicating whether the fund is a mutual fund (MF) or hedge fund (HF):

$$\text{F1M}_{iq} = c_q + d_{MF,q}\,\text{MF}_i + d_{HF,q}\,\text{HF}_i + e_{iq}$$

The SzBm (DGTW) label indicates that the measure uses returns adjusted for size and book-to-market (and momentum). The table presents the time-series average of the estimated coefficients with their sample t-statistics in parentheses (bold if significant at the 5% level). The last column provides a test for the difference between the estimated coefficients for hedge funds and mutual funds. The sample period is from January 1998 to December 2012.

	Intercept	Mutual Funds	Hedge Funds	Difference
Dependent variable	c	d_{MF}	d_{HF}	$d_{HF} - d_{MF}$
Overall				
F1M^{SzBm}	0.026	0.106	0.244	0.138
	(0.54)	(**3.51**)	(**4.12**)	(**2.08**)
F1M^{DGTW}	0.005	0.011	0.249	0.238
	(0.17)	(0.52)	(**4.24**)	(**3.28**)
Buys				
F1Mb^{SzBm}	0.023	0.076	0.257	0.181
	(0.52)	(**2.52**)	(**2.79**)	(1.87)
F1Mb^{DGTW}	0.017	0.022	0.247	0.225
	(0.56)	(1.01)	(**3.63**)	(**3.16**)
Sells				
F1Ms^{SzBm}	0.002	0.030	−0.013	−0.043
	(0.10)	(1.16)	(−0.18)	(−0.58)
F1Ms^{DGTW}	−0.013	−0.011	0.003	−0.008
	(−0.68)	(−0.54)	(0.05)	(−0.23)

Table 6. Performance of momentum and contrarian funds

The table presents the time-series and cross-sectional average performance measures F1M_{iq}^{SzBm} and F1M_{iq}^{DGTW} for contrarian and momentum traders for both mutual and hedge funds. The SzBm (DGTW) label indicates that the measure uses returns adjusted for size and book-to-market (and momentum). Momentum (contrarian) funds are those with a positive (negative) average performance measure L0M_i over the life of the funds. There are 396 (193) momentum (contrarian) mutual funds and 475 (867) momentum (contrarian) hedge funds, respectively. Cross-sectional t-statistics are presented in parentheses (bold if significant at the 5% level). The t-test for the difference in means between contrarian and momentum funds assumes unequal variances across groups and unequal sample sizes.

Panel A: Time-series average of quarterly performance measures for each fund type

Contrarian funds (L0M_i <0)

	Mutual Funds			Hedge Funds		
Measure	All	Buys	Sells	All	Buys	Sells
F1M^{SzBm}	−0.02	0.03	−0.04	0.35	0.34	0.01
	(−0.55)	(0.83)	(−1.34)	(**3.99**)	(**2.85**)	(0.12)
F1M^{DGTW}	0.01	0.04	−0.03	0.34	0.33	0.01
	(0.31)	(1.42)	(−1.42)	(**4.09**)	(**3.52**)	(0.21)

Momentum funds (L0M_i >0)

	Mutual Funds			Hedge Funds		
Measure	All	Buys	Sells	All	Buys	Sells
F1M^{SzBm}	0.22	0.14	0.08	0.10	0.14	−0.04
	(**2.91**)	(1.58)	(1.26)	(0.95)	(0.89)	(−0.33)
F1M^{DGTW}	0.02	0.04	−0.02	0.08	0.13	−0.05
	(0.42)	(0.68)	(−0.41)	(0.86)	(1.05)	(−0.53)

Panel B: Cross-sectional average of fund-level performance measures

Contrarian funds (L0M_i <0)

	Mutual Funds			Hedge Funds		
Measure	All	Buys	Sells	All	Buys	Sells
F1M^{SzBm}	−0.11	−0.07	−0.04	0.65	0.44	0.21
	(−1.83)	(−1.87)	(−1.00)	(**7.08**)	(**6.66**)	(**3.00**)
F1M^{DGTW}	−0.04	−0.03	−0.01	0.60	0.41	0.19
	(−0.99)	(−1.03)	(−0.18)	(**7.04**)	(**6.47**)	(**3.05**)

Momentum funds (L0M_i >0)

