

Hedge Fund Performance Persistence under different Business Cycles and Stock Market Regimes

Dimitrios Stafylas^a, Athanasios Andrikopoulos^b, Konstantinos, Tolikas^c

^a York Management School, University of York, York YO10 5DD, UK.

^b Hull University Business School, University of Hull, Hull HU6 7RX, UK.

^c Sheffield University Management School, University of Sheffield, Sheffield S10 1FL, UK.

Abstract

We examine different aspects of performance persistence of US hedge funds over different business cycles and stock market regimes. During periods of economic growth and bull stock markets, we report performance persistence for up to one year in the risk-adjusted returns of fund portfolios of different investment strategies, which is mainly driven by top fund performers. Performance persistence weakens dramatically during recession periods and bear stock markets. Our results are robust to different combinations of states of economic growth and stock market regimes. Trading strategies constructed on the basis of our results confirm the economic significance of our findings.

Keywords: Hedge funds; Performance persistence; Business cycles; Stock market regimes

JEL: C58; G11; G20; G23

1. Introduction

A hedge fund is a privately organised pooled investment vehicle that is run by professional managers. An important difference between hedge funds and other professionally managed funds is that hedge funds are not available to the public and therefore not subject to the same regulation as mutual and pension funds. Thus, they enjoy greater trading flexibility and are believed to employ aggressive investment strategies, typically involving short selling, leverage and the use of derivatives, that promise to deliver superior returns (i.e., alpha) to their investors.¹ Although critics of hedge funds argue that they are run by greedy managers and that their actions pose a real threat to the stability of financial markets (see, e.g., Agarwal et al. 2015), the number of hedge funds and the size of the assets they manage have grown substantially over the last two decades. Indeed, the value of assets managed by hedge funds (including commodity trading funds) globally increased from \$210 billion in 1998 to almost \$3.4 trillion in the second quarter 2020, while their number increased from about 3,200 to over 11,000 funds over the same time period.²

The hedge fund literature reveals a number of interesting facts. First, hedge funds tend to persistently generate superior returns. Indeed, Ackermann, et al. (1999), Liang (1999), Agarwal and Naik (2000a), Banquero, et al. (2005), Stulz (2007), and Jagannathan et al. (2010), among others, provide evidence for both short- and long-term fund persistence. Second, the literature indicates that fund performance persistence varies across funds with different investment strategies and characteristics including contractual features (i.e., incentive fee, high-water mark, lockup period, etc.) and time-varying features (i.e., size, age) (e.g., Boyson, 2008). Third, a part of the literature also shows that a large amount of the time-series and cross-sectional variation in hedge fund returns can be explained by market-related risk factors (e.g., Fung and Hsieh, 1997,

¹ Alpha is a measure of the average return over and above the reward obtained for exposure to different systematic risk factors (i.e., beta). Berk and Green (2004) provide a theoretical model where the allegedly superior picking ability of fund managers is measured by their alpha.

² According to the Committee on Banking and Financial Services, U.S. House of Representatives, 150th Congress, (1998), Full Committee Hearing on Hedge Fund Operations, Hennessee Hedge Fund Advisory Group.

2001, and 2004; and Agarwal and Naik, 2004), and macroeconomic variables (e.g., Avramov et al. 2013; Bali et al. 2014; Stafylas et al. 2018). The latter suggests that the performance persistence of hedge funds may be related, to a large extent, to the state of both the economy and the stock market rather than the allegedly superior investment strategies they employ.³ Studies like Cappoci (2009) and Hentati-Kaffel and Peretti (2015) document that hedge funds tend to significantly outperform market-wide indices, and that less than 80% of hedge funds have random returns. This is in agreement with Zhai and Wang (2020) who find evidence that performance persistence exists for some years for both hedge and mutual funds. Do et al. (2010) and Baquero et al. (2005) also document short-term hedge fund performance persistence. The recent literature also indicates that hedge fund characteristics such as fund flows, length of notice and the redemption period, incentive and closed-ended funds fees, are positively related to the probability of observing positive (i.e., winner) performance persistence (Ammann et al. 2013; Aspadarec, 2021).

Although the literature on fund performance is vast, there is only limited research on performance persistence over different business cycles and stock market regimes. Cappoci et al. (2005) document that most hedge funds outperform the market, and especially during bullish periods. Recently, Sun et al. (2018) show that hedge fund performance is persistent following bear markets but not persistent following bull markets.⁴ Using mutual fund data, Kacperczyk et al. (2014) develop an attention allocation model that uses the state of the business cycle to predict observable patterns in fund portfolio returns. They find that fund managers exhibit higher stock-

³ Also, hedge funds have low correlation with other securities and typically perform better than mutual funds (e.g., Amin and Kat, 2003). However, their returns are more volatile than those of mutual funds (e.g., Ackermann et al. 1999; Liang, 1999). In addition, as hedge funds experience higher attrition rates than mutual funds, studying the performance persistence is of a particular importance for hedge fund investors (Liang 1999; Brown et al. 2001).

⁴ In comparison to our study, Sun et al. (2018) focus mostly on hedge fund performance persistence forecasting during stressful time periods and adopt different definitions for the hedge fund market state. It should also be noted that, in general, there is no unique way one can differentiate between ‘good’ or ‘bad’ times in the hedge fund market. For instance, Sun et al. (2018) define a hedge fund market to be in a down (up) state when the overall hedge funds market return during a particular month is below (above) its historical median monthly return over the time period they examine. In our study, we use a straightforward definition considering performance persistence during business cycles and hedge fund market regimes, making a strict comparison and distinction between them. More specifically, our definition is based on the official business cycles according to the National Bureau of Economic Research (NBER), whilst the different stock market regimes are determined using a Markov switching model (for more details see section 3.1).

picking abilities in economic booms and more market timing ability during economic recessions. Further, Glode et al. (2009) show that fund returns are more predictable after periods of high stock market returns but not predictable after periods of low stock market returns. Similar results are reported by Abdou and Nasereddin (2011) when using a support vector machine approach. It is also important to distinguish between business cycles and stock market regimes, as they do not necessarily coincide, resulting in different implications for fund performance persistence. Kacperczyk et al. (2016), for example, show that funds exhibiting higher dispersion across portfolio securities, achieve high returns during recessions, despite the increased correlation between the returns of the portfolio securities. Thus, fund managers are more likely to become more active during economic recessions.

The limited literature related to our study serves as the main motivation of our paper. In particular, we address the following questions: (i) Does hedge fund performance persistence vary with respect to different business cycles and general market regimes? and (ii) If yes, is there any economic significance for investors? Our sample comes from the merge of the BarclayHedge and EurekaHedge databases and covers the time period from January 1990 to March 2014.⁵ Our database has the advantage of starting earlier than other commercial databases (e.g., CISDM) and therefore it includes three different business cycles and stock market regimes. Our dataset contains both live and defunct funds and therefore it is free of survivorship bias. Further, we apply standard filters to eliminate backfilling bias.⁶ The different business cycles are determined according to the National Bureau of Economic Research (NBER) calendar, while the different stock market regimes are determined using a Markov switching model.

⁵ Similar to Denvir and Hutson (2006), Haris and Mazibas (2010), and Giannikis and Vrontos (2011).

⁶ Survivorship bias occurs when considering live hedge funds only; and this leads to upward bias in hedge fund performance. The backfill (or instant history) bias occurs since fund managers are not obliged to report their performance, and only successful hedge fund managers with a good track record have an incentive to report their performance at a private database vendor. This also leads to an upward bias in the hedge fund performance.

Our study reports a number of interesting findings. First, during good economic and stock market regimes, the risk-adjusted returns of different fund strategies exhibit performance persistence, which, however, weakens dramatically during economic recessions and periods of stock market distress. Also, non-directional strategies exhibit higher performance persistence compared to directional strategies. Second, during good economic and market regimes a few strategies (e.g., Long-Short and Multi-Strategy) exhibit strong performance persistence with respect to the stock market (i.e., Wilshire 5000 index). In contrast, during adverse economic and market regimes there is no statistically significant evidence of performance persistence in the risk-adjusted returns of the different fund strategies with respect to the stock market. Third, when we examine performance persistence at the fund strategy level, we find statistically significant short-term persistence during bull markets which can be attributed mainly to top performing funds rather than to the bottom performing funds. However, during depressed negative economic and market regimes, performance persistence decreases dramatically. Finally, we implement a number of zero-net investment strategies and confirm the economic significance of our findings.

The main contribution of our study to the broad literature on hedge fund performance persistence is that it is the first study, to our knowledge, to examine performance persistence over different business cycles and stock market regimes. In addition, we examine three different aspects of performance persistence. First, we use both the Sharpe and Information ratios as risk-adjusted proxies for fund performance; secondly, we use a measure of over- or under-performance of funds relative to the stock market; and thirdly, we use a measure of the over- or under-performance of portfolios of funds that follow the same strategy. Therefore, our paper enables us to better understand the hedge fund performance, thus, extending and complementing previous studies on fund performance persistence (e.g., Agarwal and Naik, 2000a; Ackermann, et al. 1999; Ammann, et al. 2013). Further, the economic significance of our results may assist investors and fund of funds managers to enhance their performance using appropriately constructed trading strategies that take advantage of the behavior of hedge fund returns during different business

cycles and stock market regimes (e.g., momentum and contrarian trading strategies). Further, fund administrators may also construct compensation schemes that are aligned to the different aspects of performance persistence and jointly take into account fund performance and the different states of the economy and stock market regimes.

The rest of our paper is set out as follows. Section 2 discusses the data selection process and describes the data used in the empirical analysis. Section 3 describes the methodology, presents the empirical results and discusses their implications for investors. Section 4 examines the economic significance of our empirical findings and provides a number of robustness tests. Finally, section 5, summarizes and concludes our paper.

2. Sample Construction and Data Description

Our monthly data comes from the merge of the BarclayHedge and EurekaHedge hedge fund databases and cover the time period from January 1990 to March 2014.⁷ We group funds according to their investment strategies. We start by mapping the fund strategies as reported to the two different databases by following the process described in Joenvaara, et al. (2012). This process results in the following 11 different hedge fund investment strategies: Short Bias, Long Only, Sector, Long-Short, Event Driven, Multi-Strategy, Other, Global Macro, Relative Value, Market Neutral, and CTA (i.e., Commodity Trading Advisors). We then follow Bali et al. (2011) and we further group the Short Bias, Long Only, Sector and Long-Short investment strategies as directional strategies (i.e., absolute values of the correlation coefficient between the returns of an equally weighted portfolio of the funds following the same investment strategy and the returns of the stock market above 0.5); the Event Driven, Multi-Strategy, Others, and Global Macro as semi-

⁷ We construct a sample of US diversified hedge funds that contains data that start much earlier than those of other commercial databases, e.g., Morningstar and HFR. We follow a strict merging and cleaning process. First, we detect and remove duplicate funds according to a number of general and contractual characteristics including the fund name and its legal structure, the management company's name, the manager's name, and the fund's inception date. For the few funds we are not certain that they are duplicates, we also look at their return correlations and we remove those with very high correlation (i.e., >0.90) that also have some of the other characteristics the same.

directional strategies (i.e., absolute values of the correlation coefficient between the returns of an equally weighted portfolio of the funds following the same investment strategy and the returns of the stock market between 0.22 and 0.49); and the Relative Value, Market Neutral, and CTA as non-directional strategies (i.e., absolute values of the correlation coefficient between the returns of an equally weighted portfolio of the funds following the same investment strategy and the returns of the stock market between 0.00 and 0.21). The Other group of funds contains funds that use different investment styles (e.g., investment in public equity) or funds allocation (e.g., start-ups), that are not commonly used by the other fund strategies.⁸ In order to minimize the impact of survivorship bias in our results, our sample contains both live and defunct funds. We also minimize backfill bias by removing the first 12 monthly returns of the funds in our sample. We also remove funds with a number of consecutive zero and/or missing returns, and following the literature, we also cross-sectionally winsorise the top and bottom 0.5% outliers (Ramadorai, 2012).

