Hedge Fund Performance Persistence and Mixed Strategies of Hedge Fund Investors

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Abstract.

We examine performance persistence of hedge funds (HF) and momentum (contrarian) strategies of HF investors across different economic and market conditions using parametric and nonparametric methods. During bad (good) times HF (risk-adjusted) returns do (not) fluctuate a lot. There is no performance persistence against the market. During good (bad) times there is persistence up to one year (six months) within each strategy group and is mainly driven by the top performers. Moreover, recessions are severer than bear regimes for HF persistence. Finally, we construct zero investment portfolios using momentum, contrarian and "*momentrarian*" strategies with high excess returns.

Keywords: Hedge funds; Performance persistence; Momentum strategy; Contrarian strategy

EFM Classification Codes: 380; 310; 370

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1 Introduction

The selection decision of HF investors is based on the assumption that some HF managers have a superior ability and that this ability persists, allowing the investor to predict future performance based on past results. We should expect some HF managers to have a superior ability, but over what horizon? There is strong evidence that there is HF relative performance persistence over periods as short as one year, short-term persistence (see Agarwal and Naik, 2000a; Harri, and Brosen, 2004; Do, *et al.*, 2010; Eling, 2009; Joenvaara, *et al.*, 2012; Hentati-Kaffel and Peretti, 2015). However, Jagannathan, *et al.*, (2010) and Ammann, *et al.*, (2013) show that the HF performance persistence might extend over periods longer than a year, and this is called long-term persistence.

Bares, *et al.*, (2003) and Eling (2009) provide evidence that some non-directional strategies like Merger Arbitrage and Convertible Arbitrage strategies present more persistence than directional strategies like Long-Only and Short Bias strategies. HF persistence is still a subject under study. Persistence varies among different HF strategies and among different HF characteristics, such as size (Boyson, 2008; Joenvaara, *et al.*, 2012), age (Meredith, 2007; Boyson, 2008), fees (Amenc and Martellini, 2003) and flow restrictions (Bae and Yi, 2012). Other studies (e.g. Bollen and Pool, 2006; Agarwal, *et al.*, 2011; Itzhak, *et al.,* 2013) show that illiquidity has a significant effect, and the fluctuation of returns is widespread as some HF managers invest in illiquid assets or manage their returns.

Although there are different results regarding HF persistence due to industry heterogeneity and the use of different databases, time periods and methodologies, these results are robust even when comparing funds operating in emerging or developed markets (Abugri and Dutta, 2009). Despite the importance of the studies mentioned previously, the exact association between HF performance persistence and multiple business cycles and different market conditions has not yet been fully examined; market conditions are not limited to only one recession/growth period or financial event. We distinguish business cycles and market conditions as they do not necessarily coincide, having different implications for HF performance persistence. For example, recessions periods are, on average, fiercer in terms of HF performance persistence compared with bear regimes (see section 3). Moreover, HF literature does not deal with different strategies of HF investors based on persistence and spreads of top/bottom performers that can lead to higher returns. We fill this gap by suggesting various mixed strategies (investment styles) for HF investors that can help them to achieve higher returns.

Our objective is to offer a comprehensive investigation of HF performance persistence allowing HF investors to implement mixed trading strategies utilizing spreads between top and

bottom performers of different HF strategies. We distinguish between different types of performance and we do not focus only on one type of persistence, such as persistence within each strategy. Moreover, we examine the impact of different market conditions on HF performance persistence focusing on North America. We also apply a switching Markov model to endogenously determine different market conditions.

We contribute to the literature in a number of different ways. We are the first, to the best of our knowledge, to introduce the term "*momentrarian strategy*". A *momentrarian strategy* is a combination of a momentum and a contrarian strategy under specific conditions, as discussed in section 2.2. Unlike earlier studies (e.g. Harri, and Brosen, 2004; Malkiel and Saha, 2005; Eling, 2009; Hentati-Kaffel, and Peretti, 2015) that focus only on whether HF winners (losers) continue to be HF winners (losers), we measure three different aspects of performance persistence. The first aspect is the variability of returns and risk-adjusted returns for HFs groups at strategy level. The second aspect is the over- (under-) performance of HF returns against the market index. The third aspect is persistence at HF level. Moreover, we examine each of these aspects within multiple business cycles and different market conditions using several parametric and nonparametric tests (see section 2.1). We also examine HFs that invest primarily only in North America, as North America accounts for 72% of the worldwide HF industry, and we can identify three full business cycles since 1990. Finally, there is an execution of a systematic database merging and cleaning process.

Our study offers a number of interesting results. First, we use a regression-based parametric approach and we conclude that non-directional and semi-directional strategies have, on average, less volatile returns compared to directional strategies. However, during stressful market conditions there is a negative impact on HF return volatility for all strategies. When considering risk-adjusted returns, the return volatility increases even more in all cases. Second, we use the cross-product ratio (CPR) test and the Chi-square test (χ^2-test) and we find that there is little or no persistence of HFs against the market benchmark. Only the Long/Short and the Multi-strategy present some performance persistence against the market during "good" market conditions. Third, when examining persistence within strategies, using a portfolio construction approach, we find short-term persistence. However, during stressful market conditions there is mostly quarterly persistence, as we explain in section 2.3.

Fourth, persistence, on average, is attributed mainly to top performing and less to bottom performing HFs. Often there is a slight improvement of bottom performers for a number of reasons, such as HF managers are under pressure to deliver higher returns because, for example, they face the risk of going out of business, or the threat of management turnover. During stressful

market conditions persistence drops dramatically. Fifth, this study presents a framework using various zero investment strategies of HF investors that utilize differences in spreads between top and bottom performing HFs among different strategies. There is evidence that the momentum investment strategy is, on average, the most efficient within "good" market conditions, namely growth periods and bull regimes, whereas *momentrarian* is, on average, the most efficient during stressful or "bad" market conditions, namely recessions and bear regimes.

Investors can benefit from these findings, as they are able to know what to expect from different strategies in terms of performance persistence. As most investors, in their capital allocation process, rely on HFs past records, they expect performance to be stable over time and that some HF managers perform better compared to their peers. HF administrators can benefit by applying more flexible fees incorporating performance persistence. Financial governance authorities can benefit in the event that there is a need for change in the regulation framework or for closer monitoring (e.g. "unusual" HF persistence).

The rest of the paper is organised as follows: section 2 presents the methodology and describes the HF database. Section 3 offers the empirical results by presenting some key statistics, the regime switching model, the performance persistence analysis at strategy level, and the mixed strategies of HF investors. Then the robustness tests are presented. Section 4 concludes.

2   Methodology

2.1 Empirical Specification

We first examine HF raw and risk-adjusted returns using predefined structural breaks conditional on the growth and recession periods. Then we present the methods used in order to detect performance persistence. We also present several strategies of HF investors that include the *momentrarian* trading strategies, which is a combination of momentum and contrarian strategies, to offer investors higher returns (see section 2.2).

We use the official business cycles following the National Bureau of Economic Research (NBER) and the Economic Cycle Research Institute (ECRI). Hence, this approach takes into account returns that belong to a particular state of the economy. Let $r_{i,S}$ denote the HF raw return in month $i = 1, \ldots n$, in state S, where S is the state of the economy, which is either a growth or a recession period. Assume then that the HF raw return time series is generated by the following process:

$$r_{i,S} = \begin{cases} r_{i,G}, & \text{when we are in growth} \\ r_{i,R}, & \text{when we are in a recession} \end{cases} \tag{1}$$

We also use undefined structural breaks that are specified by a statistical stochastic process using a Markov regime-switching model (Hamilton, 1989). We relate HF returns to the market factor since we want to capture the different conditions in the market, following Akay, *et al.,* (2013), Meligkotsidou and Vrontos (2014) and Teulon, *et al.,* (2014) who measure the structural breaks of HF returns and volatility using the Markov switching approach. However, we use the Wilshire 5000 Total Return Index (TRI) including dividends. Since it captures almost all firms within the US economy, it is a better proxy for the entire market compared to the S&P 500.

The Markov switching approach is based on the idea that it is possible to decompose a series into a finite sequence of regimes. Therefore, it is possible to describe the behavior of a variable or a combination of variables within a model, which describes the stochastic process that determines the switch from one regime to another using a Markov Chain. A Markov Chain can be described as:

$$P\{s_t = j|s_{t-1} = k\} = P\{s_t = j|s_{t-1} = i\} = P_{ij} \tag{2}$$

where P_{ij} indicates the probability that for a variable s_t state (regime) i is followed by a state (regime) j. The Markov transition probabilities satisfy $P_{i1} + P_{i2} + \cdots + P_{in} = 1$. The transition matrix of the following form is estimated:

$$P = \begin{bmatrix} p_{11} & p_{12} & \cdots & p_{1m} \\ p_{21} & p_{22} & \cdots & p_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ p_{m1} & p_{m2} & \cdots & p_{mm} \end{bmatrix}.$$

The Markov regime switching model is estimated with shifts in the mean and the error variance represented with the following general form, which allows the error variance to change across states:

$$\Delta_{r_t} = v(s_t) + \Gamma\Delta_{r_{t-1}} + u_i \quad \text{where} \quad u_t|s_t \sim NID(0, \Sigma(s_t))$$

Unlike earlier studies (see section 1) that focus only on whether HF winners (losers) continue to be HF winners (losers), we measure three different aspects of performance persistence. The first aspect is the variability of raw and risk-adjusted returns for HFs groups at strategy level. We compute the Sharpe ratio and Information ratio at a cross-sectional level using HFs at the strategy and fundamental level, for each time period, as some strategies are riskier, whereas others offer more stable returns. We use the regression-based parametric method described previously. The

second aspect is the over- (under-) performance of HF returns against a specific benchmark, which is the market index. In other words, we determine whether HFs consistently provide higher or lower returns against the market index (Wilshire 5000TRI, including dividends). We examine performance persistence in terms of variability of returns against the market benchmark and within strategy groups (HFs) using quarterly, semi-annual, and annual time horizons. These are the most common time horizons examined in the literature. We do not use time horizons of more than a year because of insufficient data during stressful market conditions; the numbers of observations for recessions and bear regimes are 34 and 36, respectively. Hence, at the annual time horizon we would have only three observations.

Finally, the third aspect is persistence at a HF level. We form portfolios of HFs according to their strategy (total 11 strategy portfolios – see section 2.3). We form ranked portfolios of HFs that are rebalanced every subsequent period. We use a decile classification following the literature (e.g. Carhart, 1997; Capocci, 2009). Each period (quarter, semester, year) all HFs within a specific group (e.g. strategy) are ranked in ten equally weighted portfolios with P1 having the highest and P10 the lowest return based on the previous period results. The portfolios are held until the next period and then rebalanced again. HFs that disappear are included in the equally weighted average until their death, then the portfolio weights are adjusted appropriately.

Then we examine the spread between the highest-ranked and the lowest-ranked portfolios and we use the regression-based parametric approach to examine the variability of the underlying spread. We then examine the relationship between initially top- (bottom-) ranked portfolios against the subsequent performance in the next period of the same portfolios. Finally, we compare the returns of the subsequent periods (top or bottom initially ranked portfolios) with the average of all HFs within the same strategy, using the tests mentioned in the previous section.

As Agarwal and Naik (2000a) argue, there are generally two categories of statistical methods that examine performance persistence: the two-period and the multi-period approach. The first approach examines two consecutive time periods (e.g. months) while the second one more than two consecutive periods; this is the Kolmogorov-Smirnov test. We use the traditional two-period framework because there are not enough available observations for the stressful market conditions to study a multi-period framework.

Within the two-period framework we construct tables of winners and losers and then we use a nonparametric approach known as the contingency-table method. We use the non-parametric approach as it is conceptually simple and free of the econometric biases involved in parametric tests. Winners are HFs whose performance is higher than the median within the same group or benchmark, whereas losers are HFs whose performance is lower than the median. In other words,

we examine whether HF winners (losers) continue to be HF winners (losers) in the next period. HFs that are winners (losers) in both periods are denoted by WW (LL) while HFs that are winners (losers) in the first period and losers (winners) in the second period are denoted by WL (LW). HFs that are winners (WW) or losers (LL) in both time periods are persistent.

In this framework we conduct as a primary test the CPR and as a secondary the χ^2-test to detect performance persistence. The CPR is stricter than the χ^2-test because it is able to capture the positive or negative manner of the persistence while the χ^2-test is not. The CPR test is the ratio of HFs that present persistence to the HFs that do not (Agarwal and Naik, 2000b).

$$CPR = (WW * LL)/(WL * LW) \qquad (3)$$

The null hypothesis is that there is persistence when the CPR is equal to one. Under this, it is expected that each of the four categories (WL, LL, WL, and LW) will have 25% of the HFs under study. The statistical significance of the CPR can be tested using the standard error of the natural logarithm of CPR that is given by:

$$\ln(CPR) = \sqrt{\frac{1}{WW} + \frac{1}{LL} + \frac{1}{WL} + \frac{1}{LW}}$$

The resulting Z-statistic is the ratio of the natural logarithm of the CPR to the standard error of the natural logarithm. In the χ^2-test (see Park and Staum, 1998) the observed frequency distribution of WW, LL, WL, and LW is compared to the expected frequency distribution.

$$\chi^2 = \frac{(WW-D1)^2}{D1} + \frac{(WL-D2)^2}{D2} + \frac{(LW-D3)^2}{D3} + \frac{(LL-D4)^2}{D4} \qquad (4)$$

where

$$D1 = \frac{(WW+WL)*(WW+LW)}{N}; D2 = \frac{(WW+WL)*(WL+LL)}{N}; D3 = \frac{(LW+LL)*(WW+LW)}{N} \text{ and}$$

$$D4 = \frac{(LW+LL)*(WL+LL)}{N} \text{ where N is the number of HFs.}$$

Following the χ^2 distribution with one degree of freedom, a critical value χ^2 greater than 3.84 (6.64) indicates significance at the 5% (1%) confidence level.

Within the two-period framework we use the regression-based parametric approach (Brown, *et al.,* 1999). We regress HF raw and risk-adjusted returns during the current period against the raw and risk-adjusted returns during the previous period.

$$r_t = a + br_{t-1} + \varepsilon_i \text{ where } r_t \text{ are HF returns} \tag{5}$$

A significantly positive slope coefficient means performance persistence. This says that a HF (or group of HFs) that did well in a specific period tends to do well in the subsequent period. In other words, there are no high fluctuations in its returns. The statistical significance of the slope is tested using the t-test.

We use the Sharpe ratio and the Information ratio as risk-adjusted measures. For each month, we compute the Sharpe ratio, which is the portfolio return minus the risk-free return divided by the standard deviation of the portfolio return; Sharpe ratio= $(\bar{r}_p - r_f) / \sigma_p$, (Sharpe, 1994). Similarly, for each month, we compute the Information ratio, which is the expected portfolio return minus the benchmark (Wilshire 5000TRI, including dividends) return divided by the standard deviation of the excess market returns; Information ratio= $E(r_p - r_B)/\sigma(r_P - r_B)$, (Goodwin, 1998). As it was mentioned, we use the regression-based parametric method in order to examine the variability of returns for each HF strategy.

Finally, we use the portfolio construction approach and we form initial portfolio winners P1 and losers P10 and track the performance of these portfolios for the next period denoted by P1* and P10*. We examine the difference in means of P1 versus P1*, and the difference in means of P10 versus P10*. Then we examine the difference in means between P1* and the average within the same strategy and the difference in means of P10* and the average of the same strategy as well. It is important to clarify the distinction between P1 versus P1* and P10 versus P10*. P1 are the ex-ante best performing portfolios and, more specifically, HFs that were formed based on best past performance (quarterly, semi-annual or annual). P1* are that of ex-post portfolios and, more specifically, the previous P1 after one time period (e.g. quarterly, semi-annual, annual). Similar rules apply to P10. Moreover, we study the correlations of the above pairs using a parametric (Pearson) and nonparametric (Spearman) correlation test for robustness.

2.2 A Momentrarian trading strategy of HF investors

We borrow the concepts of the momentum (e.g. Jegadeesh and Titman, 1993) and contrarian (e.g. DeBondt and Thaler, 1990) trading strategies from the stock literature. We find that the momentum and contrarian trading strategies produce significant excess returns to HF investors. The rationale behind the momentum strategy is that HFs (similar to stocks) will continue to

perform well (poorly) during relatively short periods. One reason that this may happen is because HF managers have short-term overreaction to new information, but it is a phenomenon that requires further research.

The contrarian strategy is explained in a similar way to stocks, where good (poor) performers will reverse their performance in the long-run. One reason might be that HF managers have long-term underreaction to new information. Another reason might be HF managers reversing their poor performance to stay in business. A final explanation might be that HF managers are "dried up" of new ideas or that there are other HF managers that they can outperform them. This is a phenomenon that requires further research.

