Performance Evaluation of Hedge Funds with Option-based and Buy-and-Hold Strategies

Vikas Agarwal
Narayan Y. Naik*

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Abstract

Since hedge fund returns exhibit non-linear option-like exposures to standard asset classes (Fung and Hsieh (1997a, 2000a)), traditional linear factor models offer limited help in evaluating the performance of hedge funds. We propose a general asset class factor model comprising of excess returns on passive option-based strategies and on buy-and-hold strategies to benchmark the performance of hedge funds. Although, in practice, hedge funds can follow a myriad of dynamic trading strategies, we find that a few simple option writing/buying strategies are able to explain a significant proportion of variation in the hedge fund returns over time. Overall, we find that only 35% of the hedge funds have added significant value in excess of monthly survivorship bias of 0.30% as estimated by Fung and Hsieh (2000b). Their performance has been varying over time – 38% of the funds added value in the early nineties compared to 28% in the late nineties. When we compare the averages and the distributions of alphas and information ratios of funds that use leverage with those that do not, we find that the two are statistically indistinguishable in an overwhelming majority of the cases.

Performance Evaluation of Hedge Funds with Option-based and Buy-and-Hold Strategies

Evaluating the performance of managed portfolios has received considerable attention in the recent years, both in the popular press and in the financial economics literature. Although the theoretical principle behind performance evaluation is straightforward, several articles have been written highlighting the difficulties one encounters in practice while evaluating the performance of managed portfolios[1]. This task of performance evaluation becomes even more difficult in case of hedge funds where the manager can invest in any asset class, trade in derivatives and follow a myriad of dynamic trading strategies. This causes hedge funds to display non-linear risk exposures to standard asset markets[2]. Clearly, any benchmarking model employed to evaluate the performance of hedge funds must account for these non-linear option-like features exhibited by hedge fund payoffs.

A fundamental challenge in the evaluation of hedge fund performance is to identify a meaningful benchmark; a problem well recognised in the literature. Brown and Goetzmann (1997) address this issue by employing a Generalized Stylistic Classification (GSC) algorithm and grouping the managers on the basis of their realized returns, while Fung and Hsieh (1997a&b) and Schneeweis and Spurgin (1998) use style analysis based multi-factor approach. These approaches differ from

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[1] See, for example, Treynor and Mazuy (1966), Jensen (1968), Treynor and Black (1972), Merton (1981), Henriksson and Merton (1981), Dybvig and Ingersoll (1982), Dybvig and Ross (1985), Admati et al (1986), Jagannathan and Korajczyk (1986), Connor and Korajczyk (1986), Lehmann and Modest (1987), Grinblatt and Titman (1989) and Glosten and Jagannathan (1994).
[2] Fung and Hsieh (1999a, 2000a) show that "Global/Macro" funds deliver "collar" like payoffs while "Trend Followers" exhibit a "look-back straddle" like payoff. Mitchell and Pulvino (2000) demonstrate that "risk arbitrage" strategy payoffs are similar to that obtained from writing an uncovered put option

the style-mean benchmark used in the performance persistence studies by Brown, Goetzmann and Ibbotson (1999) and Agarwal and Naik (2000a). They also differ from standard equity and bond index returns used by Ackermann, McEnally and Ravenscraft (1999) to benchmark the hedge fund returns.

In this paper, we propose a different approach to formulating a benchmark to evaluate the performance of hedge funds. Our approach builds on the important insight provided by the pioneering work of Fung and Hsieh (1997a), namely that the payoff on a hedge fund arises from three factors: Trading Strategy factors (Option-like payoffs); Location factors (payoffs from Buy-and-Hold policy); and Leverage factor (scaling of payoffs due to Gearing). We capture the returns from Trading Strategy factors by returns on passive strategies that involve buying or writing Put or Call options on standard asset classes. In order to ensure that a passive investor can follow these strategies, we keep them easy to understand and implement. In particular, we only consider trading in one month to maturity European options on standard asset classes with differing degree of moneyness[3]. We capture the returns from Location factors by different equity, bonds, currency and commodity index returns, and by returns to Fama-French's (1996) Size and Book-to-Market factors, Carhart's (1997) Momentum factor, and the Default spread factor. These factors are well known for their ability to explain returns earned by different assets over time. Finally, we examine the effect of the Leverage factor on hedge fund returns by analyzing funds that state that they use leverage from the ones that do not.

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on the market.
[3] It is important to note that there exist several ways to capture the non-linear nature of the payoff on a

We evaluate the performance of a hedge fund by regressing its return in excess of the risk free rate on the excess return earned by passive option-based strategies and that earned by traditional buy-and-hold strategies. To conserve degrees of freedom and to mitigate potential multi-collinearity problems, we use a stepwise regression approach to ascertain factors that best explain, ex-post, the variation in the returns of hedge funds over time[4]. Since we use excess returns on selected options on index portfolios as additional "factor excess returns" to estimate the multi-factor analogue of Jensen's (1968) alpha, the intercept from our regression represents the value added by a hedge fund after controlling for the linear and non-linear risk exposures.

Although Merton (1981) and Dybvig and Ross (1985) had noted that portfolios managed with superior information would exhibit option-like features, Glosten-Jagannathan's (1994) work was the first attempt to develop the necessary theoretical framework and to use the contingent claims approach to evaluate the performance of mutual funds. Since both Glosten-Jagannathan's (1994) work and our work conducts ex-post performance evaluation of managed portfolios, the methodologies used share similar features. However, it is important to note that we have three additional reasons for including payoffs on option-based trading strategies, reasons that do not arise in case of mutual funds examined by them. First, unlike mutual fund managers, hedge fund manager's compensation involves an explicit element of sharing of the profits (or the upside). This is equivalent to the investor having written a call option[5]. Because of

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hedge fund. We have consciously stayed away from specifying a wide range of option trading strategies and then selecting the ones that give the highest in-sample R-square.