Our final sample contains monthly net-of-fees excess returns for 6,373 funds. Table 1 presents cross-sectional summary statistics for an equally weighted portfolio of all funds in our sample as well as equally weighted portfolios of the funds that follow the same trading strategy.⁹ The third column (i.e., '*N aver.*') presents the cross-sectional average number of funds per month which is 1,347. Also, the table reveals that the portfolio of all funds in our sample delivers a monthly return of almost 1% with a standard deviation of 4.03, and with minimum and maximum cross-sectional averages of -12.38% and 17.38%, respectively. We also notice that the Sector, Others, and the CTA investment strategies deliver higher monthly mean returns, at least 1.09%, compared to the other fund strategies, but these high returns also come at higher risk. When we group the funds into the three main investment strategies, the equally weighted portfolio of the

⁸ A description of the underlying used fund investment strategies is contained in the Appendix A.

⁹ We do not consider value weighted fund portfolios to avoid the large fund bias in our results. Also, we follow the most common practice in literature by considering net-of-fees returns; mainly because this is the type of return investors care about.

funds that follow a directional strategy performs considerably better than the two fund portfolios that follow the other two main investment strategies; however, this higher return also comes with higher risk. The correlation coefficients between the fund portfolio returns and the market returns (i.e., Wilshire 5000) also support the argument that hedge funds tend to be market neutral; with the expected exception of the Short Bias funds which exhibit a high negative correlation of 0.924. Indeed, the average correlation coefficient of all funds is 0.400 which indicates that funds tend to seek a return regardless of market conditions. Our results are in line with those reported in the literature (e.g., Joenvaara, et al. 2012).

Insert Table 1 around here

3. Methodology and Empirical Results

In this section, we examine the performance persistence of funds over different business cycles and market regimes. A preliminary analysis helps us to determine the different business cycles as well as a number of time-periods characterised by different stock market regimes. We then proceed to examine fund performance using three different approaches; the parametric regression approach (Brown et al. 1999), the contingency table approach (Agarwal and Naik, 2000a; Casarin et al. 2005; Eling, 2009), and the decile portfolios approach (Carhart, 1997; Capocci, 2009).

3.1 Preliminary analysis: Determination of business cycles and market regimes

The different business cycles we consider in this study are determined by the National Bureau of Economic Research (NBER). NBER defines a recession to be a significant decline in economic activity that spreads through the economy, lasting from few months to many years that has a visible impact on production, employment, real income, and other major economic indicators.¹⁰ Since 1990, NBER has identified three periods of economic recessions: July 1990 to March 1991,

¹⁰ <https://www.nber.org/cycles.html>, <https://www.nber.org/cycles/recessions.html>.

March 2001 to November 2001, and December 2007 to June 2009. The periods between these recessions are considered to be periods of economic growth.

The time periods of different stock market regimes are defined by identifying the structural breaks in the time series of the monthly returns of the Wilshire 5000 index (WTRI) using a Markov regime-switching model (Hamilton, 1989; Akay et al. 2013).^{11,12} We start by performing a unit root test with breaks which is rejected at the 1% significance level with an Augmented Dickey-Fuller t -statistic value of -16.4.¹³ We also find a statistically significant bull market coefficient of 1.58 (t -statistic = 7.35), and a statistically significant bear market coefficient of -8.65 (t -statistic = -7.37).¹⁴ The transition probability from a bear to a bull market regime is 61.9%, while the transition probability from a bull to a bear regime is 5.32%. Further, the expected duration for a bull market regime is 19 months, whereas for a bear market regime is only two months.

In order to further assess the statistical significance of our preliminary results, we examine the time-varying transition regime coefficients with their underlying transition probabilities. The regime coefficient for the bull market regime is 1.3 (t -statistic = 5.97), and it is statistically significant. Further, the regime coefficient for the bear market regime is -9.7 (t -statistic = -7.48), and it is also statistically significant. The transition probability of a bear market regime at time t remaining a bear regime at time $t+1$ is 0.4%, while the transition probability of a bull market regime at time t switching to a bear regime is 7.5%.

In summary, our Markov regime switching analysis helps us to identify four bull market regimes: January 1990 to June 1990, November 1990 to October 2000, October 2002 to May 2008, and March 2009 to March 2014, and three bear market regimes: July 1990 to October 1990,

¹¹ We use the Wilshire 5000 index (WI) because it covers almost all firms in the US economy, and therefore can be a better proxy for the entire market compared to the S&P500 index.

¹² The Markov switching approach is based on the idea that it is possible to decompose a series into a finite sequence of different regimes. Thus, we can describe the stochastic process that determines the switch from one regime to another using a Markov Chain.

¹³ In addition, we test for the existence of inverse roots of the AR polynomials and no root lies outside the unit circle.

¹⁴ For the bull market, the coefficient confidence interval at the 95% level is [1.15, 2.01] and at the 99% level is [1.02, 2.14], while for the bear market the coefficient confidence interval at the 95% level is [-11.21, -6.09] and at the 99% level is [-12.02, -5.23].

November 2000 to September 2002, and June 2008 to February 2009. The bear market regimes are clearly related to the higher oil prices during the summer of 1990 because of the Persian Gulf crisis, the depressed Japanese stock market in March 2001, the terrorist attack in the US on September 2001, and the global financial crisis of 2008-2009.

3.2 Performance persistence over different business cycles and market regimes

Our study examines three different aspects of performance persistence, using different measures. First, for risk-adjusted proxies of fund performance we examine the Sharpe ratio (SR) and the Information ratio (IR), using the parametric regression approach (Brown et al. 1999).¹⁵ Second, we examine a measure of the over- or under-performance of funds with respect to the market (i.e., Wilshire 5000), using the contingency table approach (Casarin et al. 2005; Eling, 2009). Third, we measure the over- or under-performance of the equally weighted portfolio of the funds that follow the same investment strategy, using the decile portfolio approach (Carhart, 1997; Capocci, 2009). In the next three sections, these three approaches are explained, and the empirical results are presented and discussed.

3.2.1 Examining performance persistence using the parametric regression approach

We follow Brown et al. (1999) and we regress the two measures of risk-adjusted performance (i.e., the Sharpe and the Information ratios) in the current time-period against risk-adjusted measures of performance in the previous time-period.

$$r_{prt} = a + br_{prt-1} + \varepsilon_t \tag{1}$$

¹⁵ The Sharpe ratio is a measure of risk-adjusted performance and is defined as the fund portfolio return, \bar{r}_p , minus the risk-free return, r_f , divided by the standard deviation of the fund portfolio return, σ_p ; Sharpe ratio = $(\bar{r}_p - r_f) / \sigma_p$ (Sharpe, 1994). We follow Goodwin (1998) and we define the Information ratio as the fund portfolio return minus the market return, $(r_p - r_B)$, divided by the standard deviation of the excess market returns, $\sigma(r_p - r_B)$; Information ratio = $(r_p - r_B) / \sigma(r_p - r_B)$. We compute both the Sharpe and Information ratios on a monthly cross-sectional basis.

where r_{prt} denotes the proxies for the risk-adjusted performance in the current time period, α is an intercept term to be estimated, b is the slope coefficient to be estimated, and ε_t is an error term. A statistically significant positive slope coefficient implies performance persistence with high values indicating stronger persistence. The intuition is that a fund that did well in one period is likely to do well during the subsequent period. For the different fund strategies, we present the results for the different business cycles and market regimes in Table 2 and Table 3, respectively.

Insert Table 2 around here

The results in Panel A of Table 2 indicate that when the Sharpe ratio is considered, during periods of economic growth most fund strategies exhibit strong performance persistence. Particularly, for all rebalancing frequencies, all strategies but the Short Bias and CTA exhibit statistically significant slope coefficients (most of them at the 1% significance level). The fund portfolios with the strongest persistence are the Relative Value and Event Driven, with statistically significant coefficients of 0.840 (t -statistic = 6.31) and 0.748 (t -statistic = 4.76), respectively. Overall, non-directional strategies but the CTA, present stronger performance persistence compared to directional strategies as the average coefficient for the directional strategies is 0.41 compared to 0.62 for the non-directional strategies. When we examine the results related to the Information ratio, most fund portfolios do not exhibit statistically significant performance persistence. Exceptions include the Long-only portfolio at the semi-annual and annual rebalancing with coefficients of 0.338 (t -statistic = 2.27) and 0.421 (t -statistic = 2.11), respectively, the Sector portfolio at the semi-annual rebalancing with a coefficient of 0.366 (t -statistic = 2.58), the Long-Short portfolio at the quarterly and semi-annual rebalancing with coefficients of 0.265 (t -statistic = 2.48) and 0.570 (t -statistic = 2.74), respectively, the Multi-strategy portfolio at the quarterly and semi-annual rebalancing with coefficients of -0.250 (t -statistic = -2.36) and -0.214 (t -statistic = -4.79), respectively, and the Market-Neutral at the semi-annual rebalancing with a coefficient of 0.317 (t -statistic = 2.11). The results in Panel B of Table 2 suggest that during recessions and

when Sharpe ratios are considered, almost all fund strategies do not exhibit performance persistence. Exceptions are the semi-annual rebalancing portfolios of CTA (0.940) and Short Bias (0.393), which are both statistically significant at the 5% level. Regarding the Information ratio, all fund portfolios but the Short Bias (semi-annual rebalancing) do not present performance persistence.

Panel A in Table 3 reports the results for fund performance persistence during bull market regimes. When we use the Sharpe ratio as a measure of risk-adjusted performance, all portfolio strategies but the CTA, and Short Bias present performance persistence. Overall, directional strategies present weaker performance persistence (average coefficient 0.39) compared to non-directional strategies (average coefficient 0.62) excluding the CTA strategy. The results related to the Information ratio, indicate no performance persistence for almost all fund portfolios. An exception is the semi-annual rebalancing Multi-Strategy portfolios with a statistically significant coefficient 0.138 at the 1% level. The results in Panel B of Table 3, indicate that when the Sharpe ratio is considered, there is no evidence for performance persistence during bear stock market regimes for almost all fund portfolios. At quarterly rebalancing, exceptions are the Short Bias and CTA with coefficients of 0.487 (t -statistics = 3.34) and 0.393 (t -statistics = 2.39), respectively. Similar are the results when the Information ratio is considered leading to the same conclusions.¹⁶

Insert Table 3 around here

In summary, when considering proxies for the risk-adjusted performance such as the Sharpe ratio during economic growth there is evidence for performance persistence but for the Information ratio, the strength of persistence weakens. During recessions, for both proxies there is almost no performance persistence for all hedge fund strategies. During bull market regimes,

¹⁶ We examine cross-sectional raw returns during growth (recession) periods and up (down) regimes. We find that during growth and up regimes almost all fund strategies present statistically significant performance persistence at least at the 5% significance level but the Short Bias strategy. On the contrary, during recessions and down regimes almost all fund strategies do not present performance persistence. Exceptions include the Market Neutral strategy for recession (annual rebalancing) and down regimes (any rebalancing frequency) and the CTA strategy (quarterly rebalancing) for down regimes which are statistically significant at least at the 5% level.

there is performance persistence related to the Sharpe ratios, but persistence weakens for the Information ratios. We also find that non-directional strategies have stronger performance persistence than directional strategies; a finding similar to that for the case of time periods of economic growth. One possible explanation is that directional strategies are more aggressive and exhibit higher return volatility. Also, illiquidity and the smoothing return practices of many funds that follow non-directional strategies can also be a plausible justification.¹⁷ During bear market regimes, hardly any fund strategy exhibits performance persistence as fund managers seem to struggle with market turbulence. In general, our findings are in line with those of Bares et al. (2003), Getmansky et al. (2004), and Eling (2009).