We coin the term "*momentrarian*", which denotes an investment style or strategy of HF investors that utilizes the momentum (MOMEN-) and the contrarian (-TRARIAN) trading strategies to maximize returns. For the first time we present this trading style, which can bring conditional higher returns than just exploiting one of these strategies.

Table 1 shows the framework with the possible actions when using momentum and contrarian strategies of HF investors. These possible actions may refer to securities, financial indices or HFs, as in our case. We use again quarterly, semi-annual and annual periods. Hence, an investor using trading strategies at the HF level has the following four options: The first case (A) is the momentum trading concerning top performers; the second case (B) is the (reverse) momentum strategy of HF investors concerning the bottom performers. The third case (C) is the contrarian strategy concerning the top performers; the fourth case (D) is the (reverse) contrarian strategy with the bottom performers.

We can follow a momentum strategy by constructing a zero investment portfolio that is long recent (a few months to a year) past winners and short recent past losers. Analogously, we can follow a contrarian strategy by constructing a zero investment portfolio short in longer-term (two to three years ago) past winners and long in longer-term past losers. According to the momentum literature (e.g. Jegadeesh and Titman, 1993) for stocks, the momentum effect lasts for a few months (e.g. up to a year) and we use this period as a rule of thumb in our HF study. Hence, after a year we should expect the contrarian effect to dominate.

In Table 1 we show two cases of our *momentrarian* strategy: the *horizontal momentrarian* strategy, as we call it, which involves the use of two separate zero investment portfolios (one momentum and one contrarian); the other case is the *vertical momentrarian* strategy, as we call it, which involves the combination of a momentum and a contrarian strategy.

[Insert Table 1]

One implementation of the *vertical momentrarian* strategy involves high returns exploitation: at time *t*, select and buy a HF (A) whose returns at *t-1* (e.g. last year) were high (compared to other HFs). Also, select and short-sell another HF (C) whose returns at *t-2* (e.g. two years ago) were higher (compared to other HFs). At time *t+1* (e.g. one year ahead) sell HF (A) and buy HF (C). Then, at time *t+1*, the portfolio is rebalanced, repeating the above process.

Another implementation of the *vertical momentrarian* strategy involves low return exploitation: At time *t*, select and short-sell a HF (B) whose returns at *t-1* (e.g. last year) were low (compared to other HFs). Also, select and buy another HF (D) whose returns at *t-2* (e.g. 2 years ago) were low (compared to other HFs). At time *t+1* (e.g. one year, ahead) buy HF (B) and sell HF (D). Then, at time *t+1*, the portfolio is rebalanced, repeating the above process.

In practice, when the HF manager wants to apply the *vertical momentrarian* strategy with high returns exploitation and has to select between e.g. two similar HFs (C) whose returns are higher at *t-2* (years ago) compared to other HFs, they can choose the HF whose performance trends are poorer at *t-1*, as it is a sign that the contrarian effect starts to take place and at *t+1* HF returns will be relatively low. This applies accordingly in the next example of the *vertical momentrarian* strategy with low returns exploitation when considering two similar (D) HFs. In this case the HF manager should choose the HF whose performance trends were better at *t-1*, as it is a sign that the contrarian effect start to takes place and at *t+1* HF returns will be relatively high.

In section 3.5 we use the above framework to show that certain *momentrarian* styles of HF investors can bring substantially higher returns to them. We implement this strategy along with the momentum and the contrarian strategies of HF investors within different business cycles. Later, we consider HF redemption fees (lockups), and then perform an out-of-sample analysis with a holdback period for robustness.

In total, we have five basic strategies of HF investors: momentum, contrarian, *horizontal momentrarian, vertical momentrarian* with high returns exploitation, and *vertical momentrarian* with low returns exploitation. Finally, the proposed framework covers many variations of the above strategies with different time periods of forming/holding portfolios that an investor can choose. However, for simplicity we focus on specific equal forming/holding horizons of portfolios for momentum strategies (being in accordance with our HF persistence analysis) and one year forming with holding one, two, and three years for contrarian and momentrarian strategies.

2.3 Data

We use a merged HF database consisting of BarclayHedge and EurekaHedge. Our monthly data sample starts in January 1990 (following Denvir and Hutson 2006; Harris and Mazibas, 2010

and Giannikis and Vrontos 2011) and ends in March 2014. It also includes three business cycles. The majority of the databases for commercial use are available from the early/mid 1990s with a few exceptions, such as the EurekaHedge and BarclayHedge databases that start earlier. Our dataset contains dead HFs prior to 1994, thus there is no survivorship bias. In the robustness tests we apply an out-of-sample test with a holdback dataset.We proceed to a strict merging and cleaning process, the returns are net of fees in percentage terms and the final dataset consists of 6,373 HFs.[1]

There is no universal classification scheme for HF strategies in either the HF industry or the HF literature. Despite the fact that HF managers may change their investment styles over time, they are legally bound to operate according to the strategy described in the offering memorandum. We use a mapping between database strategies following the literature (e.g. Joenvaara, *et al.*, 2012) using these two databases. Hence, we end up with 11 HF strategies: Short Bias (SB), Long-Only (LO), Sector (SE), Long/Short (LS), Event-Driven (ED), Multi-Strategy (MS), Others (OT), Global Macro (GM), Relative-Value (RV), Market-Neutral (MN) and CTAs (CT). Based on their correlation with the market, we define Short Bias, Long-Only, Sector and Long/Short as directional strategies (absolute values of the correlation coefficient above 0.5); Event-Driven, Multi-Strategy, Others, and Global Macro as semi-directional strategies (absolute values of the correlation coefficient between 0.22 and 0.49); Relative-Value, Market-Neutral, and CTA as non-directional strategies (absolute values of the correlation coefficient between 0 and 0.21).

We describe the following HF strategies: the Others strategy contains HFs that may use different styles/tools (e.g. Private Investment in Public Equity, Close-Ended), or allocations (e.g. start-ups financed by venture capitals) that are not commonly used by other HF strategies. CTA refers to Commodity Trading Advisors HFs, which make an extensive use of systematic trading or use derivatives and commodity trading. We assume the strategies used are those that HF managers reported in these databases.

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[1]We withdraw records containing consecutive returns of zero, N/A and null) and we select HFs that invest mainly in the North America region counting for 7,541. We minimize the survivorship and instant history biases by including in the sample dead/ceased reporting HFs and we eliminate the first 12 monthly returns of each HF. Also, we adjust outliers by implementing a "winsorization" technique. We rank monthly HF returns into percentiles, excluding null values. Afterwards, those extreme outliers in returns that are below the 0.5% percentile are assigned return values equal to that of the 0.5% percentile. Returns above 99.5% are assigned a value equal to that of the 99.5% percentile. Full details of the database merging and cleaning process are available upon request.

3 Empirical Results

This section provides the basic statistics of the HF strategies and the market classification to broader categories of the HF strategies. Finally, it gives details of the regime switches.

3.1 Summary statistics

Table 2 offers the summary statistics of raw returns for each of the 11 strategies. Each strategy is an equally weighted representative average time series of all the relevant HFs. Some strategies (e.g. Sector, Long/Short, Others, CTA) deliver high monthly mean returns (at least 1.1%) and they are more aggressive than non-directional strategies (e.g. Event-Driven, Market-Neutral) and some strategies (e.g. Short Bias) deliver low monthly mean returns (0.1%). In general, directional strategies have more volatile returns than non-directional strategies. An exception is the CTA strategy.

Following Bali, *et al.*, (2011), we classify HF strategies into directional, semi-directional and non-directional. The classification is based on the correlation of HF returns with the market index Wilshire 5000TRI, including dividends. Regarding the correlation of each strategy and its relevant classification, it is not surprising that the Short Bias has a large negative correlation with the market index (-0.924) and the Market-Neutral strategy has a very low correlation (0.059). Finally, CTAs have an insignificant correlation with the market index.

[Insert Table 2]

We take into account different business cycles and market conditions. Between January 1990 and March 2014 there are three official business cycles. Hence, we divide the period under study into the following growth (01/1990–07/1990, 04/1991–03/2001, 12/2001–12/2007 and 07/2009–03/2014) and recession periods (08/1990–03/1991, 04/2001–11/2001 and 01/2008–06/2009).

Regarding the different market conditions, the Markov Switching process determines regimes based on the mean and volatility of the Wilshire 5000TRI. Also, regarding the market regimes, we perform a unit root test with breaks and the Augmented Dickey-Fuller t-statistic resulting in a value of -16.4; thus, we reject the null hypothesis of a unit root (as p-value less than 0.01). The regime coefficient for the bull regime is 1.58, which is statistically significant. The coefficient interval at 95% is 1.15 and 2.01, whereas for 99% is 1.02 and 2.14, respectively. The bear coefficient is -8.65, which is statistically significant. The coefficient interval at 95% is -11.21 and -6.09 whereas at 99% is -12.02 and -5.23, respectively. The transition probability from a bear to a bull regime is 61.9%, while the transition probability from a bull to a bear regime is as low as

5.32%. The expected duration for up regime is 19 months whereas for down regime is only two months. We examined also the time-varying transition regime coefficients with their underlying transition probabilities. The regime coefficient for the bull regime is 1.3, which is statistically significant. The coefficient interval at 95% is 0.9 and 1.7 whereas for 99% is 0.7 and 1.9, respectively. The regime coefficient for the bear regime -9.7, which is statistically significant. The coefficient interval at 95% is -12.2 and -7.2 whereas for 99% is -13.1 and -6.4, accordingly. Regarding the transition probabilities, at time t, when we are in regime one (down) then the probability at time t+1, of staying in the same regime is 0.4%. When we are in up regime the transition probability to regime one (down) is 7.5%. In addition, we tested for inverse roots of AR polynomials and no root lies outside the unit circle (have a modulus less than 1). We derive two kinds of structural breaks in the market: bull and bear regimes, within the 24-year period under examination. The time period is divided into four bull (01/1990–06/1990, 11/1990–10/2000, 10/2002–05/2008, and 03/2009–03/2014) and three bear regimes (07/1990–10/1990, 11/2000–09/2002, and 06/2008–02/2009). The down periods cover higher oil prices in summer 1990 because of the Persian Gulf crisis, the Japanese down market in March 2001. Also, it covers 9/11, and the last financial crisis in 2008-2009. There may be other negative shocks outside our identified down regimes but the Wilshire 5000TRI is not characterised by substantial return downturns and high volatility.

3.2 Performance persistence

This section examines the performance persistence at strategy level. We first examine the variability of returns, then their persistence with respect to the market index, and finally the persistence within each strategy. We examine variability using a quarterly, semi-annual, and annual horizon by computing the average return within each time period.

3.2.1 Growth and Recession periods

Table 3 Panel A presents the results for the growth period using the regression-based parametric method given in Section 2.1 Eq. 5. With regard to the raw returns, the majority of the HF strategies do not have return variability. On average, non-directional (with the exception of CTA) and semi-directional strategies have less variable returns than the directional strategies (with the exception of Short Bias). Regarding the Sharpe ratio, the result is almost the same as for raw returns. However, some strategies, such as Other, Global Macro and CTA are more variable compared to others. On average, non-directional (with the exception of CTA) and semi-directional

strategies (except for Global Macro) have less variable returns than directional strategies (except for Short Bias). Regarding the information ratio, almost all HF strategies have high variability. One exception is the Long/Short strategy, which presents low variance at semi-annual and annual horizons.

Table 3 Panel B shows the results during recession periods. All HF strategies present high variability in their raw returns. Only the Long-Only and Market-Neutral present statistically significant low variability at annual horizons. Regarding the Sharpe ratio and the Information ratio, all HFs have high variance. There are a few exceptions, such as CTA and Short Bias, which provide low variability at semi-annual horizons.

[Insert Table 3]

3.2.2. Bull and Bear regimes

Table 4 Panel A shows that during bull regimes almost all HF strategies (except for Short Bias and CTAs) present low variability in their returns for all horizons. Moreover, on average, non-directional and semi-directional strategies have lower return variability for the underlying time horizons compared to the directional strategies. In regard to the Sharpe ratio, CTA, Others and Global Macro strategies show the least persistence. In regard to the Information ratio, similar to the growth periods, almost all HF strategies present no persistence.

Table 4 Panel B offers the results during bear regimes. Almost all HF strategies present high raw return variability. One exception is the Market-Neutral strategy for all time horizons, and the CTA strategy, which has low variability but only on a quarterly basis. As far as the Sharpe ratio is concerned, almost all HF strategies provide highly variable returns. There are some exceptions, such as the Short Bias and the CTA strategies on a quarterly basis, and the Market-Neutral on an annual basis. Information ratio results during bear regimes are quite variable. However, there are a few strategies, such as Sector, Long/Short, and Event-Driven, which have low variability on a semi-annual period, whereas other strategies, such as Short Bias, Global Macro and CTA, have low variability on a quarterly period.

[Insert Table 4]

To sum up, during "good" market conditions almost all HF strategies present low return variability on quarterly, semi-annual and annual horizons. This weakens when risk-adjusted returns are considered, although they are still mostly significant. During stressful market conditions hardly any HF strategy presents low return variability. Furthermore, recession periods

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have a greater negative impact on return variability of HF strategies compared to bear regimes. This is because bear regimes, characterized by low market returns with high volatility, affect a lot of HFs performance in terms of poor but relatively constant returns. On average, non-directional and semi-directional strategies present lower variability in their returns. It seems that during "good" times HF managers present low return variability (or massage their returns more efficiently) compared to stressful market conditions, as it is more difficult to have smooth returns. These findings are similar to Getmansky, *et al.*, (2004) and Eling (2009), who observe serial correlation for HF strategies, and especially for those that invest in illiquid assets. We test for autocorrelation for one, two, four, six, and 12 months and some strategies such as Relative-Value, and Market-Neutral present autocorrelation even at the 12-month horizon. The results are not presented here but are available upon request.

3.3 Persistence against the market benchmark

We examine the persistence of the HF raw returns against the market benchmark (Wilshire 5000TRI, including dividends). In other words, we examine whether HFs out-(under-) perform the market consistently. We use three time horizons: annual, semi-annual, and quarterly with the CPR and χ^2-tests. The CPR should be significantly greater than one in order to have performance persistence. If CPR is less than one, this means that there is no persistence; hence, there is no need for further hypothesis testing (this is denoted with a "-" in Tables 5 and 6). The CPR test is stricter than the χ^2-test and based on the ratio WW/LL, there is out - or under-performance versus the market (see Section 2.1).

3.3.1 Growth and Recession periods

Table 5 Panel A shows that, using the CPR test, only a few strategies, such as Long/Short (annual), Multi-Strategy (semi-annual), and Long/Short (quarterly), are able to present performance persistence against the market (although underperforming). The χ^2-test examines the difference in the observed versus the expected frequencies. The χ^2-test cannot capture the proportion of winners and losers, unlike the CPR test. Hence, we consider that the CPR test is more powerful. However, we use more than one test, for robustness.

Using the χ^2-test, Short Bias, Market-Neutral and Relative-Value (annual) present persistence versus the market index. There are some strategies that perform better than the market; nevertheless, by using two different tests, these results are not significant. In other words, both tests show that none of the strategies presents persistence with respect to the market (in a positive

or negative manner). The only exception is the Multi-Strategy that presents weakly significant persistence for the annual and semi-annual time horizon using both tests.

During recessions, due to the small number of observations, there is a use of descriptive statistics. Table 5 Panel B shows the performance persistence of the strategies against the market benchmark. Regarding the annual period, all strategies present two or three wins against zero or one loss in terms of frequencies. However, during the semi-annual period non-persistence is more common among all HF strategies compared to persistence. The same is applied to the quarterly horizon for all HF strategies. An exception is the Long-Only strategy that presents six cases of persistence (WW and LL) against four of non-persistence (WL and LW). Hence, during recessions HFs present almost no persistence against the market benchmark.

[Insert Table 5]

3.3.2 Bull and Bear regimes

Table 6 Panel A shows the persistence against the market benchmark during bull regimes. Using the CPR test, none of the strategies show persistence against the benchmark, over all horizons. Some strategies, such as Short Bias, Global Macro, or Market-Neutral, show significant persistence over these time horizons, but only using the χ^2-test. However, there is no confirmation from the two tests of performance persistence. Hence, it can be concluded that no strategies present persistence against the market benchmark.

For the bear regimes, there are relatively few observations, so, similar to recessions, there is use of descriptive statistics. Table 6 Panel B shows that all strategies, annually, present three wins against zero losses in terms of frequencies. Similar results apply to the semi–annual period. During the quarterly time horizon, all HF strategies also present persistence in terms of wins against losses. During recessions HFs do present some persistence against the market benchmark, but we are unable to state whether this is statistically significant.