[4] In stepwise regression, the variables are entered or removed from the model depending on the significance of the F-value. The single best variable is chosen first; the initial variable is then paired with each of the other independent variables, one at a time, and a second variable is chosen, and so on. We confirm the statistical significance of the variables using Newey-West (1987) standard errors.

[5] If the incentive fee is 20% of profits, then the investor is short one-fifth of a call option. This call

this incentive fee element of manager's compensation, even if the pre-fee returns did not exhibit any option-like element, the post-fee returns will. Second, unlike a large majority of mutual fund managers that do not use derivatives, hedge fund managers frequently trade in derivatives either explicitly or implicitly through dynamic trading[6]. Moreover, these dynamic trading strategies contribute to a very significant part of their returns, as is evident from the failure of traditional linear factor models like Sharpe (1992) in explaining their returns[7]. Finally, hedge funds are well known for their "opportunistic" nature of trading and a significant part of their return is due to their taking state-contingent bets. Returns from option strategies help capture, at least in part, these state-contingent bets. All these reasons necessitate the inclusion of returns from option-based strategies in the benchmarking model used to evaluate the performance of hedge funds.

Our approach has the advantage that it is less susceptible to manipulation by the manager compared to the traditional measures used in practice. For example, Grinblatt and Titman (1989) show that if investors were evaluating the performance of a manager by measures like the Sharpe ratio, Jensen's alpha or Treynor-Black's (1972) appraisal ratio, then a manager selling call options on the index will appear to be a superior performer. Clearly, one would like the performance evaluation measure to be robust to such simple manipulations. As our measure explicitly controls for payoffs

option is written on the portfolio of assets held by the manager and the exercise price depends on hurdle rate and high watermark provisions.

[6] Koski and Pontiff (1999) find that only 20% of the mutual funds in their sample of 675 equity mutual funds invest in derivatives. Further, they find that the risk-return characteristics of the mutual funds using derivatives are similar to the ones that do not use derivatives.

[7] Fung and Hsieh (1997a) report that Sharpe's (1992) eight-asset-class-factor model provide them with an adjusted R-square of only 7%. Fung and Hsieh (2000a) find that Sharpe's model performs equally poorly for "trend-following" CTA strategies with the adjusted R-squares ranging from –3.2% to 7.5% (see their Table 2).

from option buying or writing strategies, it mitigates the ability of the manager to manipulate our performance evaluation measure.

In theory, it is easy to argue that one should include returns from dynamic trading strategies as additional regressors. However, in practice, implementing this task is far from straightforward as hedge funds can follow a myriad of dynamic trading strategies. The idea of capturing the essence of these strategies with primitive option writing or buying policies seems, at least at first sight, somewhat ambitious. Interestingly, we find that a few simple option writing/buying strategies explain a significant proportion of variation in the returns on hedge funds over time. This is more so the case for non-directional (e.g., Relative Value, Event Arbitrage, Long-Short (Equity Hedge)) hedge fund strategies as compared to the directional ones (e.g., Macro, Hedge (with Long Bias), Short).

Although we find that returns on hedge funds are highly correlated with some of our option writing or buying strategies, we would like to have an independent confirmation that they indeed capture the true risks involved in the different hedge fund strategies. We have discussed our findings with some of the hedge fund managers. Unfortunately, they are very secretive about their trading strategies. Therefore, we compare and contrast our findings with those of other researchers who have used replication methodology to examine the risk-return tradeoffs in selected hedge fund strategies.

Mitchell and Pulvino (2000) compile a sample of 4750 merger/acquisition events and find that event or merger arbitrage strategies exhibit a payoff similar to writing an

uncovered put option on the market index. When we compare this finding with the factor loadings estimated via our benchmarking model for funds following "Event Arbitrage" strategy, we find that our stepwise regression selects writing a naked put option on Russell 3000 index as the most important factor in a great majority (73%) of the cases. Furthermore, out of the five important factors explaining the returns on Event Arbitrage funds, three factors involve writing put options on Russell 3000 index with different degrees of moneyness. Overall, the Trading Strategy factors provide an average R-square which represents 81% of the average total R-square obtained from Trading strategy factors and Location factors.

Similarly, when we regress the excess returns on the individual hedge funds following "Equity-Hedge" strategy on the excess returns from Location and Trading Strategy factors, we find significant exposures to Fama-French's (1996) Size (Small-minus-Big) factor and Book-to-Market (High-minus-Low) factor. The Equity Hedge strategy involves hedge funds taking long-short positions in equities and comes closest to the "pairs trading" or "relative-value-arbitrage" strategy studied by Gatev, Goetzmann and Rouwenhorst (1999). Like us, they also find significant exposures to Size and Book-to-Market factors[8]. Thus, the similarities of their results and our results highlight the effectiveness of our approach in capturing important risk exposures of different hedge fund strategies.

We evaluate the performance of hedge funds using monthly net-of-fee returns reported in the Hedge Fund Research (HFR) database over January 1990 to October

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[8] While they find long exposure to the market index directly, our results capture it indirectly through writing of put options on the index. For the idiosyncratic risk of relative value strategies, see Richards

1998 period - a time period that covers both market upturns and downturns, as well as relatively calm and turbulent periods. We use data on 586 individual funds following ten different popular and commonly used hedge fund strategies: six of the strategies are non-directional while four are directional. We also divide the sample in two equal sub-periods (January 1990 to May 1994 and June 1994 to October 1998) and re-conduct the performance evaluation exercise. The sub-period analysis is important for three reasons. First, it is likely that hedge funds change their risk exposures and trading strategies over time to capture new opportunities. Second, in terms of market conditions, the second half of the nineties experienced many more "events" (Asian currency crisis, Russian debt default etc.) than the first. Finally, at an individual hedge fund level, there exist more funds in the second sub-period that the first. Sub-period analysis can potentially uncover interesting variation in the value added by the hedge funds over different market conditions and over different time periods.