3.2.2 Examining performance persistence using the contingency table approach

We also follow the contingency table approach to examine whether winners (losers) in one time period continue to be winners (losers) in the next time period, when performance is measured with respect to an appropriate benchmark (Agarwal and Naik, 2000a; Casarin et al. 2005; Eling, 2009). Specifically, we examine the relationship between the performance of fund portfolios that are ranked above (i.e., winners), or below (i.e., losers), the market index benchmark in one time period, t , and their performance in the subsequent second time period, $t+1$. Funds that are winners (WW) or losers (LL) in both consecutive time periods are considered to exhibit persistent performance. The statistical significance of our empirical results is assessed using the Cross-product Ratio (CPR) test, which can help to detect both positive and negative performance persistence. The CPR test is the ratio of the product of WW and LL (i.e., funds that show performance persistence) to the product of WL and LW (i.e., funds that do not show performance persistence) (see, Agarwal and Naik, 2000b):

¹⁷ This is in line with Bollen and Pool (2006), and Kim and Lee (2018) who show that hedge fund smoothing is partially attributable to managerial discretion and that the assets of funds is the main source of return smoothing.

$$CPR = (WW * LL)/(WL * LW) \quad (2)$$

The null hypothesis is that there is no performance persistence when CPR is equal to one. Under the null, it is expected that each of the four different possibilities (i.e., WW, LL, WL, and LW) will have a 25% probability to occur. We compute the statistical significance of the CPR by using the standard error of the natural logarithm of the CPR given by (see, Agarwal and Naik, 2000b):

$$\sigma_{\ln(CPR)} = \sqrt{\frac{1}{WW} + \frac{1}{LL} + \frac{1}{WL} + \frac{1}{LW}} \quad (3)$$

In addition, we also conduct a Chi-squared test to assess whether the observed frequencies of the numbers of WW, LL, WL, and LW funds are statistically equal to the expected frequencies under the null hypothesis of no performance persistence. The Chi-squared test assesses persistence but, unlike the CPR test, does not consider the proportion of winners and losers. Therefore, although it is considered to be weaker, we still use it for robustness reasons. The results for the different business cycles and market regimes are reported in Table 4 and Table 5, respectively.

When the CPR test is used, the results in Panel A of Table 4 show that during periods of economic growth, only the Long-Short fund portfolio at the annual frequency, the Multi-Strategy fund portfolio at the semi-annual frequency, and the Long-Short fund portfolio at the quarterly frequency, exhibit performance persistence, when compared to the performance of the market portfolio (i.e., Wilshire 5000). Using the Chi-squared test, the Short Bias and Market-Neutral strategies exhibit performance persistence at quarterly, semi-annual and annual frequencies. The Relative Value fund portfolios exhibit performance persistence compared to the market portfolio, at the semi-annual and annual frequencies. Although there are some fund strategies that perform better than the market, their performance is not statistically significantly better than the performance of the market at the 5% significance level. Table 4 Panel B reports the results for fund performance persistence against the market benchmark during recessions. However, due to

the small number of datapoints it is not possible to compute the CPR test and the Chi-squared test. Hence, we report only descriptive statistics, and we regret to say that they only provide indications rather than exact statistical assessment of performance persistence.

Insert Table 4 around here

Panel A in Table 5 contains the results related to the fund performance persistence with respect to the market portfolio during bull market regimes. Using the CPR test, none of the fund strategies shows statistically significant performance persistence, for all time frequencies. It should be noted, that although some fund strategies, like the Short Bias, Global Macro, and Market-Neutral, show statistically significant performance persistence at these rebalancing frequencies, this finding is only supported by the Chi-squared test. Overall, it seems that no fund strategy exhibits performance persistence against the market benchmark during bull market regimes. In the case of bear market regimes, the limited number of datapoints available for analysis, implies that we can only report descriptive statistics in Panel B of Table 5. However, these results provide just an indication that funds exhibit performance persistence with respect to the market benchmark.

Insert Table 5 around here

To sum up, during periods of economic growth and bull stock market regimes very few fund strategies seem to exhibit performance persistence (i.e., Long-Short and Multi-Strategy) with respect to the stock market. During recessions there is no evidence of performance persistence of fund strategies whereas for bear markets there is an indication of performance persistence.

3.2.3 Examining performance persistence using the decile portfolio approach

For each fund strategy, we examine whether top (bottom) fund performers continue to be top (bottom) performers compared to their peers that follow the same investment strategy. We form equally weighted decile fund portfolios on the basis of their past performance. In particular, we sort portfolios according to their past performance and we form decile portfolios from low

performance (i.e., bottom 10%) to high performance (i.e., top 10%). We rebalance these decile portfolios quarterly, semi-annually and annually, and we track their performance as well as the difference between the performance of the top and top ranked fund portfolios.¹⁸ Specifically, at time t , we form the decile portfolios of winners, $P1_t$, and losers, $P10_t$, and we track their performance in the next time period, $t+1$. We then examine the difference in the mean returns of $P1_t$ and $P1_{t+1}$, and the difference in the mean returns of $P10_t$ and $P10_{t+1}$. We also examine the difference in the mean return of $P1_{t+1}$ and the average return of the equally weighted portfolio of the peer funds that follow the same strategy (Avg), and the difference in mean return of $P10_{t+1}$ and the average return of the equally weighted portfolio of the peer funds that follow the same strategy (Avg).

Panel A in Table 6 contains the return spreads of the top performing fund portfolios and the mean performance of funds in our sample per strategy (Avg) for different time periods of economic growth. When quarterly rebalancing is used, for more than half of the fund strategies the spread between the top fund performers, $P1_{t+1}$, and the Avg is positive and statistically significantly different from zero. The highest return spread (0.88%) is for the Relative-Value portfolio, which is statistically significant at the 1% level, and the lowest return spread (0.49%) is for the Long/Short portfolio and is statistically significant at the 5% level. The return spreads of the bottom fund performers, $P10_{t+1}$, with respect to the Avg are negative and, in most cases, statistically significant. The highest and most statistically significant return spread at 5% level is for the Other fund portfolio (-0.51%), and the lowest return spread is for the Event Driven fund portfolio (-0.16%), which is statistically significant at the 5% level. We also examine the returns of the $P1_t$ and the $P1_{t+1}$ portfolios, and we find a positive and statistically significant correlation

¹⁸ We do not use assessment time periods of more than one year because of insufficient data during stressful market conditions; the numbers of observations for recessions and bear market regimes are 34 and 36, respectively, which imply that at the annual time horizon we would have only three observations.

in the cases of the Other and the Relative-Value portfolios. These findings clearly indicate that performance persistence for these two strategies are driven by the top performers. When we examine the returns of the $P10_t$ and $P10_{t+1}$ portfolios, we find a statistically significant negative correlation in the cases of the Global Macro and Relative Value strategies. This implies that, despite the reversals, bottom performing funds continue to perform poorly in the next time period. Similar are the results when semi-annual and annual rebalancing are used.

Insert Table 6 around here

The results in Panel B in Table 6, reveal that during recessions and for quarterly rebalancing frequencies, the return spreads between the $P1_{t+1}$, and the *Avg* portfolios are not statistically significant for most of fund strategies. Most return spreads between the $P10_{t+1}$ and the *Avg* portfolios are negative for most fund strategies, as well. When we examine the $P1_t$ and $P1_{t+1}$ portfolios, only in the case of the Relative Value correlation is statistically significant and highly positive. The results for the $P10_t$ and the $P10_{t+1}$ portfolios are similar but not statistically significant. Further, the results are similar when semi-annual and annual rebalancing is used.

Insert Table 7 around here

Panel A in Table 7 the results related to the bull market regimes. When quarterly rebalancing is used, the return spreads of the equally weighted portfolio of top performers $P1_{t+1}$ and *Avg*, are statistically significantly positive for all but the Global Macro strategies. The highest spread relates to the Relative Value (0.97%) and the lowest spread relates to the Sector (0.64%), which are statistically significant at the 0.1% and 0.5% levels, respectively. Further, the return spreads between the portfolio of bottom performers, $P10_{t+1}$, and the *Avg* is negative for almost all strategies but not statistically significantly different from zero. This implies that bottom performers do not differ significantly from the average fund. When we compare the $P1_t$ and $P1_{t+1}$ decile portfolios, it can be noticed that for almost half of the fund strategies, the correlation

coefficients are statistically significantly positive at the 5% level, and this is especially the case for quarterly rebalancing. Similar are the results when the bottom performing portfolios, $P10_t$ and $P10_{t+1}$, are examined. Many fund strategies have statistically significantly negative correlations at the 5% level (i.e., Long-Short, Other and CTA), implying that there is a reversal in the bottom fund performers, even though they perform poorly compared to the average fund. In general, the results are similar when semi-annual and annual rebalancing are used.

Panel B in Table 7 contains the results for bear regimes. For quarterly rebalancing the return spread between $P1_{t+1}$ and Avg are positive for most strategies but not statistically significant. Further, most return spreads between the $P10_{t+1}$ and Avg are negative, although not statistically significant. In the case of the $P1_t$ and $P1_{t+1}$, only the Event Driven fund portfolios have statistically significant positive correlations at the 0.5% level. Further, in the case of the $P10_t$ and $P10_{t+1}$, the return spread for all fund strategies are negative although not statistically significant. Similar are the results when semi-annual and annual rebalancing are used.