[Insert Table 6]

To sum up, during "good" time conditions for some strategies (e.g. Long/Short and Multi - Strategy) there is weak evidence that there is persistence with respect to the market within the underlying time horizons. For all the other strategies it is clear that there is no persistence. However, during stressful market conditions, there is some evidence that strategies present some persistence against the market benchmark. Unfortunately, there are relatively few available observations, so it is not possible to calculate statistical significance. Recessions affect HF

persistence against the market benchmark more fiercely than bear regimes, as HFs continue to outperform the market during bear regimes.

3.4 Persistence within each strategy

This section examines HF performance persistence within each of the 11 strategies. The objective is to examine whether HF winners (losers) continue to be HF winners (losers) in the next time period in terms of raw returns. Hence, we form ranked portfolios of HFs that we rebalance every subsequent period (quarterly, semi-annually, and annually). We then take the spread between the first ranked and the last ranked portfolios and implement the regression-based parametric model to examine the variability of the underlying spread.

3.4.1 Growth and Recession periods

Table 7 Panel A shows the comparison of performance of the top performers (P1*) or losers (P10*) with that of the average of all HFs, on a quarterly basis.

The monthly spread between top performers P1* and the average of all HFs is positive for more than half of all HF strategies and significantly different from zero as well. Short Bias, Sector, Global Macro, Market-Neutral, and CTA strategies have positive but insignificant spreads. The highest is from Relative-Value and the lowest from Long/Short. In regard to the bottom performers P10* for all HF strategies the spread is negative and, in most cases, significant. Short-Bias and CTA strategies have positive spread, but are insignificant. The highest (in absolute values) and most significant spread is from the Other strategy and the lowest (absolute value) is from Event-Driven. We compare the ex-ante best performers portfolios (P1) with that of ex-post (P1*); in the Other and Relative-Value strategies there is positive and significant correlation. This means that the persistence for these two strategies (their spreads are the highest) is driven by the top performers. In other words, the top performers are performing extremely well. We also compare the ex-ante portfolios of bottom performers (P10) with that of ex-post (P10); there is significant negative correlation for Global Macro and Relative-Value strategies. This means that, despite the reversals, the bottom performers continue to be poor performers, especially for the Relative-Value strategy.

Table 7 Panel B presents whether top performers continue to be top performers and bottom performers continue to be bottom performers on a semi-annual basis. In other words, we examine P1* and P10*. The majority of the HF strategies demonstrate significant persistence for top performers; the exceptions are the Short Bias, Long-Only, Global Macro and CTA strategies. The

highest significant spread of the top performers P1* and the average of all HFs within the specific strategy is Others, and the lowest is for the Market-Neutral strategy. Regarding the bottom performers (P10*), there are many strategies that have significant spreads compared to the average within the specific strategy. The highest absolute spread is from the Others strategy and the lowest is from the Market-Neutral strategy. When we compare the P1 with the P1* portfolios, Others and Relative-Value have positive and significant correlations, meaning that, especially for the Others strategy, top performers continue to perform extremely well. Comparing the P10 and P10*, in most cases there are negative correlations, although in the Relative-Value strategy it is significantly different from zero. This means that there are reversals within poorly performing HFs.

Table 7 Panel C presents persistence results on an annual basis. In regard to the top performers (P1* HFs), their spreads in relation to the average HFs within the same strategy are positive for almost all HFs strategies. The exceptions are the Market-Neutral and CTA strategies, and these spreads are not significantly different from zero. As for the rest, the highest significant spread is from Short Bias and the lowest from the Long-Only strategy. Regarding the worst performing HFs, their spreads in relation to the average HFs within the same strategy are negative, although only for the Relative-Value strategy is it significantly different from zero. By comparing the P1 with the P1* portfolios, the Long-Only strategy has significant negative correlations, meaning that, although P1* perform well above the average, there is reversal when compared with the P1. Similarly, comparing the P10 and P10*, there are no significant correlations within bottom performers.

[Insert Table 7]

In regard to top performing HFs, Table 8 Panel A shows that the spreads between the top performers P1* and the average is, for the majority of HF strategies not significant; the only exception is for the Relative-Value strategy that is weakly significant. Similar results are for spreads between bottom performers P10* and the average, which is negative in all strategies, although not significant. The only exception is for the CTA strategy with significantly positive spread. When we compare the P1 with the P1* portfolios only the Relative-Value strategy demonstrates high significant positive correlation between them. This means that top performers continue to perform extremely well. Similar results are seen when we compare P10 and P10*, where there are no significant correlations within bottom performers.

Table 8 Panel B shows that the top performers' (P1*), spreads in relation to the average within the specific strategy, are, for the majority of HF strategies positive, although not significant. The only exception is the CTA strategy, with a significantly negative spread. Similar results are seen

for spreads between bottom performers P10* and the average, which are negative in all strategies, although not significant. The only exception is for the CTA strategy, with a significantly positive spread. This means that for P1 and P10 of the CTA strategy there is not only a lack of performance persistence, but also significant reversals when comparing these portfolios with the average HF within the same strategy. By comparing the P1 with the P1* portfolios, there is no significant correlation between them, although, in most cases, it is positive. Similar results are seen when we compare P10 and P10*, where there are no significant correlations within bottom performers. The only exception is from Market-Neutral where there is a significant negative correlation, meaning that bottom performers P10* tend to reverse their performance, but still they underperform compared to the average within this strategy.

Table 8 Panel C shows that the spread between P1* and the average of HFs within the specific strategy varies between positive and negative; the largest positive is from the Long-Only strategy and the largest negative is from the Sector and Other strategy. P1 and P1* spreads for all strategies are relatively high; the largest is from the Short Bias strategy (10.70%, monthly) and the smallest is from the Multi-Strategy. P10 and P10* spreads for all strategies are negative. The largest (in terms of absolute value) is from CTA and the smallest is from the Multi-Strategy. It seems that during recessions, there is no annual performance persistence among HF strategies.

[Insert Table 8]

3.4.2 Bull and Bear regimes

Table 9 Panel A shows that the spreads of the top performers (P1*) during bull regimes in relation to the average within the same strategy are, for the majority of cases, significantly positive. Some exceptions are the Global Macro, CTAs, and Market-Neutral where the spreads are not significantly different from zero. We can draw similar conclusions for spreads between the bottom P10* performers and the average, which are not significant in all strategies. This means that the bottom performers do not differ significantly from the average HF within the same strategy. By comparing the P1 to the P1* portfolios, for almost half of the strategies there is a significantly positive correlation. For the Multi-Strategy and the Relative-Value this correlation is strongly significant. We can draw similar conclusions when we compare P10 and P10*. Many strategies have significantly negative correlations, such as the Long/Short, Other and CTA strategies, meaning that there is a reversal in bottom performers even though they perform poorly compared to the average HF in the same strategy.

Table 9 Panel B shows that in regard to top performers (P1*), their spreads with the average are, for the majority of HF strategies, significantly positive. Regarding the spreads between bottom performers P10* and the average, this is insignificant in almost all strategies; the

exceptions are for the Relative-Value and the CTA strategies, which are negative and positive respectively. In the first case, this means that bottom performers consistently underperform compared to the average within the Relative-Value strategy, whereas in the second case bottom performers outperform compared to the average, meaning there is a reversal. When we compare the P1 and P1* portfolios, the correlations between them are not significant except for the Other and Relative-Value strategies, which are significantly positive. This implies that top performers continue to perform extremely well. When we examine P10 and P10* only the Long/Short, Global Macro, and Relative-Value strategies demonstrate significantly negative correlation, meaning that there is a reversal in bottom performers even though they perform poorly compared to the average HF in the same strategy, as is the case with the Relative-Value strategy.

Panel C in Table 9 shows that regarding the top performers P1* and their spreads with the average, for specific strategies, such as the Long-Only, Event-Driven, Multi-Strategy and Relative-Value, the spread is positive and significantly different from zero. Regarding the spreads between the bottom performers P10* and the average, only the Relative-Value strategy presents a negative spread that is significantly different from zero. This means that worst performing HFs consistently underperform the average within the strategy. By comparing the P1 to the P1* portfolios, only the Relative-Value strategy presents significant results (positive correlation). When we compare P10 and P10*, only the Sector strategy presents significant negative correlation, meaning that there is a reversal in the worst performers.

[Insert Table 9]

Table 10 Panel A presents the quarterly results for bear regimes. Regarding the top performers P1* and their spreads with the average, most HF strategies present positive spreads, although they are not significant. The Relative-Value strategy presents a significant spread equal to 0.76% monthly (and the Event-Driven has a weakly significant positive spread). Regarding the spreads between the bottom performers P10* and the average, almost all HF strategies present negative spreads, although they are not significant. When we compare the P1 to the P1* portfolios, only the Long-Only and Event-Driven strategies present significantly positive correlations. When we compare P10 and P10*, we have mixed results of positive and negative correlations, although they are not significantly different from zero.

Table 10 Panel B shows that regarding the top performers P1* and their spreads with the average return, the majority of HF strategies present positive spreads, although this is not significant (some strategies, such as Sector, Long/Short, and Relative-Value provide results weakly significantly different from zero). Regarding the spreads between the bottom performers

P10* and the average, almost all HF strategies present negative spreads, although these are not significant (but some strategies such as Sector, Long/Short, and Market-Neutral present results weakly significantly different from zero). By comparing the P1 with the P1* portfolios, in all cases except for the CTA strategy, there is a positive correlation. For some strategies such as the Sector, Long/Short and Long-Only these are significantly different from zero. By examining P10 and P10*, there are mixed results of positive and negative correlations, although they are not significantly different from zero. However, the Other and the Market-Neutral strategies present results significantly different from zero.

Table 10 Panel C shows that the spread between P1* and the average of HFs within the specific strategy varies from positive to negative. The largest positive is for the Global Macro strategy and the largest negative is for the Global Macro strategy. P1 and P1* spreads for all strategies are relatively high. The largest is from the Long-Only strategy and the smallest is from CTA. P10 and P10* spreads for all strategies are negative. The most negative is from CTA and the least negative is from Global Macro.

[Insert Table 10]

To sum up, during "good" market conditions many strategies such as the Event-Driven, Relative- Value and Multi-Strategy HFs present persistence up to one year. Some other strategies, such as the Sector and Other, present persistence up to half a year. Some other strategies, such as Short Bias and Long-Only, present persistence on a quarterly basis. In most cases the persistence was driven by the top performers that continue to perform extremely well. Also, in most cases there were reversals in bottom performers. This implies that there is fierce competition among bottom performers to be at least average in terms of performance; otherwise the HF will go out of business. It is known that there are high attrition rates in the HF industry; hence HFs that are underperforming in one time period push their managers to do their best to reverse their performance. During stressful market conditions the persistence reduces dramatically for all HF strategies. Some strategies, such as Event-Driven and Relative-Value present quarterly persistence and some, such as CTA, show semi-annual persistence.

We also examine the spreads between top P1 and bottom P10 performing HFs across all HF strategies for "good" and "bad" market conditions. During "good" times there is persistence in spreads up to an annual basis. During "bad" times there is persistence in spreads on a quarterly basis, whereas for the semi-annual period many strategies, such as the Short Bias, Other, Global Macro and Relative-Value do not provide persistence in their spreads. For the annual period we find no persistence in spreads among HF strategies. It seems that during stressful market conditions there is fiercer competition among HF managers, thus making it more difficult for

sustainable outperformance against its peers. In all market conditions, on average, directional strategies present higher spreads between top P1 and bottom P10 HF performers, compared to semi or non-directional strategies (detailed results are available upon request).

The above results confirm earlier studies (e.g. Agarwal and Naik, 2000a; Eling, 2009; Joenvaara, et al., 2012; Hentati-Kaffel, and Peretti, 2015) of short term persistence. However, in this study we further confirm the initial assumption that persistence depends also on the different business cycles and the different market conditions. More specifically, there is a negative impact concerning the spreads between top P1 and bottom P10 performers and their performance persistence.

Moreover, there is evidence that some non-directional strategies (e.g. Relative-Value) are more persistent than non-directional strategies (e.g. Short Bias or Long-Only). Nevertheless, the difference in persistence is mainly related to the type of strategy each HF follows. There are studies, such as Kosowski, *et al.,* (2007), Jagannathan, *et al.,* (2010), and Amman, *et al.,* (2013) that indicate persistence beyond one year. This study examines persistence up to one year due to data availability, especially during stressful market conditions. We reveal that the persistence is driven mainly by the top performers, a finding that agrees with Jagannathan, *et al.,* (2010), as there are reversals in bottom performers in most cases. Other authors (e.g. Capocci, 2009) suggest that bad performance is more likely to persist than good performance. This is intuitive as, in general, it is easier to identify HF characteristics that result in poor performance (e.g. high expense ratios, high turnover ratios, high trading costs) than to identify the secrets of successful stock picking. However, if HFs consistently perform poorly, these bottom performers will soon be out of business unless they reverse their performance.

3.5 Mixed strategies of HF investors

This section discusses strategies of HF investors based on the persistence analysis in section 3.2 at HF level. We consider growth and recession periods. This is because we believe that bear regimes that are characterized by downward market movements with high volatility are more difficult to predict or to realize once they happen. Moreover, unlike recessions that last for a few months, bear regimes are primarily caused by a shock; thus any strategy of HF investors' implementation is difficult during these periods.

After a brief discussion of the underlying strategies of HF investors, in the next two subsections (3.5.1 and 3.5.2) we present the optimal implementation of the five different strategies of HF investors (see Table 1). We expect that strategies with higher persistence compared to other strategies and strategies with high spreads between top and bottom performers can be used by

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investors for high returns. Indeed it is shown later that some strategies that appear more commonly in the examples (e.g. Other, Sector, Short Bias, and Relative-Value) in general present these characteristics. This can be explained with the suggestion that these strategies may require particularly high skills from HF managers, such as investing in start-ups or private investment in public equity (Others), deep knowledge of specific sectors (Sector), better contrarian investment styles (Short Bias), or finding arbitrage opportunities (Relative-Value). Subsequently, we proceed to the overall evaluation of these five strategies of HF investors by presenting their average performance under different market conditions. Finally, we present a battery of robustness tests.

We first analyse growth periods on a quarterly, semi-annual, and annual basis and we continue with recession periods. We take into account three basic strategies of HF investors (based on the full sample): (i) momentum (ii) contrarian and (iii) *momentrarian* (see section 2.2). The comparisons are run on the basis that investors select a portfolio based on the expected performance represented by the P1* and P10* which are the ex post returns of P1 and P10, respectively. In other words, P1 and P1* refer to the same portfolio (e.g. top performers of a particular strategy), but in different time periods. Hence, an investor who wants to follow a specific trading style (e.g. momentum quarterly) selects the portfolio based on P1* (quarterly expected performance). Similar rules apply in the case of P10 and P10*.

The zero investment momentum strategy of HF investors consists of two legs: the first is when the investor selects one HF strategy (the one with the highest spread between P1* and P10*), but within the same period (quarterly, semi-annual, annual). The second leg is when the investor uses different HF strategies (so that the cross-sectional spread between P1* and P10* is the highest), but again within the same period.

The zero investment contrarian strategy also consists of two legs: the first is when the investor selects one HF strategy (the one with the highest spread between P1* and P10*) for a period longer than a year; in our empirical analysis we examine two and three years. The second leg is when the investor selects different HF strategies for a longer period (two or three years in our case) as well. We use longer holding periods than the previous momentum trading strategy so as to capture the contrarian effect.

Finally, the (vertical) *momentrarian* strategy consists of two sub strategies as well: the first is the *momentrarian* involving high return exploitation focusing on the top performing HF spreads. The second sub strategy is the *momentrarian* involving low return exploitation focusing on the worst performing HF spreads. Both sub strategies are on an annual basis involving P1* and P10* that are held for one, two or three years (please see the trading examples in section 2.2). We

do not consider quarterly or semi-annual periods because the contrarian effect does not work in these "short" periods.

3.5.1. Growth periods

We compute the monthly returns for top and bottom HF performers, for all HF strategies during growth periods using Table 7 and, more specifically, persistence within strategies – winners/losers returns of P1* and P10* (see section 3.4.1).[2] Since there is short term performance persistence in HF returns, investors can utilize these spreads to form appropriate trading strategies and increase their returns. We form strategies of HF investors based on the performance of winners and losers.

3.5.1.1 Momentum and Contrarian strategies of HF investors

Table 11 Panel A gives the returns for the momentum HF investment style when the investor uses only one strategy per time period (quarter, semester, or year). The investor should choose to invest in the strategy with the highest expected difference between top and bottom performers namely the Others strategy. Therefore, the investor should take long and short positions in the top and bottom performers accordingly to exploit the differences in spreads. For each time period the investor should take a long position on best performers (P1) and a short position on bottom performers (P10). In the next time period they should adjust and rebalance their portfolio accordingly. Thus, for the quarterly period the excess market return is 0.30% on a monthly basis, whereas for the semi-annual and annual periods it is 0.90% and 0.18% respectively.