We find that, in general, the non-directional strategies display more significant loadings on Trading Strategy factors compared to their directional counterparts, which show more significant loading on Location factors. Second, the R-square values from our model are substantially higher than those obtained using Sharpe's (1992) style analysis with the eight asset class factor model indicating the importance of including the Trading Strategy factors in addition to the Location factors[9]. Third, in case of the individual hedge funds following the six non-directional strategies, the proportion of observed R-square attributable to trading strategies is 70% of total R-square, on

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(1999).

[9] Fung and Hsieh (2000a) also find that the explanatory power goes up from less than 7.5% to about 48% when they include primitive trend following strategies to explain variation of returns over time of Trend following commodity trading advisors. All R-squares reported in this paper are adjusted R-squares, for expositional convenience, we refer to them as R-squares.

average, which is much higher than the average of 51% observed with directional strategies. Fourth, the risk exposures we obtain are similar to those observed by other researchers (Mitchell and Pulvino (2000), and Gatev et al (1999)) using detailed replication of strategies. This suggests that our method is able to capture important risk exposures of hedge funds. Finally, we find that only 35% of the hedge funds have added significant value in excess of monthly survivorship bias of 0.30% as estimated by Fung and Hsieh (2000b). Their performance has been varying over time – 38% of the funds added value in the early nineties compared to 28% in the late nineties.

It is well known that a large number of hedge funds use leverage. This constitutes an important determinant of the magnitude of their return (due to the scaling effect). The HFR database provides us the information about whether a hedge fund employs leverage or not. It is important to control for this difference because leverage affects the returns, alphas and factor loadings of hedge funds. Therefore, we segregate funds into two types: those who state that they use leverage and those who don't, and analyze their performance separately. Interestingly in an overwhelming majority of the cases, we find that the alphas and appraisal ratios of funds that use leverage are statistically indistinguishable from those that don't. This is true for the entire period as well as the two sub-periods.

Rest of the paper is organized as follows. Section 1 provides the sample description and classifies it into directional and non-directional hedge fund strategies. Section 2 describes the general asset class factor model consisting of both passive option-based strategies and buy-and-hold strategies. Section 3 describes the results of our analysis at an individual hedge fund level using the model and compares and

contrasts the results for the overall period with those for the two sub-periods. Section 4 segregates the funds into those that use leverage from those that don't and contrasts the findings. Finally, section 5 offers concluding remarks and suggestions for future research.

1. Data Description

Although the term 'hedge fund' originated from the equally long and short strategy employed by managers like Alfred Winslow Jones, the new definition of hedge funds covers a multitude of different strategies. Unlike the traditional investment arena, since there does not exist a universally accepted norm to classify the different strategies, we segregate them into two broad categories: 'Non-Directional' and 'Directional'. Hedge fund strategies with low exposures to standard asset markets (ones following Relative Value, Long-Short, or Risk Arbitrage type strategies) are classified as non-directional, while those having high correlation with the market are classified as directional[10].

For our analysis, we use a total of 586 funds from the Hedge Fund Research (HFR) database, following ten different popular and commonly used hedge fund strategies: six of the strategies are non-directional while four are directional. The six non-directional strategies are Event Arbitrage, Event Driven, Equity Hedge, Restructuring, Fixed Income Arbitrage and Capital Structure Arbitrage. The four

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[10] Note that the non-directional strategies are neutral only to the first moment, i.e., expected returns. They are not necessarily neutral to the second moment, as in volatile periods convergence is not always obtained and arbitrage-based strategies can make losses (as was seen in the second half of 1998).

directional strategies are Macro, Long, Hedge (Long Bias) and Short[11]. Our overall

sample period consists of 106 months from January 1990 to October 1998. To capture

potentially interesting intertemporal variation in risk exposures and performance, we

also conduct our analysis over two sub-periods (January 1990 to May 1994 and June

1994 to October 1998).

We report the summary statistics for the individual hedge funds following the

ten different strategies in Table 1. In general, we find that the non-directional

strategies have performed better than the directional ones based on various risk-return

characteristics. For example, during the overall sample period, the non-directional

strategies show an average monthly return higher than that on the directional strategies

(1. 04% compared to 0.87%) with a far lower standard deviation (3.00% compared to

6.42%). All the hedge fund strategies, except Short and Macro, show an average

negative skewness. They also display significant kurtosis indicating the presence of fat

tails in the distribution of hedge fund returns.

We contrast these against the moments of Russell 3000 index[12], MSCI World

(excluding USA), MSCI Emerging Markets, Salomon Brothers Government and

Corporate Bond index, Salomon Brothers World Government Bond index, Lehman

High Yield index, Federal Reserve Bank Trade Weighted Dollar index and the

Goldman Sachs Commodity index[13]. Panel B of Table 1 provides the summary

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[11] See Appendix A for definitions of these directional and non-directional strategies.

[12] The popular press generally compares the performance of hedge funds with that of the S&P 500 Composite index. However, considering the fact that most hedge funds invest in a wide range of equities including small cap, medium cap and large cap companies, we believe that Russell 3000 index (that represents over 95% of investable US equity market) captures their investment style better.

[13] We chose the Goldman Sachs Commodity index (GSCI) instead of a Gold index used by Fung & Hsieh (1997a) as the former indicates better the exposure of hedge funds in commodities especially

statistics of these eight indices and "Size" factor, "Value-Growth" factor, "Momentum" factor and "Default Spread" factor over the same period. We can see that in contrast to the moments of individual hedge funds, all Location factors except Lehman High Yield index and the momentum factor exhibit close to normally distributed returns.