	Mutual Funds			Hedge Funds		
Measure	All	Buys	Sells	All	Buys	Sells
F1M^{SzBm}	0.23	0.03	0.20	0.12	−0.03	0.15
	(1.31)	(0.16)	(1.54)	(1.10)	(−0.34)	(1.52)
F1M^{DGTW}	−0.10	−0.08	−0.03	0.04	−0.03	0.07
	(−0.73)	(−0.59)	(−0.32)	(0.38)	(−0.26)	(0.72)

Table 7. DGTW-adjusted monthly portfolio returns sorted on aggregate fund trades
Each month, stocks are included in equally weighted monthly buy (sell) portfolios if their aggregate fund holdings increased (decreased) over the previous quarter. The table reports time-series averages and sample t-statistics of DGTW-adjusted monthly portfolio returns. Panel A summarizes buy, sell, and buy minus sell portfolio returns by fund category, while Panel B presents summaries by style. Panel C summarizes portfolio returns based on the interaction between the trades of mutual and hedge funds. The sample period is from January 1998 to December 2012.

Panel A. By fund category

Portfolio	Buys	Sells	Buys−Sells
Mutual funds	−0.047	0.197	−0.244
	(−0.70)	(**2.79**)	(−**2.63**)
Hedge funds	0.187	−0.083	0.270
	(**3.63**)	(−1.95)	(**5.48**)

Panel B. By Style

Portfolio	Buys	Sells	Buys−Sells
Contrarian hedge funds	0.182	−0.083	0.265
	(**3.49**)	(−1.95)	(**5.38**)
Momentum hedge funds	0.123	0.087	0.035
	(1.67)	(**1.99**)	(0.39)
Contrarian mutual funds	0.030	0.145	−0.115
	(0.70)	(**2.83**)	(−**2.10**)
Momentum mutual funds	−0.015	0.176	−0.191
	(−0.22)	(**2.67**)	(−1.83)

Panel C. Buy-Sell interactions by mutual fund-hedge fund style

	Momentum Mutual Funds		Contrarian Mutual Funds	
	Buys	Sells	Buys	Sells
Contrarian hedge fund buys	0.072	0.282	0.157	0.219
	(0.86)	(**3.67**)	(**3.02**)	(**3.19**)
Contrarian hedge fund sells	−0.100	−0.042	−0.119	−0.018
	(−1.35)	(−0.48)	(−**2.42**)	(−0.30)
Momentum hedge fund buys	0.100	0.139	0.101	0.180
	(0.84)	(**2.40**)	(1.37)	(**2.03**)
Momentum hedge fund sells	−0.018	0.217	0.103	0.085
	(−0.29)	(**2.31**)	(1.85)	(1.45)

Table 8. Robustness tests

This table presents time-series means of alternative momentum and performance measures. Panel A presents 'real' momentum and performance measures defined as partial sums over weight changes that are associated with changes in the number of shares held in the same direction as the weight change. Panel B compares the L0M measure from Table 2 Panel A to an alternative momentum measure, L1M, which is based on the vector product of a fund's current quarter weights changes with prior quarter returns. Panel C presents a performance measure $\text{F1M}_{i,q}^{4-12}$, which is based on holding period returns over months 4 to 12 following portfolio rebalancing. Time-series t-statistics are provided in parentheses underneath each coefficient (bold if significant at the 5% level). The t-statistics for the F1M^{4-12} measures in Panel C are Newey-West adjusted with 2 lags due to the overlapping quarterly returns. The percent of positive quarterly measures are provided in brackets. Panel D compares momentum and performance measures calculated using alternative measures of returns, where 'Raw' indicates raw returns and 'Excess' indicates that each stock month-t return is demeaned by the month-t CRSP value-weighted return. The SzBm (DGTW) label indicates that the measure uses returns adjusted for size and book-to-market (and momentum).