Table 11 Panel B shows the momentum style, where the investor uses different HF strategies. The investor should choose the HF strategies with the highest cross strategy spread between P1 and P10. For the quarterly period, the investor by taking long and short positions in Long-Only and Short Bias of top and bottom performers respectively can have an excess market return equal to 0.63% on a monthly basis. For the semi-annual period the investor by utilizing the Other and Short Bias strategies can have an expected excess market return equal to 1.06% on a monthly basis. For the annual period the investor can have an expected excess market return equal to 2.33% on a monthly basis by using the Sector and CTA strategies.

Table 11 Panel C presents the contrarian style, where the investor uses only one strategy per time period (two and three years). The investor should use the contrarian strategies for two or

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[2] The tables concerning the top and bottom performers during growth periods and recessions are available upon request.

more years between the top and bottom performers within the HF strategy with the highest spreads among them. In the two year contrarian investment style the Short Bias strategy is the most appropriate HF strategy that the investor should exploit. Although this is the best contrarian strategy, the investor receives lower than the market returns. The results are similar for the three year contrarian investment style using the Sector strategy, although nonsignificant.

Table 11 Panel D shows the contrarian style, where the investor utilizes more than one HF strategy per time period. In this case the investor should utilize these strategies with the highest cross strategy spread. Therefore, for the two year contrarian strategy, the investor by taking a long position in the bottom performing Long-Only strategy and taking a short position in the top performing CTA strategy can have an expected excess market return equal to 1.71% per month. For the three-year contrarian strategy the expected excess market return is equal to 0.60% per month.

[Insert Table 11]

3.5.1.2. High and Low Return Momentrarian strategies of HF investors

Table 12 Panel A offers the returns for the momentrarian style of HF investors, involving high return exploitation, where the investor uses only one strategy per time period (first or second order). For the first order case, the investor exploits the spread between the top performer at *t* (long position based on previous one year portfolio performance) and top performer at *t-1* (short position based on prior two years portfolio performance). The highest spread is from the Others strategy. However, this strategy does not outperform the market index as it provides a negative excess market return equal to -0.42% on a monthly basis.

For the second order case, the investor exploits the spread between the top performer at *t* (long position based on previous one year portfolio performance) and top performer as well at *t-2* (short position based on prior three years, portfolio performance). For the Others strategy, the expected excess market return is 0.30% on a monthly basis, although nonsignificant. Table 12 Panel B shows the *momentrarian* style of HF investors involving high return exploitation, where the investor uses different strategies per time period. In the first order case the investor should take a long position in Sector top performers (one year before) and a short position in CTA top performers (two years before); the excess market return is 2.07% on a monthly basis. For the second order the excess market return is 1.25% on a monthly basis.

Table 12 Panel C presents the *momentrarian* style of HF investors, involving low return exploitation, where the investor uses only one strategy per time period (first and second order). In the first order case the investor exploits the spreads between bottom performers at one year before

(long position) and bottom performers two years before (short position). The highest spread is from the Others strategy. However, this strategy does not outperform the market index as the excess market returns equal -0.35% on a monthly basis. For the second order, there are excess market returns equal to -0.69% on a monthly basis. The results here are not significant. Table 12 Panel D shows the *momentrarian* style of HF investors, involving low return exploitation, where the investor uses different strategies. In the first order case the investor receives excess market return equal to 1.79% on a monthly basis, whereas in the second order case the excess market return is equal to 1.61% on a monthly basis.

[Insert Table 12]

Using the above examples, we calculate the average return for each of the five different styles of HF investors. Overall, during "good" market conditions, the average monthly return for the zero investment quarterly, semi-annual, and annual momentum strategies using only one HF strategy is equal to 0.71% (significantly different from zero at 1% level– two tailed test and a t-test equal to 3.404), 0.92% (significant different from zero at 1% level – two tailed test and a t-test equal to 4.610), and 0.52% (significant different from zero at 5% level – two tailed test and a t-test equal to 2.451), respectively. For the two-year and three-year contrarian strategies is 0.05% (not significantly different from zero) and -0.20% (not significantly different from zero), respectively. For the first and second order, *momentrarian* (involving high return exploitation) is 0.21% (not significantly different from zero) and 0.38% (not significantly different from zero), respectively. For the first and second order, *momentrarian* (involving low return exploitation) is 0.35% (significantly different from zero at 5% level – two-tailed test and a t-test 2.112) and -0.07% (not significantly different from zero), respectively.

3.5.2. Recession periods

During recessions again we consider three basic strategies of HF investors: (i) momentum, (ii) contrarian and (iii) *momentrarian*. We do not consider the three-year contrarian and the *momentrarian* second order trading strategy because of insufficient data during recessions.

Similar to growth periods, we compute the monthly returns for top and bottom HF performers for all HF strategies during recessions using Table 8, and more specifically, persistence within strategies –winners/losers returns, of P1* and P10* (see section 3.2.3). Since, there is short term performance persistence in HF returns (at least for a quarter), investors can ensure higher returns even during stressful market conditions.

3.5.2.1 Strategies of HF investors

We present the optimal styles, where the investor uses only one or different HF strategies per period for each of the four general strategies of HF investors: momentum, contrarian, *momentrarian* involving high return exploitation, and *momentrarian* involving low return exploitation. As the findings are not significant, we present a condensed Table (Table 13) with the results. Similar to growth periods, the investor should choose the strategies with the highest expected difference between top and bottom performers by holding long and short positions appropriately (depending on the specific strategy of HF investors). In Table 13 the Relative-Value, Short Bias, Global Macro and Event-Driven are the most common strategies that present the highest spread between top and bottom performer HFs as non- and semi-directional strategies are usually more persistent than directional strategies.

[Insert Table 13]

Based on the above examples, we compute the average return for each of the five different styles of HF investors. Overall, during stressful market conditions, the monthly return for the zero investment momentum strategies on a quarterly, semi-annual, and annual basis (using only one HF strategy) is equal to 0.50% (not significantly different from zero), -1.25% (not significantly different from zero), and 1.35% (we have an insufficient number of observations to test for significance), respectively. For the two-year contrarian strategy the return is 0.66%. For the first order *momentrarian* (high return exploitation) strategy, the return is 0.39% (we have an insufficient number of observations to test for significance) and for the first order *momentrarian* (low return exploitation) strategy, the return is 1.59% (we have an insufficient number of observations to test for significance).

3.5.3. Discussion

Based on our findings in section 3.4 regarding performance persistence, HFs show at least short- term persistence, an issue that is confirmed by the literature (see Agarwal and Naik, 2000a; Eling, 2009; Do, *et al.*, 2010; Joenvaara, *et al.*, 2012; Hentati-Kaffel, and Peretti, 2015). In our study we show that this persistence depends on the various business cycles and different market conditions. No work, to the best of our knowledge, has been done in the literature to help investors exploit the differences in HF persistence. We develop a framework, as summarised in Table 1, regarding the basic trading strategies of HF investors. These basic trading strategies can help

investors to form their own customized trading styles in order to exploit the differences between top and bottom performing funds within HF strategies. Although currently there are limitations concerning the short selling of HFs, there may be future changes in the regulation framework where fund of funds managers can use short selling.

We provide examples of the optimum five different strategies that a HF investor can use to maximize their returns. As HF behaviour changes during stressful market conditions, we implement these trading strategies during growth and recession periods only. This is because we believe bear regimes are difficult to predict or to realize once they happen. Furthermore, contrary to recessions that last for a few months, bear regimes mainly consist of shocks; thus trading strategy implementation is difficult during these periods.

The investor can get substantial excess market returns by using the basic trading strategies on specific HF strategies (e.g. Other, Sector, Relative-Value). These HF strategies present in general higher persistence compared to other strategies, and have high spreads between top and bottom performers as they require high skill levels from fund managers.

In general, zero investment strategies of HF investors, such as momentum, are more efficient during "good" time conditions, although they cannot beat the market benchmark. On the other hand, *momentrarian* strategies of HF investors are more efficient during "bad" times, and they can beat the market benchmark, although due to an insufficient number of observations, we cannot calculate the statistical significance.

3.6 Robustness Checks

In order to check the robustness of our results and, in particular, of our five strategies for HF investors, we first consider the redemption fees that managers may impose on investors, and second we replicate our analysis for two different sub-periods with a holdback period to examine whether the underlying strategies can bring out-of-sample profits for investors.

3.6.1. Redemption fees

In order to compute the redemption cost of implementing the above strategies of HF investors, we proceed as follows. In the used dataset 40.90% of the HFs contain lockup restrictions. The equally weighted average redemption fee is 3.40%, which corresponds to HFs with explicit restrictions mentioning a specific cost. The maximum redemptions that are needed for implementation are four within a year for the quarterly momentum strategy of HF investors. The minimum is one within three years for the three-year contrarian strategy. Hence, we compute the

net return by subtracting from the return of each strategy of HF investors the average monthly redemption cost of the proportional HFs that belong to the category of HFs with lockup redemption restrictions. We define this as:

$$AvREDCost_{monthly}=P_{lock}*RedFee*RedPer/12$$

where $AvREDCost_{monthly}$ is the average monthly redemption cost, P_{lock} is the proportion of HFs in the sample that impose lockups, RedFee is the average redemption fee for HFs that impose lockups, and RedPer is the redemptions per year for a given trading strategy. We standardize by dividing by 12 (the number of months in a year).

During "good" market conditions the average monthly costs for the quarterly, semi-annual and annual momentum strategies become 0.46%, 0.23%, and 0.12%, respectively. For the two-year and three-year contrarian strategy the average monthly costs become 0.06%, and 0.04%, respectively. For the first and second order *momentrarian* (involving high or low return exploitation) the average monthly costs become 0.06% and 0.04%, respectively.

During "bad" market conditions the average monthly cost for quarterly, semi-annual, annual and *momentrarian* strategies are the same as during "good" conditions. For growth periods, all strategies of HF investors, except for the contrarian and the second order *momentrarian* (low return), continue to provide positive returns to investors. For recessions all trading strategies continue to provide positive returns to investors, except for the semi-annual momentum strategy. Regarding the optimal five different strategies of HF investors, the positive returns are still higher than the market benchmark in most cases during growth periods (exceptions are the contrarian strategy, the quarterly momentum within one strategy, and the *momentrarian* low return within one strategy), whereas in recessions they are all positive.

3.6.2. Out-of-sample comparison of performance

All the strategies tested above were based on our full sample period. When using a holdback period to test whether the underlying strategies of HF investors bring out-of-sample profits, our results generally hold. The initial historical data on which these trading strategies are tested (in-sample data) consist of half of our data length and the other half are reserved (out-of-sample) data, for "good" and "bad" times separately.

During "good" market conditions the returns for all strategies of HF investors have the same sign. Exceptions are the three-year contrarian and the second order *momentrarian* (low return exploitation) strategies. We perform the out-of-sample test during "bad" times and the semi-

annual momentum strategy has the same signs, unlike the quarterly momentum strategy that presents reversals, from negative returns for the first half period to positive returns for the second half of our data period. Due to data availability we do not examine the validity of strategies that consider more than one year.

In regard to the optimal implementation of the five different trading strategies, almost all of the sub-cases do not have differences in their signs in growth periods and the same strategies, in most cases, were still the best ones for the sub-periods tested. During the recessions the quarterly momentum trading strategy returns have the same sign, unlike the semi-annual momentum strategy, which exhibits changes from negative returns for the first half period to positive returns for the second half. Most results concerning the above (half data) returns are significantly different from zero. The results of the out-of-sample tests are available upon request.

4   Conclusions

We examine different aspects of performance persistence under different market conditions using parametric and nonparametric tests. More specifically, we study HF persistence in terms of the variability of returns, persistence against the market benchmark and persistence within each strategy group. We are the first to borrow the concepts of momentum and contrarian strategies from the stocks literature when we deal with HF spreads. Moreover, we introduce mixed strategies and we coin the term "*momentrarian*" strategies that allow investors to gain higher returns.

Our conclusions contribute significantly to the HF literature. In regard to performance persistence, during "good" times there is low variability in returns for almost all HF strategies, except for the CTA and Short Bias strategies, even for one year. The return variability increases, but it is still significantly low when considering risk-adjusted returns. Moreover, on average, non-directional and semi-directional strategies present less variability in returns compared to directional strategies. During "bad" times no HF strategy presents low variability in returns.

Regarding persistence with respect to the market benchmark, we generally find no performance persistence in the examined strategies, except for the (semi-annual) Multi-Strategy, the (annual) Long/Short and the (quarterly) Long/Short. In regard to the persistence within each strategy group, we find persistence during "good" times up to one year, whereas during stressful market conditions there is a negative impact on HF persistence within every strategy. Persistence is driven mainly by the top performers, as there are changes in bottom performers in most cases, and recessions are fiercer than bear regimes in terms of HF persistence.

Investors can outperform the market by having zero investment portfolio strategies that exploit the differences between top and bottom performing HFs within HF strategies. During

"good" times momentum strategies are, on average, the most successful, followed by *momentrarian* strategies. However, during "bad" times the *momentrarian* strategies are the most successful, followed by the momentum strategies. In all market conditions the contrarian strategy is the least successful. The above results refer to strategies of HF investors that take into account the spreads of only one HF strategy. When the investors consider different HF strategies, their average returns are even higher.

Our results from this study are important as they enable us to better understand HF behavior. More specifically, we make a clear distinction between different kinds of persistence in terms of variability of (risk-adjusted) returns, persistence against the market benchmark, and persistence within each specific strategy.

We provide a comprehensive investigation of HF performance persistence, allowing investors to implement mixed trading strategies that utilize spreads between top and bottom performers of different HF strategies. HF administrators can apply more flexible fee polices by considering performance persistence. Financial regulators can benefit in the event that there is a need for monitoring HFs that exhibit "unusual" persistence, or change in the regulation framework.

References

Abugri, B, & Dutta, S. (2009). Emerging market hedge funds: Do they perform like regular hedge funds? *Journal of International Financial Markets, Institutions and Money*, 19, 834–849.

Agarwal, V., & Naik, N. (2000a). Multi-period performance persistence analysis of hedge funds. *Journal of Financial and Quantitative Analysis*, 35, 327–342.

Agarwal, V., & Naik, N. (2000b). On taking the alternative route: risks, rewards, and performance persistence of hedge funds. *Journal of Alternative Investments*, 2, 6–23.

Agarwal, V., Daniel, N., & Naik, N. (2011). Do hedge funds manage their reported returns? *Review of Financial Studies,* 24, 3281–3320.

Akay, O., Senyuz, Z., & Yoldas, E. (2013). Hedge fund contagion and risk-adjusted returns: A Markov-switching dynamic factor approach. *Journal of Empirical Finance*, 22, 16–29.

Ammann, M., Huber, O., & Schmid, M. (2013). Hedge fund characteristics and performance persistence. *European Financial management*, 19, 209–250.

Amenc, N., & Martellini, L. (2003). The alpha and omega of hedge fund performance measurement.

Available Online: http://www.edhec-risk.com/events/EDHEC_Events/Event.
2004-12-09.1402/attachments/alpha%20and%20omega.pdf [Accessed 05/10/2015].

Bae, K.H., & Yi, J. (2012). Performance persistence and flow restrictions in hedge funds, Available Online: http://asianfa2012.mcu.edu.tw/fullpaper/10331.pdf [Accessed 05/10/2015].

Bali, T., Brown, S., & Caglayan, M. (2011). Do hedge funds' exposures to risk factors predict their future returns? *Journal of Financial Economics,* 101, 36–68.

Bares, P.-A., Gibson, R., & Gyger, S. (2003). Performance in the hedge funds industry: An analysis of short-and long-term persistence. *Journal of Alternative Investments*, 6, 25–41.

Bollen, N., & Pool, V. (2006). Conditional return smoothing in the hedge fund industry. *Journal of Financial and Quantitative Analysis*, 43, 267–298.

Boyson, N. M., (2008). Hedge Fund Performance Persistence: A New Approach. Financial Analysts Journal, 64, 27–44.

Brown, S.J., Goetzmann, W.N. & Ibbotson, R.G. (1999). Offshore hedge funds: survival and performance 1989-1995. *Journal of Business*, 72, 91–117.

Capocci, D. P. J. (2009). The persistence in hedge fund performance: extended analysis. *International Journal of Finance and Economics*, 14, 233–255.

Carhart, M. (1997). On persistence in mutual fund performance. *Journal of Finance*, 52, 57–82.

DeBondt, W. & Thaler, R. (1990). Do security analysts overreact? *American Economic Review*, 80, 52–57.

Denvir, E. & Hutson, E. (2006). The performance and diversification benefits of funds of hedge funds, *Journal of International Financial Markets, Institutions and Money*, 16, 4–22.

Do, V., Faff, R., & Veeraraghavan, M. (2010). Performance persistence in hedge funds: Australian evidence, *Journal of International Financial Markets, Institutions and Money*, 20, 346–362.

Eling, M. (2009). Does hedge fund performance persist? Overview and new empirical evidence. *European Financial Management*, 15, 632–401.