In summary, during periods of economic growth and bull markets many fund strategies, such as the Event Driven, Relative Value and Multi-Strategy, exhibit performance persistence for up to one year. Some other fund strategies, such as the Sector and Other, exhibit performance persistence for up to half a year. Our results are close to Do et al. (2010) and Baquero et al. (2005) who document short-term hedge fund performance persistence. Our results also indicate that performance persistence is driven mainly by the top fund performers, a finding that is in line with Jagannathan et al. (2012), and Sun et al. (2018). In most cases, contrary to Capocci et al. (2005), who report that even mid-performers outperform the market, performance persistence is driven by the top fund performers that continue to perform well in subsequent time periods. Also, it seems that there are reversals in the bottom fund performers. This implies that there is fierce competition among bottom performers to achieve an at least average performance, otherwise, they may be abandoned by investors and even cease to exist. On the other hand, during economic

recessions and bear markets, performance persistence is very weak for all fund strategies. Our results confirm, in general, earlier studies that examine short-term performance persistence (e.g., Agarwal and Naik, 2000a; Baquero et al. 2005; Eling, 2009; Joenvaara, et al., 2012; Hentati-Kaffel, and Peretti, 2015). We further confirm the initial hypothesis that business cycles have a significant impact on fund performance persistence which is in line with previous studies, such as Capocci et al. (2005) and Sun et al. (2018). Moreover, there is evidence that non-directional fund strategies (e.g., Relative Value) have stronger performance persistence than directional fund strategies (e.g., Short Bias or Long-Only).¹⁹

4. The Economic Significance of Fund Performance Persistence

In order to assess the economic significance of our empirical findings we employ two of the most popular, out-of-sample hedge fund trading strategies; the momentum and the contrarian strategies (see, among others, Jegadeesh and Titman, 1993; DeBondt and Thaler, 1990).²⁰ Specifically, an investor or fund of funds manager using trading strategies at fund level has the following four options: (A) momentum trading of top fund performers, (B) (reverse) momentum trading of bottom fund performers, (C) contrarian trading of top fund performers, and (D) (reverse) contrarian trading of bottom fund performers. Although some of these trading strategies may not be possible at fund level, they, nevertheless, serve as good backtesting examples that highlight the economic significance of our empirical findings. In particular, we follow a momentum strategy by constructing a zero-net investment portfolio that is long in recent (i.e., quarter to annual) past winners and short in recent past losers. Analogously, we follow a contrarian strategy by

¹⁹ A number of studies have also reported performance persistence in mutual funds. For example, Hendricks et al. (1993), Brown and Goetzman (1995), Chen et al. (2016), and Wermers (1996) find that there is some performance persistence over short time periods (i.e., one to three years). However, Grinblatt and Titman (1992) and Elton et al. (1996) report predictability only in the long-term. Further, Malkiel (1995) finds that in the 1970s, 65.1% (64.5%) of the initial top (bottom) mutual funds performers fall in the top (bottom) half of the sample in the next assessment period; however, this pattern does not persist in the 1980s.

²⁰ A momentum trading strategy is based on buying or selling recent good or bad performers, respectively. It is based on the belief that the recent price trend will continue. A contrarian trading strategy is based on buying or selling recent bad or good performers, respectively. It is based on the belief that the recent price trend will reverse.

constructing a zero-net investment portfolio that is short in longer-term (i.e., two- to three-years) past winners and long in longer-term past losers. We base our trading decisions on past results over these time spans because as Jegadeesh and Titman (1993) report the momentum effect lasts from few months to up to a year, after which we would expect the contrarian effect to dominate. We implement these strategies over different business cycles. The following sections contain further details of these strategies and discuss the results obtained. We also perform a battery of robustness checks (see section 4.3).

4.1 Mixed strategies of investors

In this section, we only consider growth and recession periods because the literature indicates that it is safer to predict the state of the economy rather than the stock market (see, for example, Liew and Vassalou, 2000; Fama and French, 1989, Mariano and Murasawa, 2002). Thus, we make the implicit assumption that investors form their investment strategies on the basis of the state of the economy rather than the stock market²¹

We expect that fund strategies with higher persistence and fund strategies with high spreads between the fund portfolios of top and bottom performers can lead to abnormal returns. We first analyse the performance of trading strategies over periods of economic growth on a quarterly, semi-annual and annual frequencies, and we then repeat our analysis over recession periods. The out-of-sample comparisons are run on the basis that investors select a fund portfolio based on its expected performance represented by either the $P1_{t+1}$ (i.e., top performers) or the $P10_{t+1}$ (i.e., bottom performers) portfolios which are the ex post returns of portfolios $P1_t$ and $P10_t$,

²¹ There are some leading indicators that tend to provide good indications about the future state of the economy (i.e., manufacturers' new orders, new orders of nondefense capital goods, yield curve slope which is the 10-year minus federal funds rate, index of consumer expectations, money supply, M2 growth rate). In this study, we have also considered an analysis for bull and bear markets when applying the trading strategies and our results are similar to those reported in the case of growth and recession periods. In the interest of brevity, we do not report them here but are available upon request. In addition, as an extra robustness check (section 4.3), we calculate the average return of the 11 fund strategies at each rebalancing frequency (i.e., quarterly, semi-annually, and annually) during growth and recession periods.

respectively. In other words, $P1_t$ and $P1_{t+1}$ refer to the same fund portfolio (e.g., top performers of a particular trading strategy), but in different time periods. Hence, an investor (or a fund of funds manager) who wants to follow a specific trading style (e.g., momentum with quarterly rebalancing) selects the fund portfolio based on its expected performance in the next time period, $P1_{t+1}$. Similar rules apply in the case of $P10_t$ and $P10_{t+1}$. The investor derives her expectations based on current portfolios' performance and return spreads of $P1_t$ and $P10_t$. This is how performance persistence may in fact be exploited by investors.

The zero-investment momentum strategy of hedge fund investors consists of two legs: in the first leg the investor selects one fund strategy (i.e., the one with the highest expected return spread between $P1_{t+1}$ and $P10_{t+1}$), but within the same time period (quarterly, semi-annual, annual), while in the second leg, the investor uses different fund strategies, so that the expected return spread between $P1_{t+1}$ and $P10_{t+1}$ is the highest, but again within the same time period. The zero-investment contrarian strategy also consists of two legs: in the first leg the investor selects one fund strategy (i.e., the one with the highest expected return spread between $P1_{t+1}$ and $P10_{t+1}$) for a period longer than a year; in our analysis, we examine two and three years. In the second leg, the investor selects different fund strategies for a longer period (two or three years), based on her expected return spreads as well. We use longer holding periods than the previous momentum trading strategy to capture the contrarian effect.

4.2 Growth and recession periods: momentum and contrarian strategies

In this section we present the out-of-sample results related to the implementation of the trading strategies over different economic growth and recession periods. In particular, we compute the monthly returns for the top and bottom fund performers and for all fund strategies during periods of economic growth, as well as the performance persistence in various fund strategies. Given the previously documented short-term performance persistence in fund returns, investors should be

able to utilize the return spreads between top and bottom performers to form appropriate trading strategies that are likely to generate high returns. We proceed by forming trading strategies based on the performance of winners and losers.

Panel A in Table 8 contains the momentum trading strategy returns when only one strategy is used in each time period we consider (i.e., quarter, semi-annual, annual). The investor should choose to invest in the strategy with the highest expected return difference between the top and bottom performers; in this case is the Other fund strategy. Specifically, an investor should take both long and short positions in the top and bottom performers, respectively, to exploit the differences in performance spreads. For each time period the investor should take a long position on the best performers, $P1_t$, and a short position on the bottom performers, $P10_t$. In the next time period, the investor adjusts and rebalances her portfolio accordingly. The results indicate that for the quarterly and semi-annual holding periods the monthly return are 1.37% and 1.97%, respectively, and are both statistical significant at the 1% level, whereas for the annual period is 1.25% and is statistical significant at the 5% level.²² Panel A also contains the contrarian trading strategy results when the investor uses only one strategy per each time period considered (i.e., two- and three- years). In particular, an investor should use the contrarian strategies for two or more years between the top and bottom performers within the fund strategy with the highest performance spreads between them. In the two-year contrarian investment style, the Short Bias fund strategy is the fund strategy the investor should utilise. The results, however, imply that the investor receives a return that is below the market return. The results are similar for the three-year contrarian investment style using the Sector strategy, although statistically insignificant.

Panel B in Table 8 contains the momentum trading strategy results when different fund strategies are used. An investor aiming at abnormal returns should choose the fund strategies with the highest cross-strategy return spread between fund portfolios $P1_t$ and $P10_t$. Using quarterly

²² In the case of the semi-annual holding period there is an excess market return of 0.89% per month (which is statistically significant at the 5% level).

rebalancing, an investor that takes long and short positions in the top and bottom performers of the Long Only and Short Bias strategies, respectively, is rewarded with a return of 1.70% per month. Using semi-annual rebalancing, an investor utilizing the Other and Short Bias fund strategies, is rewarded with an expected monthly return equal to 2.14%, which is statistically significant at the 1% level. In the case of annual rebalancing, an investor employing the Sector and CTA fund strategies is rewarded with a return equal to 3.40% per month, which is statistically significant at the 1% level. Panel B contains also the results for the contrarian trading strategy when an investor utilizes more than one fund strategy. In this case the investor should utilize the strategies with the highest cross strategy performance spread between top and bottom performers. Thus, for the two-year contrarian strategy, an investor that takes a long position in the bottom performing Long Only fund strategy and a short position in the top performing CTA fund strategy is rewarded with an expected return equal to 2.72% per month. When the three-year contrarian strategy is considered, the expected return drops to 1.60 % per month. Both the contrarian strategy returns are statistically significant at the 1% level.²³

Since there is an indication of short-term performance persistence in fund returns during recessions for at least a quarter, it is possible that investors can utilize trading strategies to achieve abnormal returns. The results in Panels C and D in Table 8 indicate that during recessions, an investor should choose the long and short trading strategies with the highest expected spread between the top and bottom fund performers. The Relative Value, Short Bias, Global Macro and Event Driven present the highest spread between top and bottom performers.

Insert Table 8 around here

In summary, our results indicate that an investor can exploit the short-term persistence of funds that follow specific strategies to derive abnormal returns. In particular, the fund strategies

²³ In panel B, the momentum semi-annual and annual mixed strategies provide 1.06% and 2.32% excess monthly returns, respectively, which are both statistically significant at the 1% level. The two-year contrarian strategy provides a 1.64% excess monthly return which is statistically significant at the 1% level.

found to be more rewarding to an investor are the Other, Sector, and Relative-Value. This is because these fund strategies have higher persistence compared to other fund strategies and higher return spreads between top and bottom fund performers.

4.3 Robustness checks

In this section, we perform a battery of out-of-sample robustness checks. As a first robustness check, we compute the average return of the 11 fund strategies at each rebalancing frequency (i.e., quarterly, semi-annually, and annually) during growth and recessions periods. Table 9 presents our results. The results in Panel A indicate that, during growth, the monthly returns for the zero-net investment momentum strategies with quarterly, semi-annually and annually rebalancing periods, using one fund strategy, are equal to 0.71%, 0.92%, and 0.52%, respectively; these returns are all statistically significant at least at the 5% level. For the two-year and three-year contrarian strategies, the monthly returns are 0.05% and -0.20%, respectively, but are not statistically significant. We proceed similarly in the case of recessions. The results indicate that the monthly returns for the zero-net investment momentum strategies for all rebalancing frequencies and contrarian strategy are not statistically different from zero.

As a second robustness check of our findings, we examine the effect that redemption fees that managers impose on investors may have on our results. To compute the redemption cost of implementing the previously analysed trading strategies, we proceed as follows. In our dataset, 40.90% of the funds impose lockup restrictions, and the average redemption fee is 3.40%. Further, the minimum required number of redemptions within a year to perform the quarterly momentum strategy is four. On the other end, the minimum required number of redemptions within three years to perform the three-year contrarian strategy is one. Hence, we compute the net-after redemption return by subtracting from the return of each strategy the average monthly redemption cost of the funds that impose redemption restrictions. The monthly redemption cost is given by:

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

where $AvREDCost_{monthly}$ is the average monthly redemption cost, P_{lock} is the proportion of funds in the sample that impose lockups, $RedFee$ is the average redemption fee of the funds that impose lockups, and $RedPer$ is the redemptions per year needed to perform a trading strategy. We make an adjustment to the $AvREDCost_{monthly}$ by dividing the $P_{lock} * RedFee * RedPer$ by 12 (i.e., number of months in a year). Our results in Panel B indicate that during periods of economic growth all fund strategies, except for the two-year contrarian trading strategy, continue to provide positive monthly returns to investors. For the semi-annual momentum strategy, the monthly return is 0.69%, which is statistically significant at the 1% level. During recessions, the results are not statistically significant.