Having described the salient features of the data, in the next section we describe the benchmarking model consisting of passive option-based and buy-and-hold strategies.

2. Generalized Asset Class Factor Model with Passive Option-based Strategies and Buy-and-Hold Strategies

In order to examine the value added by hedge funds, we regress the net-of-fee monthly excess return (in excess of the risk free rate of interest) on a hedge fund on the excess return earned by passive option-based strategies (Trading Strategy factors) and that earned by traditional buy-and-hold strategies (Location factors). To conserve degrees of freedom and to mitigate potential multi-collinearity problems, we use a stepwise regression approach where the independent variables are entered into the discriminant function one at a time, based on their discriminating power. The single best variable is chosen first; the initial variable is then paired with each of the other independent variables, one at a time, and a second variable with maximum incremental explanatory power is chosen, and so on. We use this procedure to ascertain the factors that, ex

considering the fact that hedge funds may not be investing totally in gold among commodities. GSCI is designed to measure investment performance in the commodity futures market. Its components are

post, explain the returns earned by hedge funds during our sample period. We compute the statistical significance of the factors by using Newey-West (1987) standard errors.

Since we use excess returns on selected options on index portfolios as additional "factor excess returns", the intercept (α^i) from regression below represents the value added by the manager/s of hedge fund *i* after controlling for her linear and non-linear risk exposures. We examine the value added over the entire sample period as well as two equal sub-periods. We investigate the effect of leverage by comparing and contrasting the alphas and the appraisal (or information) ratios of hedge funds that use leverage with those that don't[14].

In particular, to evaluate the performance of hedge funds we run the following regression[15]

$$R_t^i = \alpha^i + \sum_{k=1}^{K} b_k^i F_{k,t} + u_t^i \tag{1}$$

where,

R_t^i = net-of-fees excess return (in excess of the risk free rate of interest) on an individual hedge fund *i* for month *t*,

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weighted according to the quantity of production in the world economy giving greater weight to those commodities that have a greater impact.

[14] We use the terms, Information Ratio and Appraisal Ratio, interchangeably throughout this study. This ratio is also referred to as Reward to Variability ratio, Alpha-Omega ratio and Signal to Noise ratio by different researchers.

[15] See Glosten and Jagnnathan's (1994) section 2 for the theoretical underpinnings of equation (1). In our regression the value added or the "alpha" is given by the intercept while in their regression (see their section 4) it is given by the sum of the intercept, the coefficient on the index and the value of the

α^i = value added by a hedge fund i over the regression time period,

b_k^i = average factor loading of an individual hedge fund i on k^{th} factor during the regression period,

F_{kt} = excess return (in excess of the risk free rate of interest) on k^{th} factor for month t, ($k=1,.......,K$) where the factor could be a Trading Strategy factor (an option-based strategy) or a Location factor (Long position in an index), and

u_t^i = error term.

The Trading Strategies we allow for are passive in nature and require the investor to, say for example, buy a one month to maturity European put (or call) option on an index portfolio like the Russell 3000 index. Since we do not know the precise strategy followed by the hedge funds, we consider buying or writing options with three different strike prices. In particular, we consider an at-the-money option trading strategy (where present value of exercise price equals the current index value), an out-of-the-money option trading strategy (where the exercise price is half a standard deviation away from that of the at-the-money option) and a deep-out-of-the-money option trading strategy (where the exercise price is one standard deviation away from that of the at-the-money option)[16]. We denote at-the-money Call (Put) option by C_a (P_a), out-of-the-money Call (Put) option by C_o (P_o) and deep out-of-the-money Call (Put) option by C_d (P_d).

Figure 1 illustrates the payoff at maturity from buying a put or a call option on an

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Call option.
[16] We use the historical volatility for determining the exercise price of out-of-the-money options. See Canina and Figlewski (1993) and Dumas, Fleming and Whaley (1998) for the relative advantages of

index with different degrees of moneyness. The payoff at maturity from writing an option is simply the mirror image of the payoff shown. We use Black and Scholes' (1973) formula to estimate the cost of following such a passive trading strategy[17]. If the option expires in the money, we compute the return on initial investment of the cost of buying the one-month to maturity European call option. If the option expires out of the money, we assign a return of –100% for that month. We subtract the risk free rate of interest from these raw returns to obtain excess returns on these option trading strategies. We allow our investor to use passive option trading strategies on the Russell 3000 index, the MSCI Emerging Markets index, the Salomon Brothers (SB) World Government Bond index, the Lehman High Yield Composite index and the Federal Reserve Bank Trade-Weighted Dollar.

The Location factors we use consist of indices representing equities (Russell 3000 index, MSCI World excluding USA index and MSCI Emerging markets index), bonds (SB Government and Corporate Bond index, SB World Government Bond index and Lehman High Yield index), Federal Reserve Bank Trade Weighted Dollar index and the Goldman Sachs Commodity index. We also include three zero investment strategies representing Fama-French's (1996) "Size" factor (Small minus Big), "Value-Growth" factor (High minus Low), Carhart's (1997) "Momentum" factor (Winners minus Losers)[18]. Finally we use "Default" factor (yield on Moody's US BAA-rated corporate bond index minus return on Treasuries). In total, we use twelve

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using different volatility measures in option valuation.

[17] For the sake of simplicity, we have used Black and Scholes (1973) prices for options. These prices may be lower than open market prices to buy options. Mitchell and Pulvino (2000) find that replacing theoretical option prices by actual prices reduces the outperformance by 4 basis points. This suggests that incorporating real-life prices will not qualitatively affect our results.

[18] Edwards and Liew (1998) find that hedge funds fail to deliver positively significant alphas when the size, book-to-market and momentum factors are added to the standard capital asset pricing model.

Location factors. Using these Location and Trading Strategy factors, we conduct the performance evaluation of hedge funds.