Getmansky, M., Lo, A., & Makarov, I. (2004). An econometric model of serial correlation and illiquidity in hedge funds returns. *Journal of Financial Economics*, 74, 529–609.

Giannikis, D. & Vrontos, I. (2011). A Bayesian approach to detecting nonlinear risk exposures in hedge fund strategies. *Journal of Banking and Finance*, 35, 1399–1414.

Goodwin, T. (1998). The Information Ratio. *Financial Analysts Journal*, 54, 1–10.

Harri, A., & Brorsen, B. (2004). Performance persistence and the source of returns for hedge funds. *Applied Financial Economics*, 14, 131–141.

Harris, R.D.F., & Mazibas, M. (2010). Dynamic hedge fund portfolio construction. *International Review of Financial Analysis*, 19, 351–357.

Hamilton, J.D. (1989). A new approach to the economic analysis of nonstationary time series and the business cycle. *Econometrica*, 57, 357–384.

Hentati-Kafell, R. & Peretti, P. (2015). Generalized runs to detect randomness in hedge funds returns. *Journal of Banking and Finance*, 50, 608–615.

Itzhak, B-D, Franzoni, F., Landier, A., & Moussawi, R. (2013). Do hedge funds manipulate stock prices? *Journal of Finance*, 48, 2383–2434.

Jagannathan, R., Malakhov, A., & Novikov, D. (2010). Do hot hands exist among hedge fund managers? An empirical evaluation. *Journal of Finance*, 65, 217–255.

Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *Journal of Finance*, 78, 65–91.

Joenvaara, J., Kosowski, R. & Tolonen, P. (2012). New 'Stylized facts' about hedge funds and database selection bias.

Available Online: http://www.efmaefm.org/0EFMAMEETINGS/EFMA%20ANNUAL%20MEETINGS/2013 -Reading/papers/EFMA2013_0410_fullpaper.pdf [Accessed 05/10/2015].

Kosowski, R., Naik, N., & Teo, M. (2007). Do hedge funds deliver alpha? A Bayesian and bootstrap analysis. *Journal of Financial Economics,* 84, 229–264.

Malkiel, B. G., & Saha, A. (2005). Hedge Funds: Risk and Return. Financial Analysts Journal, 61, 80–88.

Meligkotsidou, L., & Vrontos, I. (2014). Detecting structural breaks in multivariate financial time series: Evidence from hedge fund investment strategies. *Journal of Statistical Computation and Simulation*, 84, 1115–1135.

Meredith, J. (2007). Examination of fund age and size and its impact on the hedge fund performance. *Derivatives Use, Trading & Regulation*, 12, 342–350.

Park, L., & Staum, J. (1998). Performance persistence in the alternative investment industry.

Available Online: http://www.intercontilimited.com/mfutsarchive/ssrn-id139068.pdf [Accessed 05/10/2015].

Sharpe, W. (1994). The Sharpe ratio. *Journal of Portfolio Management*, 21, 49–58.

Teulon, F., Guesmi, K., & Jebri, S. (2014). Risk analysis of hedge funds: A Markov switching model analysis. *The Journal of Applied Business Research*, 30, 243–254.

Table 1

The five basic trading strategies of HF investors.

		Vertical *Momentrarian* Trading (high return exploitation)	Vertical *Momentrarian* Trading (low return exploitation)
Horizontal *Momentrarian* Trading	Momentum Trading	Hedge funds, A : High Recent Returns Action: Buy then Sell	Hedge funds, B : Low Recent returns Action: Short-Sell then Buy
	Contrarian Trading	Hedge funds, C : High Earlier Returns Action: Short-Sell then Buy	Hedge funds, D : Low Earlier Returns Action: Buy then Sell

This table presents five basic trading strategies of HF investors: momentum, contrarian, horizontal *momentrarian*, vertical *momentrarian* with high returns exploitation, and vertical *momentrarian* with low returns exploitation. We call Recent Returns the monthly returns realized a few months to a year ago and Earlier Returns the monthly returns realized from periods more than one year ago.

Table 2

Summary Statistics of Raw Returns by strategy.

Strategy	Mean	Standard Deviation	Correlation Coefficient	Strategy	Mean	Standard Deviation	Correlation Coefficient
Short Bias	0.050%	5.197	-0.924**	Others	1.349%	1.091	0.232**
Long-Only	0.999%	3.437	0.707**	Global Macro	0.934%	2.017	0.223**
Sector	1.151%	3.259	0.637**	Relative-Value	0.821%	1.238	0.211**
Long/Short	1.125%	2.663	0.550**	Market-Neutral	0.525%	0.874	0.059**
Event-Driven	0.937%	1.839	0.338**	CTA	1.184%	3.415	0.048
Multi-Strategy	1.062%	1.713	0.271**				

This table gives the summary statistics of monthly raw returns for each HF strategy. It also gives the correlation of each strategy with the Wilshire 5000TRI including dividends for the period (01/1990-03/2014). As a ranking criterion we use the correlation with the market index, from extreme directional strategies (Short Bias) to extreme non-directional strategies (CTAs). Each strategy is a representative-average time series of all the relevant HFs. ** denotes a correlation statistically different from zero at the 1% level (using a two tailed test). We define Short Bias, Long Only, Sector and Long Short as directional strategies (absolute values of the correlation coefficient above 0.5); Event Driven, Multi-Strategy, Others, and Global Macro as semi-directional strategies (absolute values of the correlation coefficient between 0.22 and 0.49); Relative-Value, Market-Neutral, and CTA as non-directional strategies (absolute values of the correlation coefficient between 0 and 0.21).

Table 3

HF return variability at strategy Level – Growth and Recession Periods.

Strategy	RR - Time Horizon			SR - Time Horizon			IR - Time Horizon		
	Quarterly	Semi-Annual	Annual	Quarterly	Semi-Annual	Annual	Quarterly	Semi-Annual	Annual
Panel A: Growth period									
Short Bias	-0.114	0.060	-0.082	0.168	0.198	0.634**	0.109	0.198	0.720**
	(-1.077)	(0.393)	(-0.351)	(1.575)	(1.360)	(3.609)	(1.004)	(1.355)	(4.567)
Long-Only	0.241*	0.474**	0.553*	0.222*	0.444**	0.619**	0.054	2.273	2.110
	(2.268)	(3.422)	(2.765)	(2.026)	(3.117)	(3.341)	(0.488)	0.366*	0.384
Sector	0.279**	0.543**	0.453*	0.323**	0.519**	0.529*	0.097	0.366*	0.384
	(2.665)	(4.165)	(2.248)	(3.124)	(3.843)	(2.701)	(0.913)	(2.576)	(0.129)
Long/Short	0.322**	0.532**	0.597**	0.299**	0.462**	0.509*	0.265*	0.296	0.570*
	(3.112)	(4.028)	(3.235)	(2.862)	(3.283)	(2.476)	(2.484)	(1.986)	(2.744)
Event-Driven	0.578**	0.661**	0.805**	0.604**	0.649**	0.748**	0.102	0.178	0.289
	(6.467)	(5.646)	(5.983)	(6.897)	(5.414)	(4.764)	(0.932)	(1.147)	(1.258)
Multi-Strategy	0.712**	0.763**	0.760**	0.518**	0.612**	0.582**	-0.250*	-0.214**	-0.005
	(9.315)	(7.622)	(5.310)	(5.496)	(4.945)	(4.091)	(-2.364)	(-4.790)	(-0.059)
Other	0.786**	0.850**	0.843**	-0.001	0.596**	0.606**	-0.120	0.147	0.380
	(11.892)	(10.490)	(7.138)	(-0.007)	(8.723)	(9.019)	(-0.948)	(0.764)	(1.330)
Global Macro	0.411**	0.571**	0.524**	0.340**	0.457**	0.366	0.111	0.298	0.191
	(4.146)	(4.499)	(2.990)	(3.093)	(3.121)	(1.619)	(0.963)	(1.897)	(0.804)
Relative-Value	0.718**	0.796**	0.871**	0.675**	0.735**	0.840**	0.015	0.227	0.311
	(9.425)	(8.301)	(7.732)	(8.310)	(6.755)	(6.314)	(0.132)	(1.478)	(1.288)
Market-Neutral	0.744**	0.771**	0.758**	0.472**	0.419**	0.620**	0.029	0.317*	0.472
	(10.181)	(7.827)	(5.257)	(4.885)	(2.885)	(3.368)	(0.264)	(2.107)	(2.079)
CTA	0.185	0.448**	0.708**	0.030	0.080	0.382	-0.007	0.085	0.445
	(1.766)	(3.342)	(4.530)	(0.286)	(0.547)	(1.851)	(-0.063)	(0.557)	(1.869)
Panel B: Recession period									
Short Bias	0.073	-0.533	0.357	0.285	0.433	-0.001	0.329	0.393*	-0.002
	(0.251)	(-1.129)	(0.258)	(0.927)	(1.196)	(-0.075)	(1.058)	(3.456)	(-0.164)
Long-Only	0.080	-0.748	3.451*	0.057	-0.065	-0.748	0.007	-0.184	-0.030
	(0.255)	(-1.705)	(4.788)	(0.168)	(-0.119)	(-1.128)	(0.084)	(-1.568)	(-0.070)
Sector	0.176	-0.437	-0.125	0.196	-0.194	-0.216	-0.038	-0.421	0.846
	(0.511)	(-0.775)	(-0.227)	(0.597)	(-0.335)	(-1.267)	(-0.122)	(-0.950)	(1.126)
Long/Short	0.141	-0.712	-0.090	0.062	-0.825	-0.224	0.106	-0.489	1.853
	(0.413)	(-1.346)	(-0.136)	(0.193)	(-1.599)	(-0.490)	(0.302)	(-0.985)	(1.622)
Event-Driven	0.206	-0.822	0.116	0.260	-0.686	-0.326	0.077	-0.362	0.041
	(0.541)	(-1.478)	(0.096)	(0.746)	(-1.106)	(-0.514)	(0.236)	(-0.824)	(0.038)
Multi-Strategy	0.138	-0.4551	-0.006	0.181	-0.576	0.243	-0.283	-0.717	0.527

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	(0.381)	(-0.709)	(-0.065)	(0.492)	(-0.779)	(0.352)	(-1.014)	(-1.500)	(0.414)
Other	0.276	-0.039	0.282	-0.254	0.332	0.899	0.120	0.032	0.671
	(0.831)	(-0.075)	(1.043)	(-0.716)	(0.448)	(0.976)	(0.314)	(0.059)	(1.746)
Global Macro	0.129	0.844	0.824	0.124	0.589	1.075	0.167	0.974	1.529
	(0.381)	(2.216)	(5.812)	(0.318)	(0.713)	(1.125)	(0.449)	(1.238)	(7.158)
Relative-Value	0.028	-0.666	0.215	0.024	-0.570	1.253	-0.053	-0.352	0.929
	(0.085)	(-1.190)	(0.546)	(0.090)	(-1.144)	(9.045)	(-0.151)	(-0.658)	(0.836)
Market-Neutral	0.183	-0.177	0.704*	-0.149	-0.569	1.716	-0.025	-0.663	0.360
	(0.977)	(-0.726)	(3.499)	(-0.554)	(-1.163)	(0.382)	(-0.083)	(-1.422)	(0.222)
CTA	0.004	0.747	0.909	0.011	0.940*	1.036	0.027	-0.433	0.156
	-0.018	(2.523)	(2.917)	(0.044)	(4.531)	(2.532)	(0.082)	(-0.814)	(0.134)

This table gives the results of the regression-based parametric model (Eq. 5) for raw returns (RR), the Sharpe ratio (SR), and the Information ratio (IR), during growth (Panel A) and recession periods (Panel B). A positive and significant slope coefficient indicates performance persistence. This suggests that a HF (or group of HFs) that did well in a specific period tend to do well in the subsequent period and vice-versa. * and ** denotes significance at 5% and 1% level respectively using a two-tailed t-test. We present the correlation coefficients followed by the t-statistics in parentheses.

Table 4

HF return variability at strategy Level – Bull and Bear Regimes.

	Time Horizon - RR			Time Horizon - SR			Time Horizon - IR		
Strategy	Quarterly	Semi-Annual	Annual	Quarterly	Semi-Annual	Annual	Quarterly	Semi-Annual	Annual
Panel A: Bull regime									
Short Bias	0.112	-0.135	-0.244	0.163	0.042	0.185	0.199	0.071	0.260
	(1.067)	(-0.894)	(-1.095)	(1.507)	(0.267)	(1.009)	(1.852)	(0.452)	(1.501)
Long-Only	0.371**	0.409**	0.539*	0.257*	0.504**	0.648**	0.020	0.223	0.093
	(3.639)	(2.863)	(2.710)	(2.388)	(3.705)	(3.498)	(0.227)	(1.743)	(0.475)
Sector	0.425**	0.511**	0.615**	0.343**	0.538**	0.689**	-0.035	0.126	0.196
	(4.282)	(3.818)	(3.849)	(3.325)	(4.054)	(4.335)	(-0.330)	(0.831)	(0.786)
Long/Short	0.407**	0.516**	0.611**	0.278*	0.506**	0.562**	0.017	0.253	0.298
	(4.059)	(3.872)	(3.577)	(2.635)	(3.740)	(2.908)	(0.155)	(1.697)	(1.214)
Event-Driven	0.604**	0.589**	0.636**	0.577**	0.641**	0.658**	-0.066	0.152	0.307
	(6.897)	(4.673)	(3.656)	(6.438)	(5.333)	(3.764)	(-0.602)	(0.988)	(1.331)
Multi-Strategy	0.721**	0.708**	0.726**	0.662**	0.691**	0.662**	0.085	0.138**	0.004
	(9.505)	(6.420)	(4.959)	(7.975)	(5.993)	(3.984)	(0.774)	(3.683)	(0.066)
Other	0.717**	0.865**	0.862**	0.002	0.615**	0.627**	-0.143	-0.119	0.631
	(9.492)	(11.162)	(7.959)	(0.033)	(9.739)	(9.295)	(-1.117)	(-0.598)	(1.785)
Global-Macro	0.397**	0.478**	0.560**	0.340**	0.465**	0.360	0.118	0.292	0.144
	(3.950)	(3.520)	(3.007)	(3.050)	(3.146)	(1.541)	(1.008)	(1.826)	(0.579)
Relative-Value	0.729**	0.691**	0.759**	0.724**	0.751**	0.793**	-0.099	0.134	0.327
	(9.661)	(6.068)	(5.676)	(9.481)	(7.077)	(5.621)	(-0.907)	(0.867)	(1.253)

Market-Neutral	0.616**	0.713**	0.840**	0.408**	0.431**	0.645**	0.142	0.252	0.330
	(7.127)	(6.598)	(6.537)	(4.055)	(3.031)	(3.477)	(1.307)	(1.667)	(1.571)
CTA	0.128	0.563**	0.594**	-0.001	0.141	-0.046	0.124	0.085	0.003
	(1.204)	(4.634)	(3.304)	(-0.002)	(0.975)	(-0.205)	(1.170)	(0.552)	(0.012)
Panel B: Bear regime									
Short Bias	0.364	0.419	0.600	0.487**	0.007	0.127	0.512**	0.056	0.160
	(1.582)	(1.170)	(0.634)	(3.348)	(0.059)	(0.491)	(3.193)	(0.380)	(0.441)
Long-Only	0.208	0.277	0.225	0.156	0.348	0.924	0.439	0.379	1.076
	(0.773)	(0.487)	(0.103)	(0.504)	(0.784)	(0.377)	(1.252)	(0.611)	(9.627)
Sector	0.008	0.757	1.401	-0.080	0.352	0.940	0.630	1.119*	1.384
	(0.027)	(1.260)	(0.757)	(-0.307)	(0.922)	(0.887)	(1.858)	(3.961)	(1.119)
Long/Short	0.174	0.681	0.148	0.187	0.440	0.221	0.518	1.294**	1.512
	(0.600)	(1.064)	(0.034)	(0.672)	(0.982)	(0.104)	(1.597)	(5.616)	(3.716)
Event-Driven	0.301	1.293	-3.749	0.404	0.579	-5.262	0.023	0.925**	0.930
	(1.005)	(1.373)	(-0.722)	(1.455)	(0.958)	(-8.776)	(0.070)	(4.757)	(9.132)
Multi-Strategy	0.004	1.011	-0.291	0.124	0.133	0.125	0.202	0.176	0.316
	(0.012)	(1.458)	(-0.183)	(1.046)	(1.143)	(0.430)	(1.577)	(1.074)	(0.922)
Other	-0.180	0.301	0.133	0.127	0.186	-0.819	0.626	0.339	1.035
	(-0.605)	(0.586)	(0.193)	(0.379)	(0.321)	(-0.870)	(1.870)	(0.649)	(7.618)
Global Macro	-0.094	0.383	0.479	0.169	0.415	1.613	1.184*	0.540	1.642
	(-0.513)	(1.946)	(9.891)	(0.443)	(0.741)	(5.200)	(2.382)	(1.077)	(2.190)
Relative-Value	-0.024	-0.126	-1.770	0.296	-0.088	-0.678	0.272	1.109**	1.429
	(-0.081)	(-0.221)	(-3.297)	(1.418)	(-0.364)	(-4.336)	(0.822)	(7.079)	(11.340)
Market-Neutral	0.535*	0.508*	0.515**	0.190	0.077	0.406*	0.260	0.583	0.825
	(2.660)	(4.179)	(9.120)	(0.885)	(0.470)	(4.883)	(1.042)	(1.354)	(0.776)
CTA	0.521*	0.267	0.359	0.393*	0.193	0.175	0.579*	0.660	0.648
	(3.097)	(1.497)	(0.962)	(2.387)	(1.085)	(0.376)	(2.495)	(2.074)	(0.686)

This table shows the results of the regression-based parametric model (Eq. 5) for raw returns (RR), the Sharpe ratio (SR), and the Information ratio (IR), during bull (Panel A) and bear (Panel B) regimes. A positive and significant slope coefficient indicates performance persistence. This suggests that a HF (or group of HFs) that did well in a specific period tend to do well in the subsequent period and vice-versa. * and ** denotes significance at 5% and 1% level respectively using a two-tailed t-test. We present coefficients followed by the t-statistics in parentheses.