Panel A: Alternative weights: 'real' L0Mr *and* F1Mr

	Mutual Funds			Hedge Funds		
Measure	All	Buys	Sells	All	Buys	Sells
L0Mr	0.72	0.39	0.33	−0.30	−0.35	0.05
	(**14.51**)	(**5.95**)	(**5.92**)	(**−3.26**)	(**−2.40**)	(0.47)
	[1.00]	[0.87]	[0.83]	[0.32]	[0.45]	[0.48]
F1Mr^{SzBm}	0.12	0.09	0.03	0.25	0.26	−0.01
	(**2.51**)	(1.65)	(0.72)	(**3.38**)	(**2.51**)	(−0.09)
	[0.65]	[0.65]	[0.55]	[0.65]	[0.62]	[0.45]
F1Mr^{DGTW}	0.02	0.04	−0.02	0.24	0.25	−0.01
	(0.54)	(1.07)	(−0.80)	(**3.49**)	(**3.07**)	(−0.14)
	[0.53]	[0.58]	[0.42]	[0.65]	[0.63]	[0.47]

Panel B: Alternative formation period: L0M versus L1M

Mutual Funds		Hedge Funds	
L0M	L1M	L0M	L1M
0.71	0.18	−0.34	−0.18
(**14.88**)	(**3.64**)	(**−3.62**)	(**−3.10**)
[1.00]	[0.70]	[0.30]	[0.28]

Panel C: Alternative holding period: F1M^{4-12}

	Mutual Funds			Hedge Funds		
Measure	All	Buys	Sells	All	Buys	Sells
$\text{F1M}^{SzBm,4-12}$	0.00	0.04	−0.04	0.10	0.17	−0.07
	(0.18)	(1.55)	(−1.51)	(**3.16**)	(**2.23**)	(−1.19)
	[0.50]	[0.62]	[0.43]	[0.67]	[0.65]	[0.42]
$\text{F1M}^{DGTW,4-12}$	−0.02	0.03	−0.05	0.09	0.14	−0.05
	(−1.23)	(1.44)	(**−2.29**)	(**3.39**)	(**2.54**)	(−1.19)
	[0.52]	[0.58]	[0.35]	[0.68]	[0.68]	[0.38]

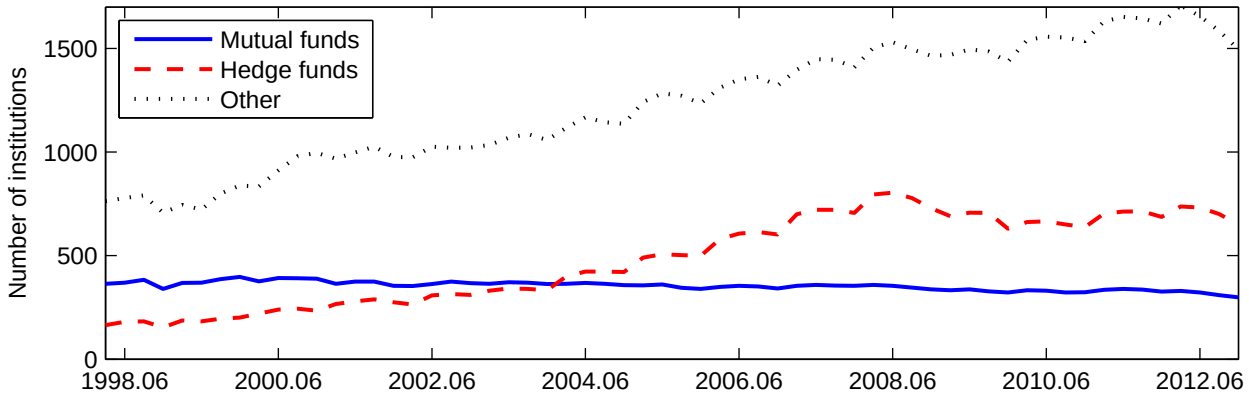
Table 8 (continued)