3. Performance Evaluation of Hedge Funds

We conduct our analysis over the entire 106-month period (January 1990 to October 1998) as well as over two equal sub-periods of 53 months each. We estimate the value added by an individual hedge fund as the intercept obtained from the regression in equation (1). We examine the risk exposures and alphas of all hedge funds following a particular strategy over the entire period as well as the two sub-periods.

Selecting the time period for regression analysis of hedge funds involves the classical trade-off. We need sufficient degrees of freedom for statistical significance. However, the factor loadings may not remain constant over too long a time[19]. Since theory does not provide us with any guidance, we follow Fung and Hsieh (2000a) and select funds with a return history of at least 24 months. To ensure that our model captures some part of the risk exposure of a hedge fund, we require the fund to have at least one significant factor loading on any factor in our model. Finally, to minimise the influence of data errors, we exclude any fund that shows an alpha of more than 10% per month in magnitude. These criteria provide us with 584 funds in the overall period, 218 funds in the first sub-period and 559 funds in the second sub-period. The corresponding numbers for the non-directional strategies are 338, 122 and 322 funds while those for the directional strategies are 246, 96 and 237 funds. Because of the

historical evolution of hedge funds, we find that the Equity Hedge and Hedge (Long Bias) strategies constitute about 30% to 35% of total number of funds.

It is a challenging task to report findings from 1361 regressions in a meaningful manner. In order to conserve space, we report our results for the entire period and report the distribution of alphas and appraisal ratios obtained from the sub-period analysis. To begin with, we report the distribution of the number of Location and Trading Strategy factors that show significant loadings. Then we describe the five most important risk factors explaining the returns on hedge funds belonging to a particular strategy. Finally, we report the alphas and appraisal (information) ratios for the entire period as well as the two sub-periods.

Table 2 reports the number of factors that come out significant in regressions conducted for the entire period based on all 584 funds (338 non-directional and 246 directional). For the total sample consisting of both directional and non-directional funds (see last row of Table 2), 97% of the funds show significant loading on up to three Location factors. Interestingly, 95% of the funds also show significant loading on up to three Trading Strategy factors. When we pool the two types of factors together, we find that about 71% (93%) of the funds show significant loading on up to three (up to five) factors. Analysis at directional and non-directional strategy levels shows broadly similar number of significant factor exposures. Overall, Table 2 gives us an idea of the number of significant factor risks borne by individual hedge funds. Moreover, although the number of funds differ in the two sub-periods, the number of factor exposures exhibited by the hedge funds look similar in the two sub-period

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[19] See Brealey and Kaplanis (2000) for changes in factor exposures of hedge funds.

analysis (not reported for the sake of brevity).

3.1 Full Period Analysis

Table 3 reports the results of the performance evaluation regression for the 584 funds strategy by strategy. At the first sight, we can see that the R-square values we obtain using the generalized asset class factor model are considerably higher than the ones obtained by Fung and Hsieh (1997a, 2000a) using Sharpe's (1992) asset class factor model. Interestingly, we find that simple option-based Trading Strategies play a major role in explaining the variation of return on these hedge fund indices over time. In case of the hedge funds following non-directional strategies, the proportion of observed R-square attributable to trading strategies is, on average, 71% of total R-square we obtain from the model. In contrast, for the case of the hedge funds following directional strategies, the average proportion of observed R-square due to trading strategies is 51% of the total R-square. These high percentages confirm the importance of including trading strategies while benchmarking the performance of hedge funds.

For the sake of brevity, we report the alpha and five factors that come out significant across a large number of funds. We notice from the last row in Table 2 that 93% of all the hedge funds show significant exposure to five or less factors, hence the five most significant factors explain most of the variation in hedge fund returns. To describe the results, we consider the findings from the performance evaluation exercise of funds following "Event Arbitrage" Strategy. This strategy is closest in spirit to that analysed by Mitchell and Pulvino (2000) and therefore enables us to

compare and contrast our findings from regression analysis with theirs using detailed replication methodology.

3.1.1 The "Value Added" by hedge funds

The first row of Table 3 tells us that there exist a total of 22 funds belonging to the Event Arbitrage category (denoted by N), out of which 18 show a positive alpha from regression in equation (1) (denoted by N^+). 10 funds out of the 18 have an alpha that is significantly positive (denoted by N^{*+}) while only 2 funds out of the 10 have a monthly alpha that exceeds 0.3% per month, the survivorship bias estimated by Fung and Hsieh (2000b). Interestingly, none of the 22 funds shows an alpha that is significantly negative. It is important to note that this just happens to be the case for funds following the Event Arbitrage strategy and is not a universal phenomenon. There exist many funds that exhibit significantly negative alphas indicating that these have failed to add value. A large number of them belong to the Fixed Income Arbitrage strategy, the Restructuring strategy and the Long strategy where the average alpha (μ) is -1.07%, -0.26%, and -0.21% respectively.

The various μ's reported in the second row report the means of alphas of the funds belonging to the different categories. For example, the 22 funds (N) display an average alpha (μ) of 0.24% per month, the 18 funds (N^+) that have a positive alpha, have a mean alpha (μ^+) of 0.36% (which is higher than 0.24% because now we are excluding funds with negative alpha). The 10 funds (N^{*+}) that have alphas significantly greater than zero have a mean alpha of (μ^{*+}) 0.47%. Finally, the 2 funds

($N^{\#+}$) that have alphas that are positive and significantly greater than 0.30% ($N^{\#+}$) have a mean alpha ($\mu^{\#+}$) of 0.49%.