Table 5

Persistence against the Market Benchmark – Growth and Recession periods.

Panel A: Growth periods

Strategy	Annual CPR	(t-stat) WW/LL	χ2-test	Semi-annual CPR	WW/LL	(z-stat) χ2-test	Quarterly CPR	(z-stat) WW/LL	χ2-test
Short Bias	2.33	0.07	22.00**	2.86	0.21	23.33**	1.01	0.31	14.15**
Long-Only	5.00	1.80	4.80	2.39	1.89	5.43	1.66	1.29	2.29
Sector	3.50	1.17	2.00	2.14	1.27	2.00	2.03	1.17	3.05
Long/Short	9.33*	0.88	5.20	3.04	0.59	5.81	2.47*	0.86	4.65
Event-Driven	3.00	0.44	4.40	0.68	-	0.48	1.15	1.00	0.13
Multi-Strategy	8.33	0.50	7.60	4.86*	0.71	7.33	1.66	0.78	2.29
Other	1.50	0.83	0.40	2.14	0.79	2.00	1.14	0.83	0.51
Global Macro	2.50	0.30	6.80	1.33	0.35	6.19	1.35	0.70	2.11
Relative-Value	0.69	-	10.80*	1.17	0.26	10.19*	0.82	-	6.06
Market-Neutral	3.75	0.07	26.80**	1.86	0.12	31.33**	0.94	-	25.54**
CTA	1.50	0.83	0.40	0.64	-	1.62	0.96	-	7.75

Panel B: Recession periods

Strategy	Annual W	L	Semiannual WW	LL	WL	LW	Quarterly WW	LL	WL	LW
Short Bias	2	1	2	0	2	1	4	1	3	2
Long-Only	2	1	1	0	2	2	4	2	2	2
Sector	3	0	2	0	2	1	5	0	3	2
Long/Short	2	1	2	0	2	1	4	1	3	2
Event Driven	2	1	0	0	3	2	4	1	3	2
Multi-Strategy	2	1	0	0	3	2	4	1	3	2
Other	3	0	2	0	2	1	4	1	3	2
Global-Macro	2	1	2	0	2	1	4	1	3	2
Relative-Value	2	1	2	1	1	1	4	1	3	2
Market-Neutral	2	1	2	0	2	1	4	1	3	2
CTA	2	1	2	0	2	1	4	1	3	2

This table shows the results for the persistence during growth (Panel A) and recessions (Panel B). Regarding the growth periods, Panel A shows the results of CPR and the χ^2-test. A significant CPR statistic indicates persistence whereas a WW/LL greater (less) than one indicates outperformance (underperformance) against the market index (Wilshire 5000TRI, including dividends). A χ^2-test less than 5% indicates significant persistence against the market index. For CPR, * and ** denotes significance at 5% and 1% level respectively using a two-tailed t-test. At an annual horizon we use the t-test (due to an insufficient number of observations) whereas at the semi-annual and quarterly horizon we use the z-test. Regarding the recessions, Panel B shows only descriptive statistics due to an insufficient number of available observations.

Table 6

Persistence against the Market Benchmark –Bull and Bear Regimes.

Panel A: Bull regime

Strategy	Annual	(t-stat)		Semi- annual	(t-stat)		Quarterly	(z-stat)	
	CPR	WW/LL	χ2-test	CPR	WW/LL	χ2-test	CPR	WW/LL	χ2-test
Short- Bias	0.75	-	12.71**	0.19	-	18.67**	0.78	-	20.48**
Long- Only	0.44	-	0.80	1.47	0.92	0.48	0.56	-	1.81
Sector	3.50	0.86	2.00	1.78	1.00	0.86	0.99	-	0.38
Long/Short	0.84	-	1.60	1.58	0.32	9.62*	1.00	-	4.10
Event-Driven	2.00	0.50	2.40	1.67	0.60	2.57	0.50	-	5.14
Multi-Strategy	3.67	0.27	9.60*	2.08	0.37	9.24*	1.40	0.64	3.14
Other	0.44	-	0.80	0.69	-	3.14	1.20	0.83	0.57
Global Macro	0.40	-	7.76*	1.17	0.19	15.33**	0.67	-	10.57*
Relative-Value	1.69	0.33	4.40	0.45	-	6.19	0.68	-	13.71**
Market-Neutral	0.69	-	10.80*	0.26	-	23.14**	0.45	-	20.10**
CTA	0.16	-	3.60	0.82	-	3.90	0.71	-	9.67*

Panel B: Bear regime

Strategy	annual		semi- annual				quarterly			
	W	L	WW	LL	WL	LW	WW	LL	WL	LW
Short Bias	3	0	5	0	0	0	7	0	2	2
Long-Only	3	0	4	0	1	0	8	0	1	2
Sector	3	0	5	0	0	0	8	1	1	1
Long/Short	3	0	5	0	0	0	7	0	2	2
Event-Driven	3	0	5	0	0	0	7	0	2	2
Multi-Strategy	3	0	5	0	0	0	7	0	2	2
Other	3	0	5	0	0	0	7	0	2	2
Global Macro	3	0	5	0	0	0	6	1	2	2
Relative-Value	3	0	5	0	0	0	7	0	2	2
Market-Neutral	3	0	5	0	0	0	6	1	2	2
CTA	3	0	5	0	0	0	6	1	2	2

This table shows the results for the persistence during bull (Panel A) and bear (Panel B) regimes. Regarding the bull regimes, Panel A shows the results of CPR and the χ^2-test. A significant CPR statistic indicates persistence whereas a WW/LL greater (less) than one indicates outperformance (underperformance) against the market index (Wilshire 5000TRI, including dividends). A χ^2-test less than 5% indicates significant persistence against the market index. For CPR, * and ** denotes significance at 5% and 1% level respectively using a two-tailed t-test. At annual horizon we use the t-test (due to an insufficient number of observations) whereas at the semi-annual and quarterly horizon we use the z-test. Regarding the bear regimes, Panel B shows only descriptive statistics due to an insufficient number of available observations.

Table 7

Persistence within Strategies – Winners/Losers – Growth Periods.

Panel A: Quarterly

Short Bias	Return	Spear	Pear	Long-Only	Return	Spear	Pear	Sector	Return	Spear	Pear	Long/Short	Return	Spear	Pear
Spr. P1-P1*	3.71%	-0.014	-0.125	Spr. P1-P1*	3.32%	0.090	-0.070	Spr. P1-P1*	5.22%	0.036	-0.162	Spr. P1-P1*	4.03%	0.125	-0.113
Spr. P10-P10*	-4.09%	-0.145	-0.206	Spr. P10-P10*	-2.99%	-0.067	-0.099	Spr. P10-P10*	-4.59%	0.123	0.041	Spr. P10-P10*	-3.90%	0.024	-0.133
Spr. P1*-Avg	0.52%			Spr. P1*-Avg	0.65%**			Spr. P1*-Avg	0.28%			Spr. P1*-Avg	0.49%*		
Spr. P10*-Avg	0.14%			Spr.. P10*-	-0.40%*			Spr. P10*-Avg	-0.39%			Spr. P10*-Avg	-0.28%**		

Event-Driven	Return	Spear	Pear	Multi-Strategy	Return	Spear	Pear	Other	Return	Spear	Pear	Global Macro	Return	Spear	Pear
Spr. P1-P1*	2.63%	0.185	-0.034	Spr. P1-P1*	2.80%	0.126	0.144	Spr. P1-P1*	2.91%	0.353**	0.237	Spr. P1-P1*	3.90%	-0.069	-0.128
Spr. P10-P10*	-2.52%	0.001	0.004	Spr. P10-P10*	-2.60%	0.063	-0.172	Spr. P10-P10*	-2.94%	-0.04	-0.139	Spr. P10-P10*	-3.57%	-0.187	-0.315*
Spr. P1*-Avg	0.62%**			Spr. P1*-Avg	0.66%*			Spr. P1*-Avg	0.85%**			Spr. P1*-Avg	0.16%		
Spr. P10*-Avg	-0.16%**			Spr. P10*-Avg	-0.28%			Spr. P10*-Avg	-0.51%*			Spr. P10*-Avg	-0.07%		

Relative-Value	Return	Spear	Pear	Market-Neutral	Return	Spear	Pear	CTAs	Return	Spear	Pear
Spr. P1-P1*	1.90%	0.307**	0.309**	Spr. P1-P1*	2.30%	0.153	-0.084	Spr. P1-P1*	5.72%	-0.011	-0.073
Spr. P10-P10*	-2.16%	-0.161	-0.292**	Spr. P10-P10*	-2.18%	-0.007	-0.04	Spr. P10-P10*	-5.51%	-0.164	-0.201
Spr. P1*-Avg	0.88%**			Spr. P1*-Avg	0.15%			Spr. P1*-Avg	0.32%		
Spr. P10*-Avg	-0.29%*			Spr. P10*-Avg	-0.20%			Spr. P10*-Avg	0.26%		

Panel B: Semi-Annual

Short Bias	Return	Spear	Pear	Long-Only	Return	Spear	Pear	Sector	Return	Spear	Pear	Long/Short	Return	Spear	Pear
Spr. P1-P1*	2.75%	0.170	0.321	Spr. P1-P1*	2.87%	0.157	0.070	Spr. P1-P1*	4.19%	-0.038	-0.047	Spr. P1-P1*	3.21%	-0.093	-0.18
Spr. P10-P10*	-2.94%	-0.010	-0.196	Spr. P10-P10*	-2.50%	-0.089	-0.071	Spr. P10-P10*	-3.64%	0.098	0.243	Spr. P10-P10*	-3.04%	-0.006	0.058
Spr. P1*-Avg	0.84%			Spr. P1*- Avg	0.38%			Spr. P1*- Avg	0.28%			Spr. P1*- Avg	0.48%*		
Spr. P10*-	-0.19%			Spr. P10*-	-0.47%*			Spr. P10*-	-0.69%			Spr. P10*-	-0.40%*		

Event-Driven	Return	Spear	Pear	Multi-Strategy	Return	Spear	Pear	Other	Return	Spear	Pear	Global Macro	Return	Spear	Pear
Spr. P1-P1*	2.13%	0.028	-0.280	Spr. P1-P1*	1.93%	0.121	0.093	Spr. P1-P1*	2.24%	0.221	0.403*	Spr. P1-P1*	2.61%	0.162	0.148
Spr. P10-P10*	-1.65%	-0.165	-0.152	Spr. P10-P10*	-2.22%	0.191	0.173	Spr. P10-P10*	-1.82%	0.071	0.136	Spr. P10-P10*	-3.04%	0.029	-0.238
Spr. P1*- Avg	0.62%**			Spr. P1*- Avg	0.9%**			Spr. P1*- Avg	1.01%**			Spr. P1*- Avg	0.47%		
Spr. P10*-	-0.55%**			Spr. P10*-	-0.17%			Spr. P10*-	-0.96%**			Spr. P10*-	0.14%		

Table 7. (Continued)

Relative-Value	Return	Spear	Pear	Market-Neutral	Return	Spear	Pear	CTAs	Return	Spear	Pear
Spr. P1-P1*	1.62%	0.395**	0.371*	Spr. P1-P1*	1.62%	0.298	0.062	Spr. P1-P1*	4.47%	-0.140	-0.202
Spr. P10-P10*	-1.74%	-0.048	-0.342*	Spr. P10-P10*	-1.47%	0.014	-0.069	Spr. P10-P10*	-4.09%	0.163	0.042
Spr. P1*- Avg	0.76%**			Spr. P1*- Avg	0.37%*			Spr. P1*- Avg	0.30%		
Spr.	-0.33%			Spr. P10*-	-0.36%*			Spr. P10*-	0.28%		

Panel C: Annual

Short Bias	Return	Spear	Pear	Long-Only	Return	Spear	Pear	Sector	Return	Spear	Pear	Long/Short	Return	Spear	Pear
Spr. P1-P1*	2.42%	0.086	0.002	Spr. P1-P1*	2.27%	-0.519*	-0.575**	Spr. P1-P1*	3.15%	-0.217	-0.271	Spr. P1-P1*	2.67%	-0.426	-0.276
Spr. P10-P10*	-3.04%	-0.060	0.055	Spr. P10-P10*	-2.21%	0.005	-0.219	Spr. P10-P10*	-3.06%	0.060	-0.369	Spr. P10-P10*	-2.67%	0.052	-0.312
Spr. P1*-Avg	1.01%*			Spr. P1*-Avg	0.44%*			Spr. P1*-Avg	0.59%			Spr. P1*-Avg	0.29%		
Spr. P10*-	0.41%			Spr. P10*-	-0.47%			Spr. P10*-	-0.35%			Spr. P10*-	-0.17%		

Event Driven	Return	Spear	Pear	Multi-Strategy	Return	Spear	Pear	Other	Return	Spear	Pear	Global Macro	Return	Spear	Pear
Spr. P1-P1*	1.90%	0.048	0.044	Spr. P1-P1*	1.98%	-0.074	0.072	Spr. P1-P1*	2.33%	0.050	0.016	Spr. P1-P1*	2.77%	-0.318	-0.244
Spr. P10-P10*	-1.72%	0.200	-0.128	Spr. P10-P10*	-2.00%	-0.164	-0.234	Spr. P10-P10*	-1.70%	0.222	0.220	Spr. P10-P10*	-2.40%	0.318	-0.277
Spr. P1*- Avg	0.46%**			Spr. P1*- Avg	0.29%			Spr. P1*- Avg	0.58%			Spr. P1*- Avg	0.08%		
Spr. P10*-	-0.19			Spr. P10*-	0.12%			Spr. P10*-	-0.68%			Spr. P10*-	-0.04%		

Relative-Value	Return	Spear	Pear	Market-Neutral	Return	Spear	Pear	CTAs	Return	Spear	Pear
Spr. P1-P1*	1.57%	0.279	0.285	Spr. P1-P1*	1.95%	0.104	-0.247	Spr. P1-P1*	3.78%	0.221	-0.011
Spr. P10-P10*	-1.39%	-0.021	-0.395	Spr. P10-P10*	-1.75%	0.064	0.065	Spr. P10-P10*	-3.71%	0.108	-0.037
Spr. P1*- Avg	0.63%**			Spr. P1*- Avg	-0.26%			Spr. P1*- Avg	-0.42%		
Spr. P10*-	-0.43%**			Spr. P10*-	0.21%			Spr. P10*-	-0.41%		

This table shows average ('Avg') monthly returns of spreads ('Spr.') between top P1 versus P1*, P10 versus P10* performers, spreads between P* versus the average, and P10* versus the average. These are for all HF strategies on a quarterly (Panel A), semi-annual (Panel B), and annual (Panel C) basis during growth periods. * and ** denotes significance at 5% and 1% level respectively (two-tailed t-tests). P1 and P10 are ex-ante best performer and worst performer portfolios, respectively. P1* and P10* are ex-post portfolios of P1 and P10, respectively. Spearman ('Spear') and Pearson ('Pear') represent the relevant correlation coefficients in order to examine whether top (bottom) performers continue to be top (bottom) performers.

Table 8

Persistence within Strategies – Winners/Losers – Recessions.