Panel D: Alternative return adjustments

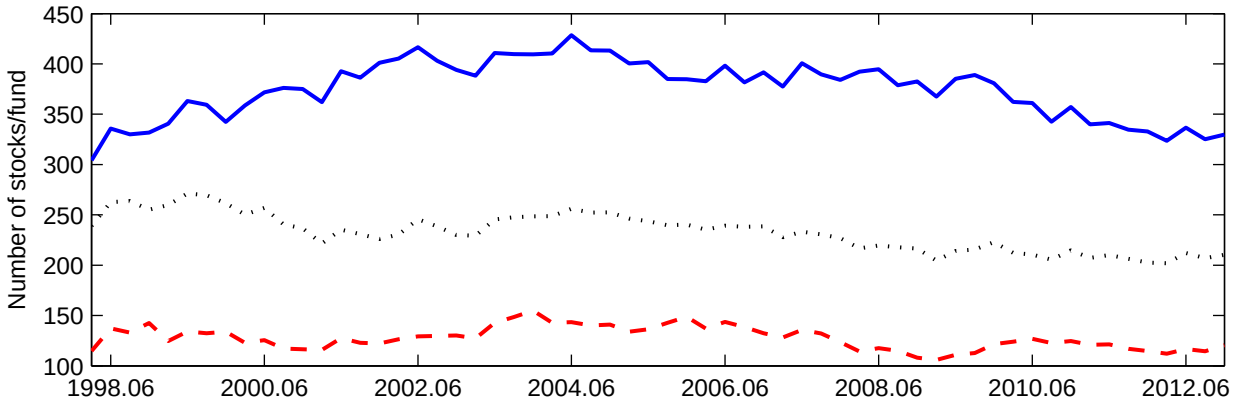
	Mutual Funds				Hedge Funds			
Measure	SzBm	DGTW	Excess	Raw	SzBm	DGTW	Excess	Raw
L0M	0.69	0.63	0.71	0.71	−0.31	−0.30	−0.34	−0.34
	(**14.71**)	(**16.60**)	(**14.88**)	(**14.88**)	(**−3.45**)	(**−3.89**)	(**−3.62**)	(**−3.62**)
F1M	0.13	0.02	0.14	0.14	0.27	0.25	0.28	0.28
	(**2.67**)	(0.51)	(**2.71**)	(**2.71**)	(**3.61**)	(**3.72**)	(**3.79**)	(**3.79**)

Figure 1. Time-series of intitutional observations, stock holdings, and turnover
Plot A presents the number of mutual funds, hedge funds, and other institutions in our sample over the 60-quarter period between January 1998 to December 2012. Plot B presents the number of stocks held by the average mutual and hedge fund throughout the sample period. Plot C presents the turnover of the average mutual and hedge fund, measured as turnover=[($buys$_q$+$sells$_q$)/(2×$holdings$_{q-1}$)].