As a third robustness test, we replicate our analysis for two equal-length sub-periods. We consider the trading strategies for the first period and then again for the subsequent period to examine whether investors can generate abnormal monthly returns. Overall, our results are similar leading to the same conclusions. Specifically, the results in Panel C of Table 9 show that during periods of economic growth, investors can achieve positive returns in both sub-periods and in all cases except in the case of the three-year contrarian strategy where the returns are negative but not statistically significant. In many cases, such in the second sub-period, the momentum trading strategy generates positive average monthly returns (i.e., 0.98% for quarterly, 0.91% for semi-annual, and 0.78% for annual rebalancing) and statistically significant at the 1% level. During recessions, the results are statistical insignificant from zero, leading to the conclusion that investors cannot benefit from momentum strategies during recessions.

Insert Table 09 around here

As a fourth robustness test, we examine whether the fund return persistence is related to the alpha component of return given that hedge funds tend to have a positive market beta (Asness et al. 2001). For this reason, we compute the alphas for each of the underlying hedge fund strategies,

during both growth and recession time periods. Specifically, we use rolling windows of 36-months to estimate the fund betas, and we then run cross-sectional regressions to estimate the fund alphas on a monthly basis. For each hedge fund strategy, we examine the performance persistence using the regression parametric approach described in section 3.2.1. Table 10 presents our results. During recession periods and for quarterly rebalancing frequency, only two strategies (i.e., Other and Relative Value) present statistically significant alphas. Our results indicate that, in addition to the market beta, the alpha component of the return also exhibits persistence. The previous findings are useful for clients with a profile of maximizing their returns, utilizing trading (momentum and contrarian) strategies.

Insert Table 10 around here

5. Conclusions

We examine different aspects of performance persistence in hedge funds under different economic and market regimes using both parametric and non-parametric methods. Our results indicate that during periods of economic growth, fund strategies exhibit performance persistence especially in relation to Sharpe ratios. Also, very few strategies exhibit performance persistence with respect to the market (i.e., Long-Short and Multi-Strategy). In addition, there is performance persistence within strategies for up to one year (i.e., Event Driven, Relative Value, and Multi-Strategy) and for other strategies up to half year (i.e., Sector, Other). In most cases, the performance persistence is driven by top fund performers that continue to perform well in the subsequent period. During recessions, there is hardly any performance persistence for fund strategies. There is also no evidence of performance persistence of fund strategies with respect to the market.

We also find that during bull markets, fund strategies exhibit performance persistence when using proxies mostly related to Sharpe ratios. Moreover, with respect to the market, very few strategies exhibit performance persistence (i.e., Long-Short, Multi-Strategy). Within strategies, performance persists for up to one year and it seems to be driven mainly by the top fund

performers, as there are more changes in the bottom performers than in the top performers. Further, there is evidence that non-directional strategies (i.e., Relative Value) have stronger performance persistence than directional strategies (i.e., Short Bias or Long Only). During bear regimes, funds present almost no performance persistence. There is an indication of performance persistence of funds with respect to the market but within strategies, performance persistence is weak for most of the fund strategies. Finally, there is no significant evidence that differences in excess returns and market betas among hedge fund strategies are associated with differences in performance persistence; this is particularly useful for clients with a profile of maximizing their returns.

Our study extends and complements previous studies on fund performance persistence (e.g., Agarwal and Naik, 2000a; Ackermann, et al. 1999; Ammann, et al. 2013). Also, our results are both statistically and economically significant. In particular, we show that investors may outperform the market by constructing zero-net investment portfolio strategies that exploit the performance spread between top and bottom fund performers. Our results can have implications for fund investors or fund of funds managers looking to maximise their investment via giving them an opportunity to exploit differences in the performance persistence of different hedge fund strategies within their due diligence process. Moreover, funds may devise more appropriate compensation schemes that align managerial incentives to those of the investors, and regulators may be able to monitor better ‘unusual’ performance persistence that may be observed in the fund industry.

Declaration of Competing Interest

None

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Table 1. Average summary statistics of the monthly performance of the US hedge funds.

This table contains cross-sectional average statistics of the US hedge funds in our sample over the period from January 1990 to March 2014. Results are presented for equally weighted fund portfolios according to the fund investment strategy (Panel A) and the main investment strategy (Panel B). ‘N (total)’ is the total number of funds, ‘N (aver.)’ is the cross-sectional average monthly number of funds, ‘Mean’ is the cross-sectional average of the fund monthly net returns, ‘Median’ is the cross-sectional average of the median fund monthly return, ‘St.Dev’ is the cross-sectional average standard deviation of the fund monthly return volatility, ‘Min’ is the cross-sectional average minimum fund monthly return, ‘Max’ is the cross-sectional average maximum fund monthly return, and ‘ ρ ’ is the correlation coefficient of the monthly net returns of the fund portfolios and the monthly returns of the Wilshire 5000 index. We classify funds into three main investment strategies according to Bali et al. (2011); directional, semi-directional, and non-directional. An ‘*’ denotes statistical significance at the 1% level.

	N (total)	N(aveg.)	Mean (%)	Median (%)	St.Dev Dev	Min (%)	Max (%)	ρ
All funds	6,373	1,347	0.99	0.83	4.03	-12.38	17.38	0.400*
<i>Panel A: By investment strategy</i>								
Short Bias	51	11	0.05	-0.08	3.32	-4.90	5.60	-0.924*
Long Only	337	70	1.00	0.87	3.61	-7.35	11.03	0.707*
Sector	501	109	1.15	1.01	4.69	-10.08	14.59	0.637*
Long-Short	2,357	539	1.03	0.91	3.99	-11.93	16.45	0.550*
Event Driven	562	141	0.94	0.81	2.74	-7.44	11.34	0.338*
Multi-Strategy	244	57	1.06	0.92	2.86	-6.36	9.43	0.271*
Others	211	33	1.09	1.03	3.10	-4.72	7.59	0.232*
Global Macro	126	21	0.93	0.81	3.65	-5.34	8.08	0.223*
Relative Value	1,207	227	0.82	0.74	2.36	-8.32	11.51	0.211*
Market Neutral	247	43	0.53	0.52	2.27	-5.19	6.59	0.059*
CTA	530	96	1.18	0.95	5.18	-10.42	14.63	0.048
<i>Panel B: By main investment strategy</i>								
Directional	3,246	729	1.03	0.92	4.24	-12.21	16.94	0.543*
Semi-directional	1,143	251	0.98	0.84	3.01	-9.62	13.93	0.299*
Non-directional	1,984	367	0.88	0.73	3.71	-11.39	15.68	0.143*

Table 2. Fund performance persistence: growth and recession periods.

This table contains the slope coefficients of the regression of the cross-sectional risk-adjusted measures of fund performance (i.e., Sharpe and Information ratios) for both recession and growth periods, and for quarterly, semiannual, and annual fund portfolio rebalancing. ‘SR’ is the Sharpe ratio, and ‘IR’ is the Information ratio. Panel A contains the results for the growth periods, and Panel B contains the results for the recession periods, as these are defined by NBER. An ‘*’ and ‘**’ denote statistical significance at the 5% and 1% level, respectively. The *t*-statistics are not presented for brevity, but they are available upon request.

Fund Strategy	SR - Rebalancing horizon			IR - Rebalancing horizon		
	Quarterly	Semi-Annual	Annual	Quarterly	Semi-Annual	Annual
<i>Panel A: Growth</i>						
Short Bias	0.168	0.198	0.634**	0.109	0.198	0.720**
Long Only	0.222*	0.444**	0.619**	0.054	0.338*	0.421*
Sector	0.323**	0.519**	0.529*	0.097	0.366*	0.384
Long-Short	0.299**	0.462**	0.509*	0.265*	0.296	0.570*
Event Driven	0.604**	0.649**	0.748**	0.102	0.178	0.289
Multi-Strategy	0.518**	0.612**	0.582**	-0.250*	-0.214**	-0.005
Other	-0.001	0.596**	0.606**	-0.120	0.147	0.380
Global Macro	0.340**	0.457**	0.366	0.111	0.298	0.191
Relative Value	0.675**	0.735**	0.840**	0.015	0.227	0.311
Market Neutral	0.472**	0.419**	0.620**	0.029	0.317*	0.472
CTA	0.030	0.080	0.382	-0.007	0.085	0.445
<i>Panel B: Recession</i>						
Short Bias	0.285	0.433	-0.001	0.329	0.393*	-0.002
Long Only	0.057	-0.065	-0.748	0.007	-0.184	-0.030
Sector	0.196	-0.194	-0.216	-0.038	-0.421	0.846
Long-Short	0.062	-0.825	-0.224	0.106	-0.489	1.853
Event Driven	0.260	-0.686	-0.326	0.077	-0.362	0.041
Multi-Strategy	0.181	-0.576	0.243	-0.283	-0.717	0.527
Other	-0.254	0.332	0.899	0.120	0.032	0.671
Global Macro	0.124	0.589	1.075	0.167	0.974	1.529
Relative Value	0.024	-0.570	1.253	-0.053	-0.352	0.929
Market Neutral	-0.149	-0.569	1.716	-0.025	-0.663	0.360
CTA	0.011	0.940*	1.036	0.027	0.433	0.156

Table 3. Fund performance persistence: bull and bear market regimes.

This table contains the slope coefficients of the regression of the cross-sectional risk-adjusted measures of fund performance (i.e., Sharpe and Information ratios) for both recession and growth periods, and for quarterly, semiannual, and annual fund portfolio rebalancing. ‘SR’ is the Sharpe ratio, and ‘IR’ is the Information ratio. Panel A contains the results for the growth periods, and Panel B contains the results for the recession periods, as these are defined by NBER. An ‘*’ and ‘**’ denote statistical significance at the 5% and 1% level, respectively. The t-statistics are not presented for brevity, but they are available upon request.