Since outliers may influence the mean alphas, we also report median alphas in the third row. The median alphas corresponding to: funds with positive alphas (ι^{+}); funds with alphas significantly greater than zero (ι^{*+}) and 0.30% ($\iota^{\#+}$), are 0.30%, 0.39% and 0.49% respectively. Note that by construction, ι^{+}, ι^{*+} and $\iota^{\#+}$ corresponding to N^{+}, N^{*+} and $N^{\#+}$ would always be in a non-decreasing order. The medians are lower than or equal to the mean in this case suggesting the presence of a few large (in magnitude) positive alpha values that pulls the mean above the median. Overall, the alphas we obtain are of similar order of magnitude as obtained by Mitchell and Pulvino (2000).

3.1.2 Risk Exposures of hedge funds

Continuing further, we now describe the five important factor exposures (in decreasing order of the number of funds that display significant loading on these factors) for the "Event Arbitrage" strategy. We find that a majority of funds (13 out of 22) show significant loading on a Trading Strategy factor that is a passive strategy involving an at-the-money put option on Russell 3000 index ($RUSP_a$). Note that the mean (median) factor loading is -0.44 (-0.31). The negative sign indicates that investing in Event Arbitrage funds exposes investors to risks similar to that involved in writing an at-the-money put option on the Russell 3000 index. Interestingly, all the 13 funds show loading of the same sign. The mean (median) order of entry is 1.08 (1.00) indicating that writing an at-the-money put on the Russell 3000 index is the

most important factor. This can be seen from the fact that in 12 out of the 13 cases, it was selected as the first factor in the stepwise regression procedure.

The next factor that affects a large number of funds is a Location factor, the Goldman Sachs Commodities Index indicating an exposure to commodities. All 4 of these show a loading of the same sign namely negative and the mean (median) factor loading is –0.11 (-0.11). The average (median) order of entry of the commodity factor is 2.00 (2.00) suggesting that although this factor affects the second largest number of funds following the Event Arbitrage strategy, it only enters like the second or the third factor in the stepwise regression. The third factor in the decreasing sequence of number of funds showing significant exposure to a factor, is the Fama-French's Value (High minus Low) factor, where 2 out of 3 funds show a positive loading and the mean (median) factor loading is 2.00 (2.00). It is the third most important factor in terms of the number of funds showing significant loading on it. However, it is less important in terms of its order of entry in the stepwise regression compared to the last two factors, namely the out-of-the-money and deep-out-of-the-money put options on the Russell 3000 index. Both of these factors show a mean (median) order of entry as 1.00 (1.00) indicating that they enter as the first factor in the regression. Overall, a put option on the Russell 3000 index (with varying degrees of moneyness) comes out as the most important or first factor in case of 16 out of 22 funds. This suggests that investing in Event Arbitrage funds exposes investors to risk that is similar to writing put options on the index, a result consistent with Mitchell and Pulvino's (2000) study.

It is important to note that all funds in a given category need not display loading on a given factor with the same sign. It just happens to be the case with the Trading

Strategy factors involving writing at-the-money, out-of-the-money and deep-out-of-the-money put options on Russell 3000 index and the Goldman Sachs Commodities Index. For example, in case of the Event Arbitrage strategy, we find that three funds show significant loading on Fama-French's Value (High minus Low) factor, where two of them show positive loading while one fund shows negative loading[20]. The mean/median loadings, order of entry etc. are as shown in the Table 3.

Finally, the four rows after the fifth most important factor report the mean and median R-square values. For Event Arbitrage strategy, the mean (median) R-square (denoted by $TR^2 \mu \mid \iota$) across the 22 funds (N) equals 37% (31%). The corresponding R-square values due to the first factor (denoted by $FR^2 \mu \mid \iota$) are 30% (26%). Location factors collectively contribute mean (median) R-square of 7% (5%) while Trading strategy factors collectively contribute mean (median) R-square of 30% (24%)[21]. The very last row tells us that in case of 19 out of 22 (86%) funds, a Trading Strategy factors gets chosen as the first factor.

This summarizes the salient findings from the performance evaluation exercise carried out for funds following the Event Arbitrage strategy. The remaining panels of Table 3 report the results strategy by strategy for the remaining nine strategies. For the sake of brevity, we highlight below the results for the best and worst performing strategies.

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[20] A positive (negative) loading indicates a tilt towards value (growth) stocks. This diversity is more in Equity Hedge category where 50 out of 179 show significant loading on Fama-French's Value factor, 17 of them positive while 33 of them negative.
[21] The mean contributions are additive. Mean TR^2 of 37% consists of 7% from Location factors and 30% from Trading Strategy factors.

3.1.3 The Best and Worst Performing Hedge Fund Strategies

For the non-directional strategies, the mean alpha is highest for funds following Equity Hedge strategy (1.57%) while it is lowest for funds following Fixed Income Arbitrage strategy (-1.07%). In terms of percentage of funds, in case of Equity Hedge funds, 84 out of the 179 or 47% of the funds exhibit a monthly alpha that exceeds 0.30% - the survivorship bias estimated by Fung and Hsieh (2000b). In contrast, for Fixed Income Arbitrage only 3 out of the 17 or 18% of the funds exhibit a monthly alpha that exceeds 0.30%. Although Fixed Income Arbitrage strategy and Restructuring strategies show negative mean alphas, the median alphas of all strategies are positive suggesting that the mean is dragged down below the median due to poor performance of a few funds. The median alpha is the highest for Equity Hedge (1.57%) while it is lowest for Event Arbitrage (0.30%).

In contrast, for directional strategies, the mean alpha is highest for funds following Hedge (Long Bias) strategy (1.31%) while it is lowest for funds following Long strategy (-0.21%). In terms of percentage of funds, in case of Hedge (Long Bias) funds, 67 out of the 155 or 43% of the funds exhibit a monthly alpha that exceeds 0.30%. The corresponding number for funds following Long strategy is 3 out of 36 or 8%. Although the Long strategy show negative mean alpha, the median alphas of all Directional strategies are positive ranging from 0.59% for Long funds to 1.35% for Hedge Long Bias .