Panel A: Quarterly

Short Bias	Return	Spearma	Pearson	Long-Only	Return	Spearma	Pearson	Sector	Return	Spearma	Pearson	Long/Short	Return	Spear	Pearso
Spr. P1-P1*	4.32%	-0.214	-0.006	Spr. P1-P1*	9.38%	0.433	0.335	Spr. P1-P1*	8.87%	-0.200	0.004	Spr. P1-P1*	7.06%	0.225	0.229
Spr. P10-P10*	-6.13%	0.143	0.057	Spr. P10-P10*	-6.41%	-0.083	0.133	Spr. P10-P10*	-8.41%	0.173	0.101	Spr. P10-P10*	-7.51%	0.027	0.094
Spr. P1*-Avg	1.77%			Spr. P1*-Avg	-0.89%			Spr. P1*-Avg	-0.42%			Spr. P1*-Avg	0.03%		
Spr. P10*-Avg	-0.70%			Spr. P10*-Avg	-0.39%			Spr. P10*-Avg	-0.44%			Spr. P10*-Avg	-0.26%		

Event-Driven	Return	Spear	Pear	Multi-Strategy	Return	Spear	Pear	Other	Return	Spear	Pear	Global Macro	Return	Spear	Pear
Spr. P1-P1*	5.42%	0.382	0.519	Spr. P1-P1*	3.93%	0.321	0.153	Spr. P1-P1*	6.41%	0.250	0.190	Spread P1-P1*	7.56%	-0.200	-0.299
Spr. P10-P10*	-3.72%			Spr. P10-P10*	-4.03%	-0.006	-0.040	Spr. P10-P10*	-6.50%	-0.567	-0.383	Spr. P10-P10*	-5.53%	-0.550	0.286
Spr. P1*-Avg	0.33%			Spr. P1*-Avg	1.21%			Spr. P1*-Avg	0.40%			Spr. P1*-Avg	0.20%		
Spr. P10*-Avg	-1.53%			Spr. P10*-Avg	-0.78%			Spr. P10*-Avg	-0.29%			Spr. P10*-Avg	-0.19%		

Relative-Value	Return	Spear	Pear	Market-Neutral	Return	Spear	Pear	CTAs	Return	Spear	Pear
Spr. P1-P1*	3.94%	0.818**	0.653*	Spr. P1-P1*	3.96%	0.418	0.332	Spr. P1-P1*	8.98%	-0.082	0.245
Spr. P10-P10*	-4.48%	-0.105	-0.309	Spr. P10-P10*	-3.06%	0.227	0.035	Spr. P10-P10*	-10.50%	-0.009	0.070
Spr. P1*-Avg	0.98%			Spr. P1*-Avg	-0.47%			Spr. P1*-Avg	-0.51%		
Spr. P10*-Avg	-0.22%			Spr. P10*-Avg	-0.48%			Spr. P10*-Avg	2.36%*		

Panel B: Semi-Annual

Short Bias	Return	Spear	Pear	Long-Only	Return	Spear	Pear	Sector	Return	Spear	Pear	Long/Short	Return	Spear	Pear
Spr. P1-P1*	5.29%	0.500	0.254	Spr. P1-P1*	4.72%	-0.200	0.082	Spr. P1-P1*	8.80%	0.500	0.652	Spr. P1-P1*	5.01%	0.300	0.733
Spr. P10-P10*	-7.86%	-0.900*	-0.943	Spr. P10-P10*	-8.00%	-0.800	-0.924	Spr. P10-P10*	-7.87%	-0.100	-0.519	Spr. P10-P10*	-7.83%	-0.100	-0.700
Spr. P1*-Avg	-1.81%			Spr. P1*-Avg	0.20%			Spr. P1*-Avg	-0.72%			Spr. P1*-Avg	0.28%		
Spr. P10*-Avg	-0.06%			Spr. P10*-Avg	2.76			Spr. P10*-Avg	-0.12%			Spr. P10*-Avg	1.28%		

Event-Driven	Return	Spear	Pear	Multi-Strategy	Return	Spear	Pear	Other	Return	Spear	Pear	Global Macro	Return	Spear	Pear
Spr. P1-P1*	6.51%	0.700	0.740	Spr. P1-P1*	3.57%	0.500	0.288	Spr. P1-P1*	4.52%	-0.200	0.354	Spr. P1-P1*	6.50%	0.400	0.471
Spr. P10-P10*	-5.29%	-0.500	-0.745	Spr. P10-P10*	-5.44%	-0.500	-0.832	Spr. P10-P10*	-6.50%	-0.400	-0.822	Spr. P10-P10*	-6.25%	-0.200	-0.565
Spr. P1*-Avg	-1.44%			Spr. P1*-Avg	0.30%			Spr. P1*-Avg	0.64%			Spr. P1*-Avg	0.48%		
Spr. P10*-Avg	1.00%			Spr. P10*-Avg	0.72%			Spr. P10*-Avg	0.98%			Spr. P10*-Avg	1.29%		

Table 8. (Continued)

Relative-Value	Monthly	Spear	Pear	Market-Neutral	Monthly	Spear	Pear	CTAs	Monthly	Spear	Pear
Sprd P1-P1*	3.74%	0.300	0.225	Spr. P1-P1*	2.46%	0.101	0.334	Spr. P1-P1*	10.19%	0.200	0.379
Spr. P10-P10*	-3.87%	-0.500	-0.471	Spr. P10-P10*	-2.60%	-0.900*	-0.887*	Spr. P10-P10*	-11.26%	0.700	0.764
Spr. P1*-Avg	0.06%			Spr. P1*-Avg	0.45%			Spr. P1*-Avg	-3.60%*		
Spr. P10*-Avg	-0.91%			Spr. P10*-Avg	-0.38%			Spr. P10*-Avg	3.04%*		

Panel C: Annual

Short Bias	Return	Long-Only	Return	Sector	Return	Long/Short	Return
Spread P1-P1*	10.70%	Spread P1-P1*	3.52%	Spread P1-P1*	5.67%	Spread P1-P1*	4.40%
Spread P10-P10*	-6.68%	Spread P10-P10*	-2.60%	Spread P10-P10*	-4.77%	Spread P10-P10*	-3.93%
Spread P1*- Average	-1.04%	Spread P1*- Average	1.83%	Spread P1*- Average	-0.07%	Spread P1*- Average	0.41%
Spread P10*- Average	1.45%	Spread P10*- Average	-1.54%	Spread P10*- Average	-2.56%	Spread P10*- Average	-1.44%

Event-Driven	Return	Multi-Strategy	Return	Other	Return	Global Macro	Return
Spread P1-P1*	4.12%	Spread P1-P1*	2.56%	Spread P1-P1*	3.92%	Spread P1-P1*	4.18%
Spread P10-P10*	-2.55%	Spread P10-P10*	-0.29%	Spread P10-P10*	-1.42%	Spread P10-P10*	-3.05%
Spread P1*- Average	-0.02%	Spread P1*- Average	0.92%	Spread P1*- Average	0.76%	Spread P1*- Average	1.18%
Spread P10*- Average	-1.41%	Spread P10*- Average	-2.33%	Spread P10*- Average	-2.56%	Spread P10*- Average	-0.94%

Relative-Value	Return	Market-Neutral	Return	CTAs	Return		
Spread P1-P1*	2.97%	Spread P1-P1*	4.37%	Spread P1-P1*	6.97%		
Spread P10-P10*	-1.39%	Spread P10-P10*	-2.77%	Spread P10-P10*	-7.31%		
Spread P1*- Average	1.16%	Spread P1*- Average	-1.65%	Spread P1*- Average	-2.27%		
Spread P10*- Average	-4.66%	Spread P10*- Average	0.01%	Spread P10*- Average	1.44%		

This table shows average ('Avg') monthly returns of spreads ('Spr.') between top P1 versus P1*, P10 versus P10* performers, spreads between P* versus the average, and P10* versus the average. These are for all HF strategies, on a quarterly (Panel A), semi-annual (Panel B), and annual (Panel C) basis, during recessions. * and ** denotes significance at 5% and 1% level respectively (two-tailed t-tests). P1 and P10 are ex-ante best performing and worst performing portfolios, respectively. P1* and P10* are ex-post portfolios of P1 and P10, respectively. Spearman ('Spear') and Pearson ('Pear') represent the relevant correlation coefficients in order to examine whether top (bottom) performers continue to be top (bottom) performers. Panel C shows only descriptive statistics due to an insufficient number of available observations.

Table 9

Persistence within strategies – Winners and Losers - Bull Regimes.

Panel A: Quarterly

Short Bias	Return	Spear	Pear	Long-Only	Return	Spear	Pear	Sector	Return	Spear	Pear	Long/Short	Return	Spear	Pear
Spr. P1-P1*	3.14%	0.040	0.125	Spr. P1-P1*	3.27%	0.175	0.267*	Spr. P1-P1*	4.70%	0.348	0.201	Spr. P1-P1*	3.88%	0.165	0.254*
Spr. P10-P10*	-3.34%	-0.009	-0.007	Spr. P10-P10*	-3.15%	-0.230*	-0.188	Spr. P10-P10*	-4.76%	-0.180	-0.103	Spr. P10-P10*	-4.01%	-0.211	-0.349**
Spr. P1*-Avg	0.77%*			Spr. P1*-Avg	0.75%*			Spr. P1*-Avg	0.64%*			Spr. P1*-Avg	0.68%**		
Spr. P10*-Avg	-0.15%			Spr. P10*-Avg	-0.21%			Spr. P10*-Avg	-0.16%			Spr. P10*-Avg	-0.16%		
Event-Driven	Return	Spear	Pear	**Multi-Strategy**	Return	Spear	Pear	**Other**	Return	Spear	Pear	**Global Macro**	Return	Spear	Pear
Spr. P1-P1*	2.73%	0.143	0.374**	Spr. P1-P1*	2.76%	0.353**	0.373**	Spr. P1-P1*	3.18%	0.143	0.068	Spr. P1-P1*	4.76%	0.141	0.165
Spr. P10-P10*	-2.56%	-0.052	-0.105	Spr. P10-P10*	-3.13%	0.083	0.118	Spr. P10-P10*	-3.57%	-0.155	-0.329**	Spr. P10-P10*	-4.65%	-0.181	-0.298**
Spr. P1*-Avg	0.7%**			Spr. P1*-Avg	0.71%**			Spr. P1*-Avg	0.87%*			Spr. P1*-Avg	-0.31%		
Spr. P10*-Avg	-0.28%			Spr. P10*-Avg	0.24%			Spr. P10*-Avg	-0.09%			Spr. P10*-Avg	0.83%*		
Relative-Value	Return	Spear	Pear	**Market-Neutral**	Return	Spear	Pear	**CTAs**	Return	Spear	Pear				
Spr. P1-P1*	1.96%	0.460**	0.550**	Spr. P1-P1*	2.37%	0.213	0.082	Spread P1-P1*	5.66%	-0.112	-0.100				
Spr. P10-P10*	-2.06%	-0.052	-0.012	Spr. P10-P10*	-2.21%	0.041	-0.045	Sprd P10-P10*	-5.15%	-0.318**	-0.234*				
Spr. P1*-Avg	0.97%**			Spr. P1*-Avg	0.09%			Spr. P1*-Avg	0.28%						
Spr. P10*-Avg	-0.31%			Spr. P10*-Avg	-0.11%			Spr. P10*-Avg	0.12%						

Panel B: Semi-Annual

Short Bias	Return	Spear	Pear	Long-Only	Return	Spear	Pear	Sector	Return	Spear	Pear	Long/Short	Return	Spear	Pear
Spr. P1-P1*	2.74%	0.197	0.038	Spr. P1-P1*	2.92%	0.023	0.102	Spr. P1-P1*	3.56%	0.088	0.098	Spr. P1-P1*	3.04%	0.079	0.145
Spr. P10-P10*	-2.87%	0.085	0.165	Spr. P10-P10*	-2.71%	-0.284	-0.368*	Spr. P10-P10*	-3.68%	-0.112	0.053	Spr. P10-P10*	-3.02%	-0.223	-0.347*
Spr. P1*-Avg	0.43%			Spr. P1*-Avg	0.36%			Spr. P1*-Avg	0.82%**			Spr. P1*-Avg	0.54%		
Spr. P10*-Avg	0.14%			Spr. P10*-Avg	0.03%			Spr. P10*-Avg	-0.27%			Spr. P10*-Avg	-0.19%		
Event-Driven	Return	Spear	Pear	**Multi-Strategy**	Return	Spear	Pear	**Other**	Return	Spear	Pear	**Global Macro**	Return	Spear	Pear
Spr. P1-P1*	2.24%	-0.144	0.123	Spr. P1-P1*	2.18%	0.069	-0.139	Spr. P1-P1*	3.09%	0.428**	0.347*	Spr. P1-P1*	3.24%	-0.205	-0.139
Spr. P10-P10*	-2.28%	0.008	-0.269	Spr. P10-P10*	-2.14%	0.224	0.102	Spr. P10-P10*	-2.68%	0.115	0.094	Spr. P10-P10*	1.16%	-0.322	-0.425*
Spr. P1*-Avg	0.51*			Spr. P1*-Avg	0.52%*			Spr. P1*-Avg	0.54%*			Spr. P1*-Avg	0.21%		
Spr. P10*-Avg	-0.08			Spr. P10*-Avg	-0.03%			Spr. P10*-Avg	-0.28%			Spr. P10*-Avg	0.32%		

Table 9. (Continued)

Relative-Value	Return	Spear	Pear	Market-Neutral	Return	Spear	Pear	CTAs	Return	Spear	Pear
Spr. P1-P1*	1.84%	0.467**	0.505**	Spr. P1-P1*	1.97%	0.230	0.096	Spr. P1-P1*	4.66%	0.124	0.187
Spr. P10-P10*	-1.59%	0.036	-0.308*	Spr. P10-	-1.81%	0.236	0.132	Spr. P10-P10*	-4.20%	-0.094	-0.103
Spr. P1*-Avg	0.67%**			Spr. P1*-	0.04%			Spr. P1*-Avg	2.14%**		
Spr. P10*-Avg	-0.38%**			Spr. P10*-	-0.08%			Spr. P10*-Avg	2.53%**		

Panel C: Annual

Short Bias	Return	Spear	Pear	Long-Only	Return	Spear	Pear	Sector	Return	Spear	Pear	Long/Short	Return	Spear	Pear
Spr. P1-P1*	2.46%	-0.064	-0.207	Spr. P1-P1*	2.32%	-0.120	-0.003	Spr. P1-P1*	3.53%	-0.099	0.061	Spr. P1-P1*	2.81%	-0.019	0.048
Spr. P10-P10*	-3.32%	-0.130	-0.173	Spr. P10-P10*	-1.97%	-0.376	-0.410	Spr. P10-P10*	-3.28%	-0.370	-0.474*	Spr. P10-P10*	-2.71%	-0.156	-0.228
Spr. P1*-Avg	0.43%			Spr. P1*-Avg	0.54%*			Spr. P1*-Avg	0.57%			Spr. P1*-Avg	0.36%		
Spr. P10*-Avg	0.54%			Spr. P10*-Avg	-0.33%			Spr. P10*-Avg	-0.07%			Spr. P10*-Avg	-0.16%		

Event-Driven	Return	Spear	Pear	Multi-Strategy	Return	Spear	Pear	Other	Return	Spear	Pear	Global Macro	Return	Spear	Pear
Spr. P1-P1*	1.98%	-0.052	0.041	Sprd P1-P1*	1.93%	-0.114	0.036	Spr. P1-P1*	2.96%	0.286	0.173	Spr. P1-P1*	3.11%	0.135	0.140
Spr. P10-P10*	-1.81%		-0.374	Spr. P10-P10*	-2.30%	0.196	0.118	Spr. P10-P10*	-2.19%	0.154	0.149	Spr. P10-P10*	-2.50%	-0.094	-0.240
Spr. P1*-Avg	0.38%**			Spr. P1*-Avg	0.46%*			Spr. P1*-Avg	0.26%			Spr. P1*-Avg	-0.07%		
Spr. P10*-Avg	-0.18%			Spr. P10*-Avg	0.18%			Spr. P10*-Avg	-0.42%			Sprd P10*-	0.40%		

Relative-Value	Monthly	Spear	Pear	Market-Neutral	Monthly	Spear	Pear	CTAs	Monthly	Spear	Pear
Spr. P1-P1*	1.78%	0.640**	0.674**	Spr. P1-P1*	1.58%	-0.048	-0.040	Spr. P1-P1*	3.56%	0.065	0.024
Spr. P10-P10*	-1.41%	-0.145	-0.216	Spr. P10-P10*	-2.44%	0.011	0.013	Spr. P10-P10*	-3.49%	-0.013	-0.023
Spr. P1*-Avg	0.64%**			Spr. P1*-Avg	0.03%			Spr. P1*-Avg	0.19%		
Spr. P10*-Avg	-0.29%*			Spr. P10*-Avg	-0.04%			Spr. P10*-Avg	0.07%		

This table shows average ('Avg') monthly returns of spreads ('Spr.') between top P1 versus P1* P10 versus P10* performers, spreads between P* versus the average, and P10* versus the average. These are for all HF strategies, quarterly basis, during bull regimes. * and ** denotes significance at 5% and 1% level respectively (two-tailed t-tests). P1 and P10 are ex-ante best and worst performing portfolios, respectively. P1* and P10* are ex-post portfolios of P1 and P10, respectively. Spearman ('Spear') and Pearson ('Pear') represent the relevant correlation coefficients in order to examine whether top (bottom) performers continue to be top (bottom) performers.