Fund Strategy	SR - Rebalancing horizon			IR - Rebalancing horizon		
	Quarterly	Semi-Annual	Annual	Quarterly	Semi-Annual	Annual
<i>Panel A: Growth</i>						
Short Bias	0.163	0.042	0.185	0.199	0.071	0.260
Long Only	0.257*	0.504**	0.648**	0.020	0.233	0.093
Sector	0.343**	0.538**	0.689**	-0.035	0.126	0.196
Long-Short	0.278*	0.506**	0.562**	0.017	0.253	0.298
Event Driven	0.577**	0.641**	0.658**	-0.066	0.152	0.307
Multi-Strategy	0.662**	0.691**	0.662**	0.085	0.138**	0.004
Other	0.002	0.615**	0.627**	-0.143	-0.119	0.631
Global Macro	0.340**	0.465**	0.360	0.118	0.292	0.144
Relative Value	0.724**	0.751**	0.793**	-0.099	0.134	0.327
Market Neutral	0.408**	0.431**	0.645**	0.142	0.252	0.330
CTA	-0.001	0.141	-0.046	0.124	0.085	0.003
<i>Panel B: Recession</i>						
Short Bias	0.487**	0.007	0.127	0.512**	0.056	0.160
Long Only	0.156	0.348	0.924	0.439	0.379	1.076
Sector	-0.080	0.352	0.940	0.630	1.119*	1.384
Long-Short	0.187	0.440	0.221	0.518	1.294**	1.512
Event Driven	0.404	0.579	-5.262	0.023	0.925**	0.930
Multi-Strategy	0.124	0.133	0.125	0.202	0.176	0.316
Other	0.127	0.186	-0.819	0.626	0.339	1.035
Global Macro	0.169	0.415	1.613	1.184*	0.540	1.642
Relative Value	0.296	-0.088	-0.678	0.272	1.109**	1.429
Market Neutral	0.190	0.077	0.406*	0.260	0.583	0.825
CTA	0.393*	0.193	0.175	0.579*	0.660	0.648

Table 4. Performance persistence against the market benchmark: growth and recession periods

This table presents the performance persistence results during periods of growth (Panel A) and recessions (Panel B). Regarding the growth periods, Panel A shows the results of the CPR and the Chi-squared tests. A significant CPR statistic indicates performance persistence whereas a WW/LL ratio greater (less) than one indicates outperformance (underperformance) against the market represent by the return of the Wilshire5000 index. A statistically significant Chi-squared test indicates performance persistence against the market. ‘*’ and ‘***’ denote statistical significance at the 5% and 1% levels, respectively, using a two-tailed *t*-test. At the annual horizon we use the *t*-test (due to the insufficient number of observations), whereas at the semi-annual and the quarterly horizons we use the *z*-test. Regarding the recessions, Panel B shows only descriptive statistics due to the insufficient number of available observations.

<i>Panel A: Growth</i>	Quarterly horizon			Semi-Annual horizon			Annual horizon			
	CPR (<i>t</i> -stat)	WW/LL	Chi-squared test	CPR (<i>z</i> -stat)	WW/LL	Chi-squared test	CPR (<i>z</i> -stat)	WW/LL	Chi-squared test	
Short Bias	1.01	0.31	14.15**	2.86	0.21	23.33**	2.33	0.07	22.00**	
Long Only	1.66	1.29	2.29	2.39	1.89	5.43	5.00	1.80	4.80	
Sector	2.03	1.17	3.05	2.14	1.27	2.00	3.50	1.17	2.00	
Long-Short	2.47*	0.86	4.65	3.04	0.59	5.81	9.33*	0.88	5.20	
Event Driven	1.15	1.00	0.13	0.68	-	0.48	3.00	0.44	4.40	
Multi-Strategy	1.66	0.78	2.29	4.86*	0.71	7.33	8.33	0.50	7.60	
Other	1.14	0.83	0.51	2.14	0.79	2.00	1.50	0.83	0.40	
Global Macro	1.35	0.70	2.11	1.33	0.35	6.19	2.50	0.30	6.80	
Relative Value	0.82	-	6.06	1.17	0.26	10.19*	0.69	-	10.80*	
Market Neutral	0.94	-	25.54**	1.86	0.12	31.33**	3.75	0.07	26.80**	
CTA	0.96	-	7.75	0.64	-	1.62	1.50	0.83	0.40	
<i>Panel B: Recession</i>	Quarterly horizon				Semi-Annual horizon				Annual horizon	
	WW	LL	WL	LW	WW	LL	WL	LW	W	L
Short Bias	4	1	3	2	2	0	2	1	2	1
Long Only	4	2	2	2	1	0	2	2	2	1
Sector	5	0	3	2	2	0	2	1	3	0
Long-Short	4	1	3	2	2	0	2	1	2	1
Event Driven	4	1	3	2	0	0	3	2	2	1
Multi-Strategy	4	1	3	2	0	0	3	2	2	1
Other	4	1	3	2	2	0	2	1	3	0
Global Macro	4	1	3	2	2	0	2	1	2	1
Relative Value	4	1	3	2	2	1	1	1	2	1
Market Neutral	4	1	3	2	2	0	2	1	2	1
CTA	4	1	3	2	2	0	2	1	2	1

Table 5. Performance persistence against the market benchmark: bull and bear regimes

This table presents the performance persistence results during bull (Panel A) and bear (Panel B) market regimes. Regarding the bull regimes, Panel A shows the results of the CPR and the Chi-squared tests. A significant CPR statistic indicates performance persistence whereas a WW/LL ratio greater (less) than one indicates outperformance (underperformance) against the market represented by the return of the Wilshire5000 index. A statistically significant Chi-squared test indicates performance persistence against the market. ‘*’ and ‘***’ denote statistical significance at the 5% and 1% levels, respectively, using a two-tailed *t*-test. At an annual horizon we use the *t*-test (due to the insufficient number of observations), whereas at the semi-annual and quarterly horizons we use the *z*-test. Regarding the bear regimes, Panel B shows only descriptive statistics due to the insufficient number of available observations.

<i>Panel A: Bull regime</i>	Quarterly horizon			Semi-Annual horizon			Annual horizon			
	CPR (<i>t</i> -stat)	WW/LL	Chi-squared test	CPR (<i>z</i> -stat)	WW/LL	Chi-squared test	CPR (<i>z</i> -stat)	WW/LL	Chi-squared test	
Short Bias	0.78	-	20.48**	0.19	-	18.67**	0.75	-	12.71**	
Long Only	0.56	-	1.81	1.47	0.92	0.48	0.44	-	0.80	
Sector	0.99	-	0.38	1.78	1.00	0.86	3.50	0.86	2.00	
Long-Short	1.00	-	4.10	1.58	0.32	9.62*	0.84	-	1.60	
Event Driven	0.50	-	5.14	1.67	0.60	2.57	2.00	0.50	2.40	
Multi-Strategy	1.40	0.64	3.14	2.08	0.37	9.24*	3.67	0.27	9.60*	
Other	1.20	0.83	0.57	0.69	-	3.14	0.44	-	0.80	
Global Macro	0.67	-	10.57*	1.17	0.19	15.33**	0.40	-	7.76*	
Relative Value	0.68	-	13.71**	0.45	-	6.19	1.69	0.33	4.40	
Market Neutral	0.45	-	20.10**	0.26	-	23.14**	0.69	-	10.80*	
CTA	0.71	-	9.67*	0.82	-	3.90	0.16	-	3.60	
<i>Panel B: Bear Regime</i>	Quarterly horizon				Semi-Annual horizon				Annual horizon	
	WW	LL	WL	LW	WW	LL	WL	LW	W	L
Short Bias	7	0	2	2	5	0	0	0	3	0
Long Only	8	0	1	2	4	0	1	0	3	0
Sector	8	1	1	1	5	0	0	0	3	0
Long-Short	7	0	2	2	5	0	0	0	3	0
Event Driven	7	0	2	2	5	0	0	0	3	0
Multi-Strategy	7	0	2	2	5	0	0	0	3	0
Other	7	0	2	2	5	0	0	0	3	0
Global Macro	6	1	2	2	5	0	0	0	3	0
Relative Value	7	0	2	2	5	0	0	0	3	0
Market Neutral	6	1	2	2	5	0	0	0	3	0
CTA	6	1	2	2	5	0	0	0	3	0

Table 6. Performance Persistence within strategies – winners/losers for growth periods and recessions.

This table contains the average monthly returns (%) of the spreads between fund portfolios $P1_t$ and $P1_{t+1}$, $P10_t$ and $P10_{t+1}$, $P1_{t+1}$ and the mean average strategy ‘Avg’, and $P10_{t+1}$ and the mean average strategy ‘Avg’. We examine all fund strategies on a quarterly, semi-annual, and annual basis during growth periods (Panel A) and recessions (Panel B). ‘*’ and ‘**’ denotes significance at 5% and 1% level, respectively, assuming a two-tailed t -test. $P1_t$ and $P10_t$ are the ex-ante best performing and worst performing portfolios, respectively. $P1_{t+1}$ and $P10_{t+1}$ are ex-post portfolios of $P1_t$ and $P10_t$, respectively. In this table and the subsequent tables, we examine the spread of $P1_t - P1_{1+t}$ ($P10_t - P10_{t+1}$) in relation to $P1_t$ ($P10_t$) fund performers. The coefficient of the Pearson correlation (ρ) is used to whether top (bottom) performers continue to be top (bottom) performers in the next period.

Panel A: Growth												
	<u>Return (%), ρ</u>		<u>Return (%), ρ</u>		<u>Return (%), ρ</u>		<u>Return (%), ρ</u>		<u>Return (%), ρ</u>		<u>Return (%), ρ</u>	
Quarterly	Short Bias		Long Only		Sector		Long-Short		Event Driven		Multi-Strat.	
$P1_t - P1_{t+1}$	3.71	-0.125	3.32	-0.07	5.22	-0.162	4.03	-0.113	2.63	-0.034	2.80	0.144
$P10_t - P10_{t+1}$	-4.09	-0.206	-2.99	-0.099	-4.59	0.041	-3.90	-0.133	-2.52	0.004	-2.60	-0.172
$P1_{t+1} - \text{Avg}$	0.52		0.65**		0.28		0.49*		0.62**		0.66*	
$P10_{t+1} - \text{Avg}$	0.14		-0.40*		-0.39		-0.28**		-0.16**		-0.28	
	Other		Global Macro		Relative Value		Market Neutral		CTA			
$P1_t - P1_{t+1}$	2.91	0.237	3.90	-0.128	1.90	0.309**	2.30	-0.084	5.72	-0.073		
$P10_t - P10_{t+1}$	-2.94	-0.139	-3.57	-0.315*	-2.16	-0.292**	-2.18	-0.04	-5.51	-0.201		
$P1_{t+1} - \text{Avg}$	0.85**		0.16		0.88**		0.15		0.32			
$P10_{t+1} - \text{Avg}$	-0.51*		-0.07		-0.29*		-0.20		0.26			
Semi-Ann	Short Bias		Long Only		Sector		Long-Short		Event Driven		Multi-Strat.	
$P1_t - P1_{t+1}$	2.75	0.321	2.87	0.07	4.19	-0.047	3.21	-0.18	2.13	-0.280	1.93	0.093
$P10_t - P10_{t+1}$	-2.94	-0.196	-2.50	-0.071	-3.64	0.243	-3.04	0.058	-1.65	-0.152	-2.22	0.173
$P1_{t+1} - \text{Avg}$	0.84		0.38		0.28		0.48*		0.62**		0.90**	
$P10_{t+1} - \text{Avg}$	-0.19		-0.47*		-0.69		-0.40*		-0.55**		-0.17	
	Other		Global Macro		Relative Value		Market Neutral		CTA			
$P1_t - P1_{t+1}$	2.24	0.403*	2.61	0.148	1.62	0.371*	1.62	0.062	4.47	-0.202		
$P10_t - P10_{t+1}$	-1.82	0.136	-3.04	-0.238	-1.74	-0.342*	-1.47	-0.069	-4.09	0.042		
$P1_{t+1} - \text{Avg}$	1.01**		0.47		0.76**		0.37*		0.30			
$P10_{t+1} - \text{Avg}$	-0.96**		0.14		-0.33		-0.36*		0.28			
Annual	Short Bias		Long Only		Sector		Long-Short		Event Driven		Multi-Strat.	
$P1_t - P1_{t+1}$	2.42	0.002	2.27	-0.575*	3.15	-0.271	2.67	-0.276	1.90	0.044	1.98	0.072
$P10_t - P10_{t+1}$	-3.04	0.055	-2.21	-0.219	-3.06	-0.369	-2.67	-0.312	-1.72	-0.128	-2.00	-0.234
$P1_{t+1} - \text{Avg}$	1.01*		0.44*		0.59		0.29		0.46**		0.29	
$P10_{t+1} - \text{Avg}$	0.41		-0.47		-0.35		-0.17		-0.19		0.12	
	Other		Global Macro		Relative Value		Market Neutral		CTA			
$P1_t - P1_{t+1}$	2.33	0.016	2.77	-0.244	1.57	0.285	1.95	-0.247	3.78	-0.011		