Plot A: Number of funds



Plot B: Number of stocks per fund



Plot C: Turnover per quarter

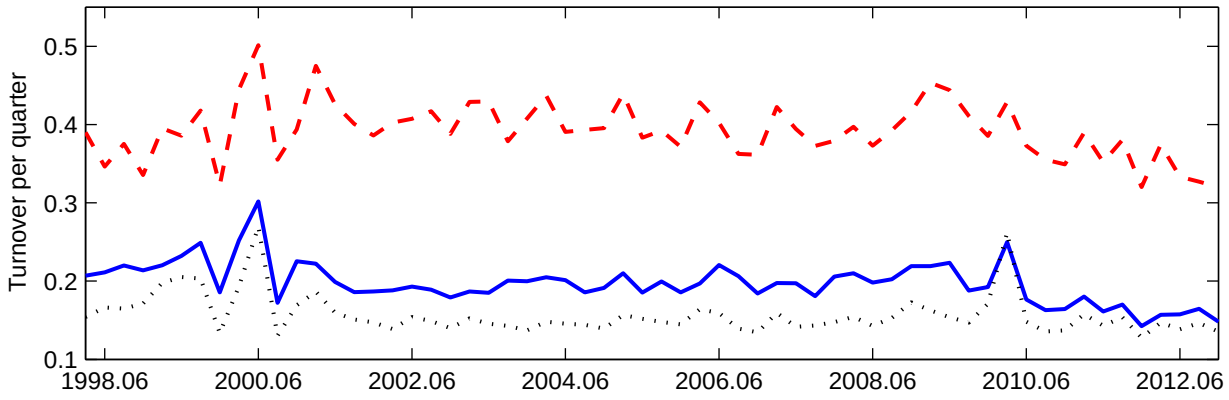
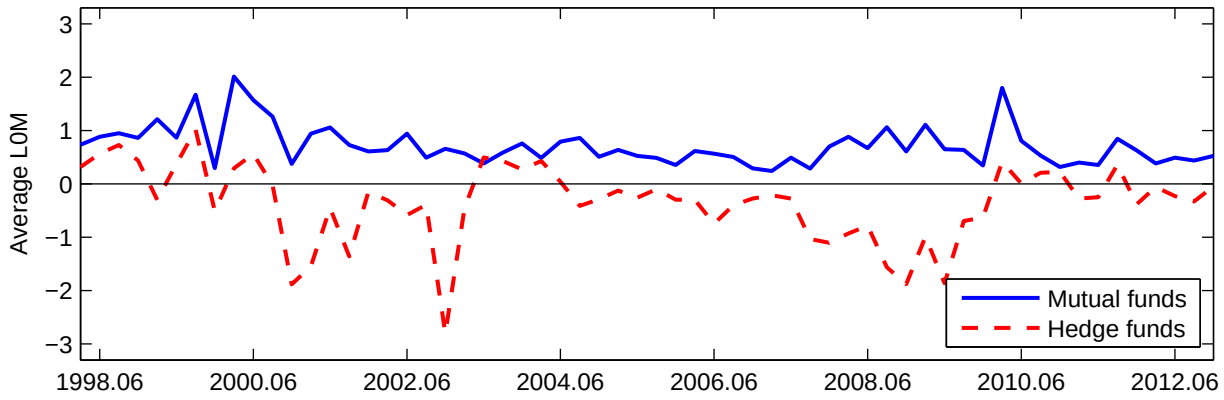
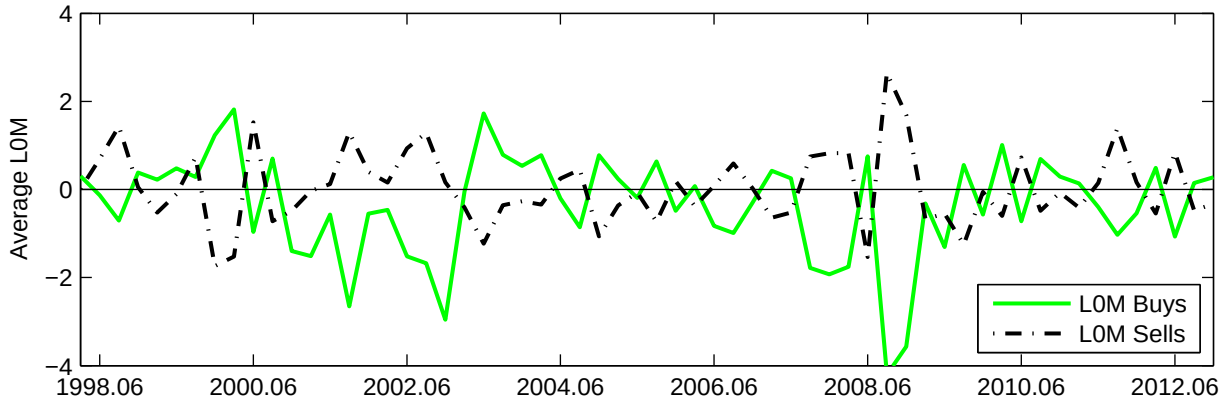


Figure 2. Time-series of momentum measures
Plot A presents the time-series of the average L0M momentum measure (equation 1) across mutual (hedge) funds over the 60-quarter period between January 1998 to December 2012. Plot B (C) presents the contributions of buys and sells to the overall L0M momentum measure for hedge funds (mutual funds).