3.1.4 Relative Importance of Trading Strategy factors vis-à-vis Location Factors

We know from Table 3 that the average total R-squares (ranging from 37% to 61% for non-directional strategies and from 47% to 75% for directional strategies) are much higher than that obtained by using Sharpe's (1992) model (see footnote 7). It is important to note that a large majority of the total R-square is contributed by Trading Strategy factors. For example, in case of the six non-directional strategies, the percentage of total R-square attributable to Trading Strategy factors is about 70%, highest being 81% for Event Arbitrage funds while the lowest being 51% for Equity Hedge funds. Moreover, in the case of 71% of the non-directional funds, a Trading Strategy factor gets selected as the "first" or most significant factor, the highest being 86% for Event Arbitrage funds while the lowest being 51% for Equity Hedge funds. In contrast, in case of directional hedge funds, the percentage of total R-square attributable to Trading Strategy factors is about 51%, highest being 77% for Long funds while the lowest being 13% for Short funds. A Trading Strategy factor is chosen as the "first" or most significant factor in the case of 54% of funds, highest being 81% for Long funds and the lowest being 18% for Short funds. This highlights the importance of including Trading Strategy factors in evaluating the performance of hedge funds across different strategies.

3.2 Sub-Period Analysis

Until now we have been discussing the results for the entire period (January 1990 to October 1998). It is interesting to see the extent of time variation in the performance of hedge funds in different market conditions. Towards that end, we repeat this exercise for the two sub-periods (January 1990 to May 1994 and June 1994 to October 1998). Since our main interest lies in the alphas (the value added) and the

ability of our model to capture the variation in the returns over time, in Table 4, we report the information about alphas and R-square values. We find that the mean alphas for all strategies based on the entire sample are positive in the first sub-period while this is not the case in the second sub-period. Strategies like the Fixed Income Arbitrage, Restructuring and Long that displayed a positive mean alpha in the first sub-period show negative alphas that are large in magnitude in the second sub-period, with the Fixed Income Arbitrage bearing the biggest brunt due to the events following the Russian Debt default in 1998. The R-square values we obtain in the two sub-periods are similar to that found in the entire period. For all strategies except the Short, Trading Strategy factors contribute a very large proportion of the total R-square.

We also conducted the performance evaluation exercise over three equal sub-periods of about three years each and find that (results not reported), among the three sub-periods, the performance of hedge funds was good in the first sub-period (January 1990 to December 1992), intermediate in the second sub-period (January 1993 to December 1995) and the poor in the final sub-period (January 1996 to October 1998). Once again funds belonging to the Fixed Income Arbitrage strategies performed the worst followed by Restructuring and Long strategy funds.

3.3 Summary of Alphas over Full Sample Period and Two Sub-Periods

We summarize our findings on alphas of hedge funds for the entire sample period and sub-periods by reporting the summary statistics of alphas in Table 5. The first three columns show the name of the strategy, the time period over which the

regression is run and the number of funds in the sample during that period. The fourth and fifth columns show the percentage of funds showing positive alphas (α^+) and the percentage of funds showing negative alphas (α^-) in each strategy. From the last row in the table, we can see that 77% (23%) of the funds show positive (negative) alphas during the entire sample period. The corresponding figures for the two sub-periods are 80% (20%) and 73% (27%). The sixth and seventh columns in the Table 5 show the percentage of funds showing positive alphas significantly different from zero (α^{*+}) and the percentage of funds showing negative alphas significantly different from zero (α^{*-}) in each strategy. From the last row in the table, we can see that 49% (9%) of the funds show positive alphas significantly greater than (less than) zero during the entire sample period. The corresponding figures are 46% (7%) and 40% (10%) for the two sub-periods. Finally, the eighth and ninth columns in the Table 5 show for each strategy the percentage of funds showing positive and negative alphas significantly different from an estimated survivorship figure of 0.3% per month, denoted by $\alpha^{\#+}$ and $\alpha^{\#-}$ respectively. Using this higher hurdle rate, we find that only 35% of the hedge funds have added significant value during the entire sample period, 38% adding value in the first sub-period and only 28% of them adding value in the second sub-period. The corresponding numbers for funds failing to add value are 13% for the overall period, and 11% and 14% for the two sub-periods.

For the full sample period, on average, the non-directional strategies show similar percentage figures of value addition as their directional counterparts. If we compare α^{*+} and $\alpha^{\#+}$, we find that directional funds show a marginally higher percentage of funds adding significant value in the first sub-period. The situation is reversed in the

second sub-period where non-directional funds show a marginally higher percentage of funds adding significant value. Overall, our results suggest that, on average, performance of hedge funds has been better in the early nineties compared to the late nineties.

4. Analysis of the Effect of Leverage

It is well known that hedge funds commonly use leverage and the alphas may be affected by the use of leverage. However, this also scales up the standard deviation of alpha. Since appraisal ratios are more robust than alphas to this scaling effect, we also estimate the appraisal ratios (or information ratios) of individual hedge funds. We compute the information ratio of a fund by dividing the alpha of each hedge fund by the standard deviation of the error term of the regression providing that alpha. We report the alphas and information ratios of hedge funds that state that they use leverage separately from those that state that they do not use leverage. It is important to note that leverage can be used explicitly (through debt on the balance sheet) or implicitly (through trading in derivatives). The HFR database does not distinguish between these two forms of leverage but provides information whether a hedge fund uses leverage or not.

In general, out of the 584 funds we have for the entire period, 414 (or 70%) of funds using leverage (see Table 6)[22]. The proportion for non-directional strategies is 262 out of 338 (or 77%) while that for directional strategies is 152 out of 246 (or 61%). The percentages for the two sub-periods are very similar as well. In general, for

a particular hedge fund strategy, the difference between the mean information ratios of the funds that use leverage and the funds that don't, is smaller than the difference between their mean alphas. This is consistent with our expectation that the appraisal ratio is more leverage invariant than the alphas. The ordering is broadly the same, i.e., if a fund that uses leverage has greater mean alpha, then it also shows greater mean information ratio[23].