$P10_t - P10_{t+1}$	-1.70	0.220	-2.40	-0.277	-1.39	-0.395	-1.75	0.065	-3.71	-0.037		
$P1_{t+1} - \text{Avg}$	0.58		0.08		0.63**		-0.26		-0.42			
$P10_{t+1} - \text{Avg}$	-0.68		-0.04		-0.43**		0.21		-0.41			
Panel B: Recession	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ
Quarterly	Short Bias	Long Only	Sector	Long-Short	Event Driven	Multi-Strat.						
$P1_t - P1_{t+1}$	4.32	-0.006	9.38	0.335	8.87	0.004	7.06	0.229	5.42	0.519	3.93	0.153
$P10_t - P10_{t+1}$	-6.13	0.057	-6.41	0.133	-8.41	0.101	-7.51	0.094	-3.72	0.092	-4.03	-0.040
$P1_{t+1} - \text{Avg}$	1.77		-0.89		-0.42		0.03		0.33		1.21	
$P10_{t+1} - \text{Avg}$	-0.70		-0.39		-0.44		-0.26		-1.53		-0.78	
	Other	Global Macro	Relative Value	Market Neutral	CTA							
$P1_t - P1_{t+1}$	6.41	0.190	7.56	-0.299	3.94	0.653*	3.96	0.332	8.98	0.245		
$P10_t - P10_{t+1}$	-6.50	-0.383	-5.53	0.286	-4.48	-0.309	-3.06	0.035	-10.50	0.070		
$P1_{t+1} - \text{Avg}$	0.40		0.20		0.98		-0.47		-0.51			
$P10_{t+1} - \text{Avg}$	-0.29		-0.19		-0.22		-0.48		2.36*			
Semi-Ann.	Short Bias	Long Only	Sector	Long-Short	Event Driven	Multi-Strat.						
$P1_t - P1_{t+1}$	5.29	0.254	4.72	0.082	8.80	0.652	5.01	0.733	6.51	0.740	3.57	0.288
$P10_t - P10_{t+1}$	-7.86	-0.943	-8.00	-0.924	-7.87	-0.519	-7.83	-0.700	-5.29	-0.745	-5.44	-0.832
$P1_{t+1} - \text{Avg}$	-1.81		0.20		-0.72%		0.28		-1.44		0.30	
$P10_{t+1} - \text{Avg}$	-0.06		2.76		-0.12%		1.28		1.00		0.72	
	Other	Global Macro	Relative Value	Market Neutral	CTA							
$P1_t - P1_{t+1}$	4.52	0.354	6.50	0.471	3.74	0.225	2.46	0.334	10.19	0.379		
$P10_t - P10_{t+1}$	-6.50	-0.822	-6.25	-0.565	-3.87	-0.471	-2.60	-0.887*	-11.26	0.764		
$P1_{t+1} - \text{Avg}$	0.64		0.48		0.06		0.45		-3.60*			
$P10_{t+1} - \text{Avg}$	0.98		1.29		-0.91		-0.38		3.04*			
Annual	Short Bias	Long Only	Sector	Long-Short	Event Driven	Multi-Strat.						
$P1_t - P1_{t+1}$	10.70		3.52		5.67		4.40		4.12		2.56	
$P10_t - P10_{t+1}$	-6.68		-2.60		-4.77		-3.93		-2.55		-0.29	
$P1_{t+1} - \text{Avg}$	-1.04		1.83		-0.07		0.41		-0.02		0.92	
$P10_{t+1} - \text{Avg}$	1.45		-1.54		-2.56		-1.44		-1.41		-2.33	
	Other	Global Macro	Relative Value	Market Neutral	CTA							
$P1_t - P1_{t+1}$	3.92		4.18		2.97		4.37		6.97			
$P10_t - P10_{t+1}$	-1.42		-3.05		-1.39		-2.77		-7.31			
$P1_{t+1} - \text{Avg}$	0.76		1.18		1.16		-1.65		-2.27			
$P10_{t+1} - \text{Avg}$	-2.56		-0.94		-4.66		0.01		1.44			

Table 7. Performance persistence within strategies: winners and losers in both bull and bear markets

This table contains the average monthly returns (%) of the spreads between fund portfolios $P1_t$ and $P1_{t+1}$, $P10_t$ and $P10_{t+1}$, $P1_{t+1}$ and the mean average strategy ‘Avg’, and $P10_{t+1}$ and the mean average strategy ‘Avg’. We examine all fund strategies on a quarterly, semi-annual, and annual basis during bull (Panel A) and bear regimes (Panel B). ‘*’ and ‘***’ denote statistical significance at the 5% and 1% level, respectively, assuming a two-tailed t -test. $P1_t$ and $P10_t$ are the ex-ante best performing and worst performing portfolios, respectively. $P1_{t+1}$ and $P10_{t+1}$ are ex-post portfolios of $P1_t$ and $P10_t$, respectively. In this table and the subsequent tables, we examine the spread of $P1_t - P1_{t+1}$ ($P10_t - P10_{t+1}$) in relation to $P1_t$ ($P10_t$) fund performers. The coefficient of the Pearson correlation (ρ) is used to whether top (bottom) performers continue to be top (bottom) performers in the next time period.

Panel A:	Return (%), ρ		Return (%), ρ		Return (%), ρ		Return (%), ρ		Return (%), ρ		Return (%), ρ	
Bull mkt												
Quarterly	Short Bias		Long Only		Sector		Long-Short		Event Driven		Multi-Strat.	
$P1_t - P1_{t+1}$	3.14	0.125	3.27	0.267*	4.70	0.201	3.88	0.254*	2.73	0.374**	2.76	0.373**
$P10_t - P10_{t+1}$	-3.34	-0.007	-3.15	-0.188	-4.76	-0.103	-4.01	-0.349**	-2.56	-0.105	-3.13	0.118
$P1_{t+1} - \text{Avg}$	0.77*		0.75*		0.64*		0.68**		0.70**		0.71**	
$P10_{t+1} - \text{Avg}$	-0.15		-0.21		-0.16		-0.16		-0.28		0.24	
	Other		Global Macro		Relative Value		Market Neutral		CTA			
$P1_t - P1_{t+1}$	3.18	0.068	4.76	0.165	1.96	0.550**	2.37%	0.082	5.66	-0.100		
$P10_t - P10_{t+1}$	-3.57	-0.329**	-4.65	-0.298**	-2.06	-0.012	-2.21	-0.045	-5.15	-0.234*		
$P1_{t+1} - \text{Avg}$	0.87*		-0.31		0.97**		0.09		0.28			
$P10_{t+1} - \text{Avg}$	-0.09		0.83*		-0.31		-0.11		0.12			
Semi-An.	Short Bias		Long Only		Sector		Long-Short		Event-Driven		Multi-Strat.	
$P1_t - P1_{t+1}$	2.74	0.038	2.92%	0.102	3.56	0.098	3.04	0.145	2.24	0.123	2.18	-0.139
$P10_t - P10_{t+1}$	-2.87	0.165	-2.71	-0.368*	-3.68	0.053	-3.02	-0.347*	-2.28	-0.269	-2.14	0.102
$P1_{t+1} - \text{Avg}$	0.43		0.36		0.82**		0.54		0.51*		0.52*	
$P10_{t+1} - \text{Avg}$	0.14		0.03		-0.27		-0.19		-0.08		-0.03%	
	Other		Global Macro		Relative Value		Market Neutral		CTA			
$P1_t - P1_{t+1}$	3.09	0.347*	3.24	-0.139	1.84	0.505**	1.97	0.096	4.66	0.187		
$P10_t - P10_{t+1}$	-2.68	0.094	1.16	-0.425*	-1.59	-0.308*	-1.81	0.132	-4.20	-0.103		
$P1_{t+1} - \text{Avg}$	0.54*		0.21		0.67**		0.04		2.14**			
$P10_{t+1} - \text{Avg}$	-0.28		0.32		-0.38**		-0.08		2.53**			
Annual	Short Bias		Long Only		Sector		Long-Short		Event Driven		Multi-Strat.	
$P1_t - P1_{t+1}$	2.46	-0.207	2.32	-0.003	3.53	0.061	2.81	0.048	1.98	0.041	1.93	0.036
$P10_t - P10_{t+1}$	-3.32	-0.173	-1.97	-0.410	-3.28	-0.474*	-2.71	-0.228	-1.81	-0.374	-2.30	0.118
$P1_{t+1} - \text{Avg}$	0.43		0.54*		0.57		0.36		0.38**		0.46*	
$P10_{t+1} - \text{Avg}$	0.54		-0.33		-0.07		-0.16		-0.18		0.18	
	Other		Global Macro		Relative Value		Market Neutral		CTA			
$P1_t - P1_{t+1}$	2.96	0.173	3.11%	0.140	1.78	0.674**	1.58	-0.040	3.56	0.024		
$P10_t - P10_{t+1}$	-2.19	0.149	-2.50	-0.240	-1.41	-0.216	-2.44	0.013	-3.49	-0.023		