Table 10

Persistence within Strategies – Winners and Losers – Bear regimes.

Panel A: Annual

Short Bias	Return	Spear	Pear	Long-Only	Return	Spear	Pear	Sector	Return	Spear	Pear	Long/Short	Return	Spear	Pear
Spr. P1-P1*	8.34%	-0.048	-0.049	Spr. P1-P1*	5.57%	0.636*	0.403	Spr. P1-P1*	6.37%	-0.509	-0.502	Spr. P1-P1*	5.90%	0.309	0.125
Spr. P10-P10*	-5.63%	0.001	-0.258	Spr. P10-P10*	-6.20%	-0.188	-0.081	Spr. P10-P10*	-6.67%	-0.145	-0.204	Spr. P10-P10*	-6.11%	0.036	0.001
Spr. P1*-Avg	-1.12%			Spr. P1*-Avg	0.65%			Spr. P1*-Avg	0.60%			Spr. P1*-Avg	0.36%		
Spr. P10*-	-0.43%			Spr. P10*-Avg	-1.00%			Spr. P10*-Avg	-2.94%			Spr. P10*-Avg	-1.74%		

Event-Driven	Return	Spear	Pear	Multi-Strategy	Return	Spear	Pear	Other	Return	Spear	Pear	Global Macro	Return	Spear	Pear
Spr. P1-P1*	3.31%	0.618*	0.718*	Spr. P1-P1*	0.50%	0.467	0.305	Spr. P1-P1*	4.78%	0.055	-0.271	Spr. P1-P1*	5.52%	-0.167	-0.109
Spr. P10-P10*	-4.18%	0.300	0.157	Spr. P10-P10*	-3.48%	-0.309	-0.192	Spr. P10-P10*	-5.80%	-0.442	-0.345	Spr. P10-P10*	-6.98%	0.050	0.124
Spr. P1*-Ag	1.34%			Spr. P1*-Avg	0.78%			Spr. P1*-Avg	-0.30%			Spr. P1*-Avg	0.88%		
Spr. P10*-	-0.87%			Spr. P10*-Avg	-1.58%			Spr. P10*-Ag	-0.20%			Spr. P10*-Avg	0.33%		

Relative-Value	Return	Spear	Pear	Market-Neutral	Return	Spear	Pear	CTAs	Return	Spear	Pear				
Spr. P1-P1*	3.17%	0.491	0.324	Spr. P1-P1*	3.01%	0.445	0.223	Spr. P1-P1*	8.97%	0.309	0.347				
Spr. P10-P10*	-4.47%	-0.227	-0.246	Spr. P10-P10*	-3.81%	0.300	0.399	Spr. P10-P10*	-6.45%	-0.564	-0.423				
Spr. P1*-Avg	0.76%*			Spr. P1*-Avg	0.54%			Spr. P1*-Avg	-1.23%						
Spr. P10*-	-1.01%			Spr. P10*-Avg	-0.05%			Spr. P10*-Avg	0.05%						

Panel B: Semi-Annual

Short Bias	Return	Spear	Pear	Long-Only	Return	Spear	Pear	Sector	Return	Spear	Pear	Long/Short	Return	Spear	Pear
Spr. P1-P1*	6.02%	0.200	0.033	Spr. P1-P1*	3.18%	0.900*	0.825	Spr. P1-P1*	4.10%	0.998*	0.964**	Spr. P1-P1*	0.14%	0.900*	0.902*
Spr. P10-P10*	-3.47%	0.600	-0.002	Spr. P10-P10*	-3.46%	0.400	-0.251	Spr. P10-P10*	-5.42%	-0.100	-0.024	Spr. P10-P10*	-3.91%	0.200	0.184
Spr. P1*-Avg	0.42%			Spr. P1*-Avg	-0.01%			Spr. P1*-Avg	1.80%			Spr. P1*-Avg	1.07%		
Spr. P10*-Avg	-1.14%			Spr. P10*-Avg	-2.52%*			Spr. P10*-Avg	-3.98%			Spr. P10*-Avg	-3.01%		

Event-Driven	Return	Spear	Pear	Multi-Strategy	Return	Spear	Pear	Other	Return	Spear	Pear	Global Macro	Return	Spear	Pear
Spr. P1-P1*	3.26%	0.600	0.412	Spr. P1-P1*	3.25%	0.700	0.713	Spr. P1-P1*	2.90%	0.600	0.435	Spr. P1-P1*	4.44%	0.300	0.669
Spr. P10-P10*	-2.38%	0.400	0.214	Spr. P10-P10*	-3.64%	-0.700	-0.029	Spr. P10-P10*	-2.27%	0.900*	0.755	Spr. P10-P10*	-3.92%	-0.100	-0.070
Spr. P1*-Avg	0.61%			Spr. P1*-Avg	0.70%			Spr. P1*-Avg	0.55%			Spr. P1*-Avg	1.69%		
Spr. P10*-Avg	-2.02%			Spr. P10*-Avg	-1.50%*			Spr. P10*-Avg	-2.44%			Spr. P10*-Avg	-1.84%		

Table 10. (Continued)

Relative-Value	Return	Spear	Pear	Market-Neutral	Return	Spear	Pear	CTAs	Return	Spear	Pear
Spr. P1-P1*	3.56%	0.300	0.479	Spr. P1-P1*	2.37%	0.800	0.445	Spr. P1-P1*	8.11%	-0.100	-0.315
Spr. P10-P10*	-3.06%	-0.100	-0.327	Spr. P10-P10*	-2.94%	0.700	0.879*	Spr. P10-P10*	-7.82%	-0.100	-0.195
Spr. P1*-Avg	0.80%			Spr. P1*-Avg	0.68%			Spr. P1*-Avg	-1.29%		
Spr. P10*-Avg	-2.14			Spr. P10*-Avg	-0.88%			Spr. P10*-Avg	-0.31%		

Panel C: Annual

Short Bias	Return	Long-Only	Return	Sector	Return	Long/Short	Return
Spread P1-P1*	2.83%	Spread P1-P1*	5.01%	Spread P1-P1*	4.02%	Spread P1-P1*	3.84%
Spread P10-P10*	-3.00%	Spread P10-P10*	-1.62%	Spread P10-P10*	-3.53%	Spread P10-P10*	-2.97%
Spread P1*-Average	1.08%	Spread P1*-Average	-0.28%	Spread P1*-Average	1.46%	Spread P1*-Average	0.85%
Spread P10*-Average	-1.68%	Spread P10*-Average	-1.82%	Spread P10*-Average	-2.94%	Spread P10*-Average	-1.91%
Event-Driven	Return	**Multi-Strategy**	Return	**Other**	Return	**Global Macro**	Return
Spread P1-P1*	2.48%	Spread P1-P1*	3.36%	Spread P1-P1*	3.49%	Spread P1-P1*	4.55%
Spread P10-P10*	-1.89%	Spread P10-P10*	-2.87%	Spread P10-P10*	-2.45%	Spread P10-P10*	-0.28%
Spread P1*-Average	-2.75	Spread P1*-Average	0.32%	Spread P1*-Average	-0.29%	Spread P1*-Average	2.59%
Spread P10*-Average	-2.61	Spread P10*-Average	-1.70%	Spread P10*-Average	-1.10%	Spread P10*-Average	-3.64%
Relative-Value	Return	**Market-Neutral**	Return	**CTAs**	Return		
Spread P1-P1*	2.50%	Spread P1-P1*	2.21%	Spread P1-P1*	1.82%		
Spread P10-P10*	-1.49%	Spread P10-P10*	-2.24%	Spread P10-P10*	-4.34%		
Spread P1*-Average	0.50%	Spread P1*-Average	0.12%	Spread P1*-Average	1.69%		
Spread P10*-Average	-1.80%	Spread P10*-Average	-0.49%	Spread P10*-Average	-0.04%		

This table shows average ('Avg') monthly returns of spreads ('Spr.') between top P1 versus P1*, P10 versus P10* performers, spreads between P* versus the average, and P10* versus the average. These are for all HF strategies, at quarterly (Panel A), semi-annual (Panel B), and annual (Panel C) basis, during bear regimes. * and ** denotes significance at 5% and 1% level respectively (two-tailed t-tests). P1 and P10 are ex-ante best and worst performing portfolios, respectively. P1* and P10* are ex-post portfolios of P1 and P10, respectively. Spearman ('Spear') and Pearson ('Pear') represent the relevant correlation coefficients so as to examine whether top (bottom) performers continue to be top (bottom) performers. Panel C shows only descriptive statistics (due to an insufficient number of observations).

Table 11.

Momentum and Contrarian Trading Strategies of HF investors – Same and Mixed HF Strategies.

Panel A

Momentum		Actions		Return	Exc. Mkt Rtn
Quarterly	t	Buy P1 of OT	Short-sell P10 of OT	1.37**	0.30
	t+1	Sell P1 of OT then rebalance	Buy P10 of OT then rebalance		
	…	…	…		
Momentum		**Actions**		**Return**	**Exc. Mkt Rtn**
Semi-annual	t	Buy P1 of OT	Short-sell P10 of OT	1.97**	0.90*
	t+1	Sell P1 of OT then rebalance	Buy P10 of OT then rebalance		
	…	…	…		
Momentum		**Actions**		**Return**	**Exc. Mkt Rtn**
Annual	t	Buy P1* of OT	Short-sell P10* of OT	1.25**	0.18
	t+1	Sell P1 of OT then rebalance	Buy P10 of OT then rebalance		
	…	…	…		

Panel B

Momentum		Actions		Return	Exc. Mkt Rtn
Quarterly	t	Buy P1 of LO	Short-sell P10 of SB	1.70**	0.63
	t+1	Sell P1 of LO then rebalance	Buy P10 of SB then rebalance		
	…	…	…		
Momentum		**Actions**		**Return**	**Exc. Mkt Rtn**
Semi-annual	t	Buy P1 of OT	Short sell P10 of SB	2.14**	1.06*
	t+1	Sell P1 of OT then rebalance	Buy P10 of SB then rebalance		
	…	…	…		
Momentum		**Actions**		**Return**	**Exc. Mkt Rtn**
Annual	t	Buy P1 of SE	Short sell P10 of CT	3.40**	2.33**
	t+1	Sell P1 of SE then rebalance	Buy P10 of CT then rebalance		
	…	…	….		

Panel C

Contrarian		Actions		Return	Exc. Mkt Rtn
2 Years	t	Buy P10 of SB|	Short sell P1 of SB|	0.64	-0.38
	t+1	Sell P10 of SB| then rebalance	Buy P1 of SB| then rebalance		
	…	…	…		
Contrarian				**Return**	**Exc. Mkt Rtn**
3 Years	t	Buy P10* of SE||	Short sell P1* of SE||	0.46	-0.55
	t+1	Sell P10* of SE|| then rebalance	Buy P1* of SE|| then rebalance		
	…	…	…		

Panel D

Contrarian		Actions		Return	Exc. Mkt Rtn
2 Years	t	Buy P10 of LO|	Short sell P1 of CT|	2.72**	1.71**
	t+1	Sell P10 of LO| then rebalance	Buy P1 of CT| then rebalance		
	…	…	….		
Contrarian		**Actions**		**Return**	**Exc. Mkt Rtn**
3 Years	t	Buy P10 of ED||	Short sell P1 of CT||	1.60**	0.60
	t+1	Sell P10 of ED|| then rebalance	Buy P1 of CT|| then rebalance		
	…	…	….		

This table gives the optimum momentum strategies of HF investors during growth periods, when using one only strategy (Panel A) and different HF strategies (Panel B) per time period. It also gives the optimum contrarian strategies of HF investors during growth periods, when using one only strategy (Panel C) and different HF strategies (Panel D) per time period. Return: Trading Raw Return, Exc.Mkt Rtn: is the Return minus the market return (Wil5000TRI including dividends); CT, ED, LO, OT SB and SE is the CTA, Event Driven, Long Only, Others Short Bias and Sector, strategy respectively. * and ** denotes significance at 5% and 1% level respectively using a two-tailed t-test. "…" denotes the same activity after each horizon ($t+2$, $t+3$, and so on). The returns are expected average monthly returns from P1 and P10 portfolios. "|" denotes the portfolio selected based on high (P1) performance two years before t ($= 0$) and "||"denotes the portfolio selected on high (P1) performance three years before t. "…" denotes the same activity after each annual horizon ($t+2$, $t+3$, and so on).

Table 12

High and Low Return *Momentrarian* trading strategies of HF investors – Same and Mixed HF strategies.

Panel A

Momentrarian		Actions		Return	Exc. Mkt Rtn
first order	t	Buy P1 of OT	Short sell P1 of OT|	0.65	-0.42
	t+1	Sell P1 of OT then rebalance	Buy P1 of OT| then rebalance		
	…	…	…		

Momentrarian		Actions		Return	Exc. Mkt Rtn
second order	t	Buy P1 of SE	Short sell P1 of SE||	1.37	0.30
	t+1	Sell P1 of SE then rebalance	Buy P1 of SE|| then rebalance		
	…	…	…		

Panel B

Momentrarian		Actions		Return	Exc. Mkt Rtn
first order	t	Buy P1 of SE	Short sell P1 of CT|	3.14**	2.07**
	t+1	Sell P1 of SE then rebalance	Buy P1 of CT| then rebalance		
	…	…	…		

Momentrarian		Actions		Return	Exc. Mkt Rtn
second order	t	Buy P1 of SE	Short sell P1 of CT||	2.32**	1.25
	t+1	Sell P1 of SE then rebalance	Buy P1 of CT|| then rebalance		
	…	…	…		

Panel C

Momentrarian		Actions		Return	Exc. Mkt Rtn
first order	t	Buy P10 of OT|	Short sell P10 of OT	0.72	-0.35
	t+1	Sell P10 of OT| then rebalance	Buy P10 of OT then rebalance		
	…	…	…		

Momentrarian		Actions		Return	Exc. Mkt Rtn
second order	t	Buy P10 of CT||	Short sell P10 CT	0.38	-0.69
	t+1	Sell P10 of CT|| then rebalance	Buy P10 of CT then rebalance		
	…	…	…		

Panel D

Momentrarian		Actions		Return	Exc. Mkt Rtn
first order	t	Buy P10 of SE|	Short sell P10 of CT	2.86**	1.79**
	t+2	Sell P10 of SE| then rebalance	Buy P10 of CT then rebalance		
	…	…	…		

Momentrarian		Actions		Return	Exc. Mkt Rtn
second order	t	Buy P10 of ED||	Short sell P10 of CT	2.69**	1.61**
	t+2	Sell P10 of ED|| then rebalance	Buy P10 of CT then rebalance		
	…	…	…		

This table gives the optimum *momentrarian* strategy of HF investors (involving high return exploitation) during growth periods, when using one only strategy (Panel A) and different strategies (Panel B) per time period. It also presents the optimum *momentrarian* strategy of HF investors (involving low return exploitation) during growth periods, when using only one strategy (Panel C) and different strategies (Panel D) per time period. Return: Trading Raw Return, Exc. Mkt Rtn: is the Return minus the market return (Wil5000TRI including dividends). CT, ED, OT and SE is the CTA, Event Driven, Others and Sector, strategy respectively. "|" denotes the portfolio selected based on high (P1) performance two years before *t* (= 0) and "||"denotes the portfolio selected on high (P1) performance three years before *t*. "…" denotes the same activity after each annual horizon (*t+2*, *t+3*, and so on). The returns are expected average monthly returns from P1 portfolios. ** denotes significance at 1% level using a two-tailed t-test.

Table 13

Trading strategies of HF investors – Same/Mixed HF strategies.

	Same strategy	Return	Mixed strategies	Return
Momentum trading				
Quarterly	SB	2.46%	SB and ED	3.66%
Semi-Annual	RV	0.96%	SB and RV	2.41%
Annual	RV	4.94%	GM and RV	5.99%
Contrarian				
2 Year	RV	4.32%	SB and RV	7.30%
Momentrarian (**HRE**)				
first order	RV	5.43%	GM and RV	6.48%
Momentrarian (**LRE**)				
first order	RV	3.84%	SB and RV	6.82%

This table shows the optimum strategies of HF investors for all trading styles using only one strategy and different HF strategies during recessions. The returns are raw returns. Due to data availability we compute the contrarian for two years (we cannot calculate the statistical significance for this horizon). We calculate the first order *momentrarian* styles using high (HRE) or low return exploitation (LRE) due to data availability (for the same reason we cannot calculate the statistical significance for this horizon). ED, GM, RV and SB is the Event Driven, Global Macro, Relative Value and Short Bias, strategy respectively.