Plot A: Momentum measures (L0M) for mutual and hedge funds



Plot B: Hedge funds' buys and sells



Plot C: Mutual funds' buys and sells

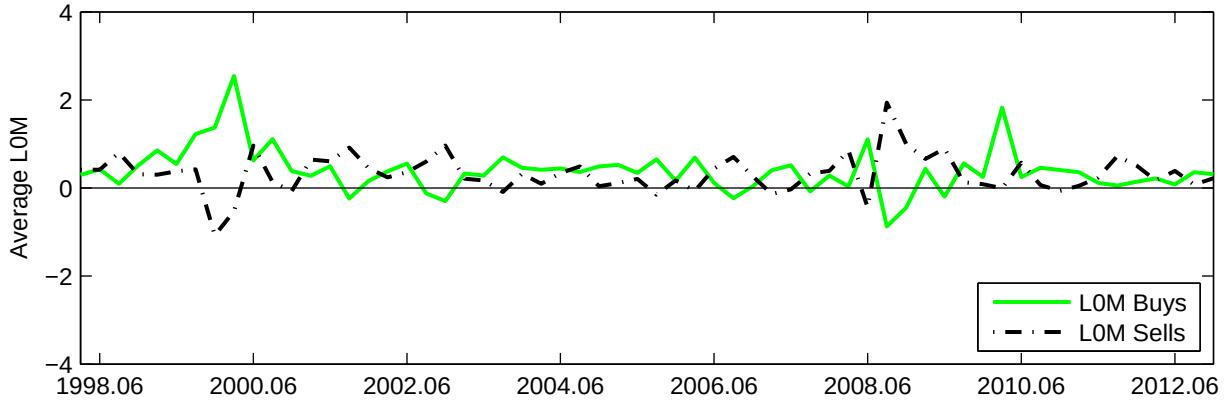
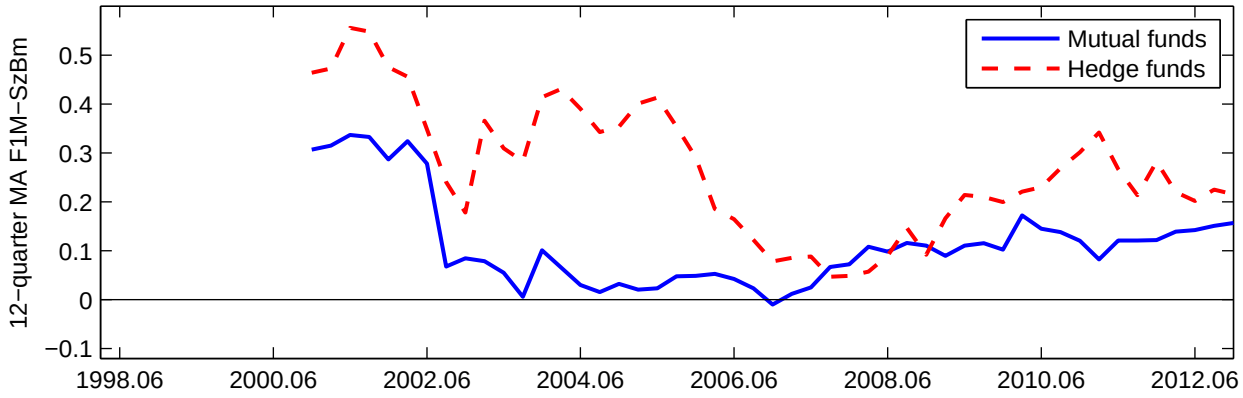
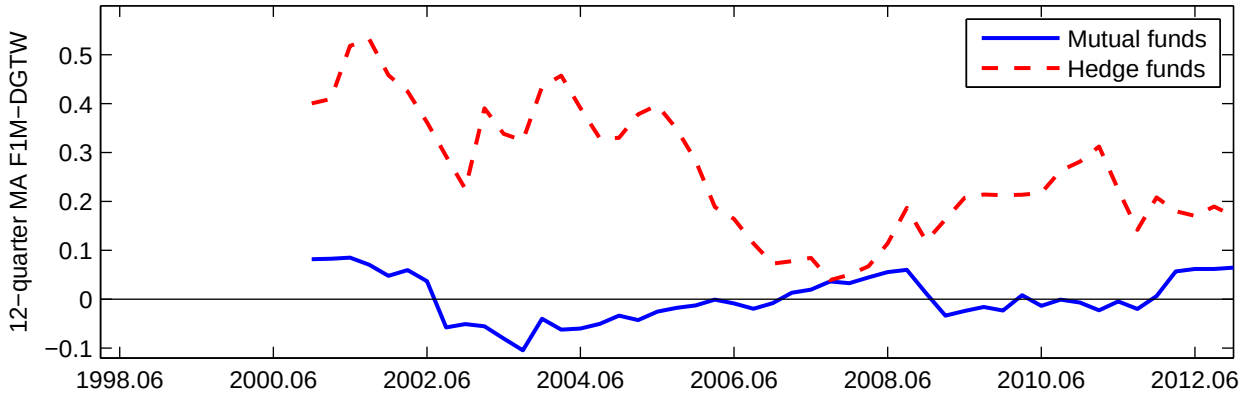


Figure 3. Time-series of performance measures
Plots A and B present the 12-quarter moving average of the performance measures (equation 13) for hedge funds and mutual funds. The SzBm (DGTW) label indicates that the measure uses returns adjusted for size and book-to-market (Plot A) and momentum (Plot B). Plot C presents the contributions of buys and sells to the overall F1M^{DGTW} performance measure for hedge funds.