$P1_{t+1}^-$ Avg	0.26		-0.07		0.64**		0.03		0.19			
$P10_{t+1}^-$ Avg	-0.42		0.40		-0.29*		-0.04		0.07			
Panel B: Bear Mkt	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ	Return (%), ρ
Quarterly	Short Bias		Long Only		Sector		Long-Short		Event Driven		Multi-Strat.	
$P1_t - P1_{t+1}$	8.34	-0.049	5.57	0.403	6.37	-0.502	5.90	0.125	3.31	0.718*	0.50	0.305
$P10_t^-$ $P10_{t+1}$	-5.63	-0.258	-6.20	-0.081	-6.67	-0.204	-6.11	0.001	-4.18	0.157	-3.48	-0.192
$P1_{t+1}^-$ Avg	-1.12		0.65		0.60		0.36		1.34		0.78	
$P10_{t+1}^-$ Avg	-0.43		-1.00		-2.94		-1.74		-0.87		-1.58	
	Other		Global Macro		Relative Value		Market Neutral		CTA			
$P1_t - P1_{t+1}$	4.78	-0.271	5.52	-0.109	3.17	0.324	3.01	0.223	8.97	0.347		
$P10_t^-$ $P10_{t+1}$	-5.80	-0.345	-6.98	0.124	-4.47	-0.246	-3.81	0.399	-6.45	-0.423		
$P1_{t+1}^-$ Avg	-0.30		0.88		0.76*		0.54		-1.23			
$P10_{t+1}^-$ Avg	-0.20		0.33		-1.01		-0.05		0.05			
Semi-An.	Short Bias		Long Only		Sector		Long-Short		Event Driven		Multi-Strat.	
$P1_t - P1_{t+1}$	6.02	0.033	3.18	0.825	4.10	0.964**	0.14	0.902*	3.26	0.412	3.25	0.713
$P10_t^-$ $P10_{t+1}$	-3.47	-0.002	-3.46	-0.251	-5.42	-0.024	-3.91	0.184	-2.38	0.214	-3.64	-0.029
$P1_{t+1}^-$ Avg	0.42		-0.01		1.80		1.07		0.61		0.70	
$P10_{t+1}^-$ Avg	-1.14		-2.52*		-3.98		-3.01		-2.02		-1.50*	
	Other		Global Macro		Relative Value		Market Neutral		CTA			
$P1_t - P1_{t+1}$	2.90	0.435	4.44	0.669	3.56	0.479	2.37%	0.445	8.11	-0.315		
$P10_t^-$ $P10_{t+1}$	-2.27	0.755	-3.92	-0.070	-3.06	-0.327	-2.94	0.879*	-7.82	-0.195		
$P1_{t+1}^-$ Avg	0.55		1.69		0.80		0.68		-1.29			
$P10_{t+1}^-$ Avg	-2.44		-1.84		-2.14		-0.88		-0.31			
Annual	Short Bias		Long Only		Sector		Long-Short		Event Driven		Multi-Strat.	
$P1_t - P1_{t+1}$	2.83		5.01		4.02		3.84		2.48		3.36	
$P10_t^-$ $P10_{t+1}$	-3.00		-1.62		-3.53		-2.97		-1.89		-2.87	
$P1_{t+1}^-$ Avg	1.08		-0.28		1.46		0.85		-2.75		0.32	
$P10_{t+1}^-$ Avg	-1.68		-1.82		-2.94		-1.91		-2.61		-1.70	
	Other		Global Macro		Relative Value		Market Neutral		CTA			
$P1_t - P1_{t+1}$	3.49		4.55		2.50		2.21		1.82			
$P10_t^-$ $P10_{t+1}$	-2.45		-0.28		-1.49		-2.24		-4.34			
$P1_{t+1}^-$ Avg	-0.29		2.59		0.50		0.12		1.69			
$P10_{t+1}^-$ Avg	-1.10		-3.64		-1.80		-0.49		-0.04			

Table 8. Momentum and contrarian trading strategies of investors: same and mixed strategies

This table presents the optimum momentum strategies of investors during growth (recession) periods, when using one only strategy in Panel A (Panel C) and different hedge fund strategies in Panel B (Panel D). ‘Return’ is the trading monthly raw return (%), ‘Exc.Rtn’ is the monthly return minus the market return (%) (i.e., Wil5000 Total Return Index, including dividends). An ‘*’ and ‘**’ denote significance at the 5% and 1% level, respectively, using a two-tailed *t*-test. The returns reported are the expected average monthly returns from the $P1_t$ and $P10_t$ fund portfolios. “|” denotes the portfolio selected based on high performance ($P1_t$) over the previous two years ($t=0$), and “||” denotes the portfolio selected on high performance ($P1_t$) over the three years before t . Due to the insufficient number of datapoints, in the case of recessions we present results for the contrarian strategy for only two years. For the same reason, we also cannot calculate the statistical significance of the reported figures.

Panel A: Single Strategy		Return	Exc.Rtn	Panel B: Mixed Strategies		Return	Exc.Rtn
Momentum				Momentum			
Quarterly	Buy $P1_t$ of Other and Short-sell $P10_t$ of Other.	1.37**	0.29	Quarterly	Buy $P1_t$ of Long Only and Short-sell $P10_t$ of Short Bias.	1.70**	0.62
Semi-annual	Buy $P1_t$ of Others and Short-sell $P10_t$ of Other.	1.97**	0.89*	Semi-annual	Buy $P1_t$ of OT and Short sell $P10_t$ of Short Bias.	2.14**	1.06**
Annual	Buy $P1_{t+1}$ of Others and Short-sell $P10_{t+1}$ of Other.	1.25*	0.17	Annual	Buy $P1_t$ of Sector and Short sell $P10_t$ of CTA.	3.40**	2.32**
Contrarian				Contrarian			
Two Years	Buy $P10_t$ of Short Bias and Short sell $P1_t$ of Short Bias .	0.64	-0.44	Two Years	Buy $P10_t$ of Long Only and Short sell $P1_t$ of CTA .	2.72**	1.64**
Three Year	Buy $P10_{t+1}$ of Sector and Short sell $P1_{t+1}$ of Sector .	0.46	-0.62	Three Years	Buy $P10_t$ of Event Driven and Short sell $P1_t$ of CTA .	1.60**	0.52
Panel C: Single Strategy		Return	Exc.Rtn	Panel D: Single Strategy		Retur	Exc.Rtn
Momentum				Momentum			
Quarterly	Buy $P1_t$ of Short Bias and Short Sell $P10_t$ of Short Bias.	2.46	3.24	Quarterly	Buy $P1_t$ of Short Bias and Short-sell $P10_t$ of Event Driven.	3.65	4.43
Semi-annual	Buy $P1_t$ of Relative Value and Short Sell $P10_t$ of Relative Value.	0.96	1.74	Semi-annual	Buy $P1_t$ of Short Bias and Short-sell $P10_t$ of Relative Value.	2.41	3.19
Annual	Buy $P1_t$ of Relative Value and Short Sell $P10_t$ of Relative Value.	4.94	5.72	Annual	Buy $P1_t$ of Global Macro and Short-sell $P10_t$ of Relative Value.	5.99	6.77
Contrarian				Contrarian			
Two Year	Buy $P10_t$ of Relative Value and Short sell $P1_t$ of Relative Value .	4.32	5.10	Two Year	Buy $P10_t$ of Short Bias and Short sell $P1_t$ of Relative Value .	7.30	8.08

Table 9. Robustness checks - trading strategies.

Panel A presents the zero-net momentum and contrarian strategies for the average return of all hedge fund strategies, during growth and recessions. Panel B presents the zero-net momentum and contrarian strategies for the average returns of all hedge fund strategies when considering the cost of redemption fees, for growth and recessions. Panel C presents the average returns of all hedge fund strategies when considering two equal subperiods of our data sample for growth and recessions, separately. An * and ** denotes significance at 5% and 1% level respectively using a two-tailed *t*-test. We calculate the statistical significance of figures only for growth periods due to sufficient datapoints availability. We use “-” due to the insufficient number of datapoints.

<i>Panel A: Economy State</i>			<i>Panel B: Economy State with redemption fees</i>					
Growth			Recession	Growth		Recession		
Rebalancing	Return	<i>t</i>-stat	Return	Cost	Return	<i>t</i>-stat	Return	
Momentum trading								
Quarterly	0.71% **	3.404	0.50%	0.46%	0.25%	1.189	0.04%	
Semi-Annual	0.92% **	4.610	-1.25%	0.23%	0.69% **	3.455	-1.48%	
Annual	0.52% *	2.451	1.35%	0.12%	0.40%	1.881	1.23%	
Contrarian trading								
Two Years	0.05%	0.286	0.66%	0.06%	-0.11%	-0.656	0.60%	
Three Years	-0.20%	-1.325	-	0.04%	0.16%	1.061	-	
<i>Panel C</i>			Growth		Recession		Recession	
			First period	Second period	First	Second period		
Rebalancing	Return	<i>t</i>-stat	Return	<i>t</i>-stat				
Momentum trading								
Quarterly	0.43%	1.178	0.98% **	5.324	-0.72	1.72		
Semi-Annual	0.93% *	2.626	0.91% **	4.666	-1.33	-1.17		
Annual	0.26%	0.805	0.78% **	3.460	-	-		
Contrarian trading								
Two Years	0.07%	0.238	0.02%	0.148	-	-		
Three Years	-0.35%	-1.441	-0.04%	-0.226	-	-		

Table 10. Robustness checks – alpha persistence

This table contains the slope coefficients of the regression of the cross-sectional alphas of funds' performance for both growth and recession periods and for quarterly, semiannual, and annual portfolio rebalancing. Panel A contains the results for the growth periods and Panel B contains the results for the recession periods, as these defined by NBER. An '*' and '**' denote statistical significance at the 5% and 1% level, respectively. The *t*-statistics are presented in parentheses. Due to insufficient number of available observations in the case of recessions, we present quarterly results, only.

Panel A											
Growth	Short Bias	Long Only	Sector	Long-Short	Event-Driven	Multi-Strategy	Other	Global Macro	Relative Value	Market Neutral	CTA
Quarterly	0.339** (2.709)	0.297* (2.434)	0.529** (5.684)	0.755** (10.325)	0.671** (8.282)	0.665** (7.968)	0.515** (4.304)	0.279* (2.067)	0.777** (11.087)	0.635** (7.161)	0.236* (2.106)
Semimanual	-0.004 (-0.021)	0.022 (0.126)	0.617** (4.891)	0.713** (6.738)	0.704** (5.975)	0.692** (7.001)	0.749** (6.674)	0.441* (2.579)	0.827*** (10.352)	0.789** (8.404)	0.372* (2.575)
Annual	0.084 (0.452)	-0.149 (-0.601)	0.714** (4.070)	0.736** (4.455)	0.806** (5.953)	0.684** (3.759)	0.716** (4.362)	0.146 (0.487)	0.876** (8.233)	0.834** (6.085)	0.622** (3.181)
Panel B											
Recession	Short Bias	Long Only	Sector	Long-Short	Event-Driven	Multi-Strategy	Other	Global Macro	Relative Value	Market Neutral	CTA
Quarterly	0.479 (1.254)	0.321 (1.291)	0.021 (0.073)	0.291 (0.901)	0.120 (0.302)	0.579 (1.808)	0.799** (3.838)	0.650 (1.821)	0.723* (2.665)	0.249 (0.655)	0.386 (0.971)

Appendix A. Description of the Hedge Fund Strategies

Short Bias (SB): This strategy involves a short net position in equities and aims to profit from rare but extreme negative events.

Long Only (LO): This strategy invests mostly in equities using long positions, i.e., it is a buy-and-hold strategy.

Sector (SE): This strategy invests in a particular industry using fundamental analysis and specialist knowledge.

Long-Short (LS): This strategy has long positions in under-priced stocks, and short positions in over-priced stocks.

Event Driven (ED): This strategy seeks to capitalize on opportunities arising due to corporate events such as mergers and acquisitions, restructuring, spin-offs, bankruptcies, and share buybacks.

Multi-Strategy (MS): This strategy focuses on distressed securities, merger arbitrage, or convertible bond and fixed income arbitrage.

Others (OT): This strategy contains funds that invest in start-ups, 'PIPES' (private investment in public equity). Also, this strategy includes close-end funds.

Global Macro (GM): This strategy exploits opportunistic directional investments in global markets, using almost all the available strategies and financial instruments.

Relative Value (RV): This strategy involves arbitrage transactions aiming to profit from relative pricing anomalies between related instruments such as debt, equities, futures and options.

Market Neutral (MN): This strategy seeks to be unaffected by market movements, exploiting mispricings at the lowest possible risk.

Commodity Trading Advisor (CTA): This strategy mainly trades options or futures contracts on behalf of investors, relying heavily on computerized systems or on fundamental and technical analysis.