Plot A: Performance measure F1M^{SzBm} for mutual and hedge funds



Plot B: Performance measure F1M^{DGTW} for mutual and hedge funds



Plot C: The contribution of buys and sells to hedge fund performance based on the F1M^{DGTW} measure

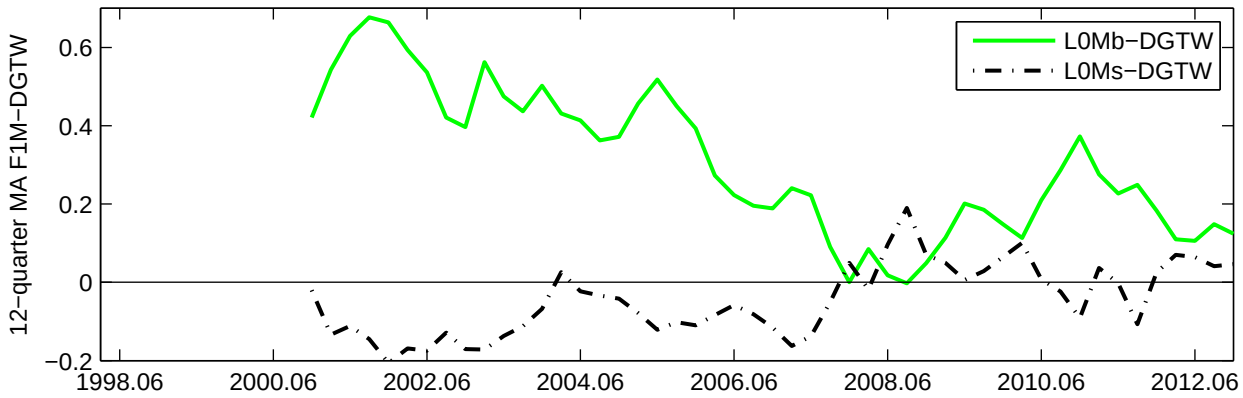
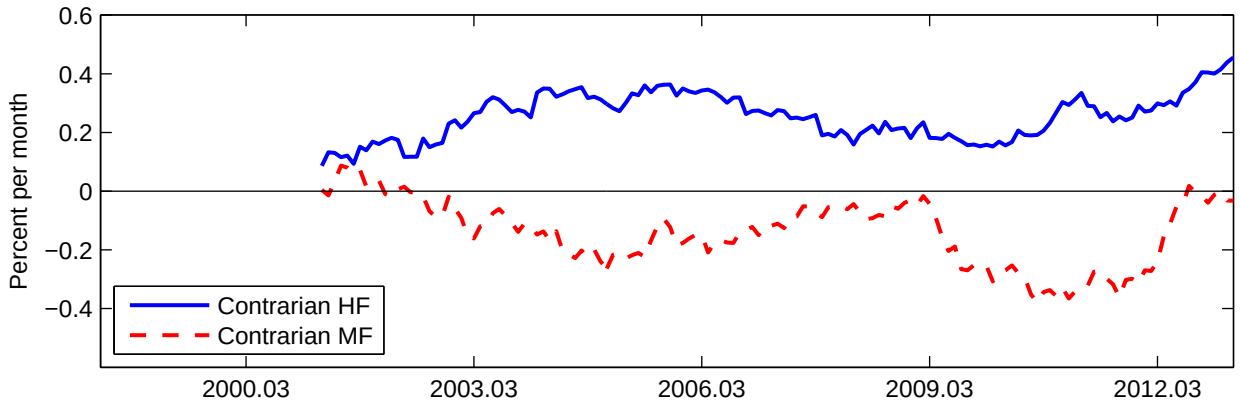


Figure 4. Time-series of DGTW-adjusted monthly portfolio returns
Each quarter, we sort stocks into buy and sell portfolios depending on whether a particular type of funds increased or decreased their aggregate holdings of the stock over the previous quarter. For each type of fund, we take the difference between the equally weighted DGTW-adjusted monthly stock returns of their buys and sells. Plots A and B present the 36-month moving average of DGTW-adjusted buy−sell returns for portfolios based on the trades of contrarian and momentum funds, respectively.

Plot A: DGTW-adjusted portfolio returns for contrarian funds



Plot B: DGTW-adjusted portfolio returns for momentum funds