Interestingly, if we look at the mean alphas reported for the sample as a whole (see the last two rows of Table 6), we find that the leveraged funds deliver a mean alpha of 0.86% which is marginally worse than that of the funds that don't use leverage (0.92%). This is true not only for the entire sample period but also for each of the two sub-periods covering very different market conditions. The mean alphas for the funds that employ leverage and the ones that don't for the first sub-period are 0.86% and 1.46% respectively while those for the second sub-period are 0.72% and 0.81% respectively. Furthermore, this result also holds when we aggregate over funds showing positive alphas (N^+) and over funds showing negative alphas (N^-). If we see the figures in the last two rows of Table 6 under μ^+ and μ^-, we find that when the mean alphas are positive (when the hedge funds are adding value), the funds that do not employ leverage show larger alphas compared to the funds that use leverage. Similarly, when the mean alphas are negative (when the hedge funds are failing to add value), the funds that do not use leverage show alphas that are less in magnitude than the funds that use leverage.

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[22] The numbers reported can be obtained by adding the funds belonging to the different categories.
[23] There are some reversals as well, e.g., Event Driven for the full sample period. Funds that use

It is also interesting to note that this result carries through when we compare their information ratios (see the last two rows of Table 7). If we look at the mean information ratios reported for the sample as a whole, we find that the funds that use leverage, on average, show a mean information ratio of 0.15 which is marginally worse than that of the funds that do not use leverage (0.20). The mean information ratios for the funds that use leverage and the ones that don't, for the first sub-period are 0.10 and 0.33 respectively while those for the second sub-period are 0.16 and 0.20 respectively. Moreover, as with the alphas, this finding holds whether we aggregate over funds showing positive alphas (N^+) or over funds showing negative alphas (N^-)[24].

Although in terms of the magnitude of the alphas and the information ratios, the funds that use leverage seem to perform worse than the funds that don't, it is not obvious that this difference is statistically significant. Therefore, we use both parametric and non-parametric tests to formally examine whether the funds that use leverage perform any better than the funds that do not. The parametric t-test examines whether the average alpha and information ratio of funds using leverage is statistically different from the average alpha and information ratio of funds not using leverage. A priori, as we do not know whether the funds that use leverage will have higher alphas and information ratios, we provide the results of the t-test for difference of means for both one-tailed and two-tailed cases. Also, we do not have information about the population variances being equal or not equal. Hence, we provide the results for both the cases. We provide the results of the t-test for the entire sample period as well as the two sub-periods in Table 8.

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leverage show higher alpha but lower information ratio.

[24] See the figures in the last two rows of Table 8 under μ^+ and μ^+.

We find that only in a very few cases, the average alpha and information ratio of the funds that use leverage is statistically different from the average alpha and information ratio of the funds that do not use leverage. Assuming equal (unequal) variance with one-tailed test, we find that the alphas and information ratios are statistically different at 5% level in only 5 (5) out of the 30 cases and 8 (7) out of the 30 cases. For the two-tailed test assuming equal (unequal) variance, the corresponding figures are 4 (4) out of the 30 cases and 6 (2) out of the 30 cases. This suggests that although there exists some difference in the magnitude of the average alpha and information ratio of funds that use leverage and the ones that do not, this difference is not statistically significant in a large majority of the cases.

As the t-test assumes normality in the distribution of alphas and the information ratios at the population level, we also perform a non-parametric Wilcoxon rank-sum (also known as Mann-Whitney) test to confirm the robustness of our results. Unlike the t-test, this test does not make any assumptions about the distribution of alphas and information ratios. However, it is more stringent than the t-test as it checks whether the alphas and information ratios of the funds using leverage and the funds not using leverage come from a population with the same distribution. We report the results from this test for the full sample period and the two sub-periods in Table 9. We find that the results from the non-parametric test are broadly consistent with those from the parametric t-test. In particular, we find that the null hypothesis of the alphas and information ratios of the funds that use leverage and the funds that don't coming from the same distribution is rejected at 5% level in only 3 out of 30 cases for alphas and 4 out of 30 cases for information ratios.

Overall, on average, and across funds over different time periods, we do not find significant difference in the performance of funds that use leverage from the ones that follow the same strategy but do not use leverage. This is true when we measure performance in terms of their alphas as well as their information ratios.

5. Concluding Remarks

This paper evaluates the performance of hedge funds following different strategies using a generalized asset class factor model consisting of excess return on Location (buy-and-hold) factors and on Trading Strategy (option writing/buying) factors. We use our model to examine the risk exposures, alphas and information ratios of hedge funds. We conduct our analysis at an individual hedge fund level. We also examine if there are differences in the alphas and the information ratios of the funds that use leverage and the funds that do not use leverage.

We have five main findings. First, we observe that our model consisting of Trading Strategy factors and Location factors is able to explain a significant proportion of the variation in the hedge fund returns over time. Second, we find that, in general, the non-directional strategies display more significant loadings on Trading Strategy factors compared to their directional counterparts, which show more significant loading on Location factors. Third, our results are similar to those observed by other researchers (Mitchell and Pulvino (2000), and Gatev et al (1999)) using detailed replication methodology. This offers independent confirmation that our approach is able to capture important risk exposures of hedge funds as well as the

value added by the hedge funds. Fourth, we find that only 35% of the hedge funds have added significant value in excess of monthly survivorship bias of 0.30% as estimated by Fung and Hsieh (2000b). Their performance has been varying over time – 38% of the funds added value in the early nineties compared to 28% in the late nineties. Finally, when we compare the averages and the distributions of alphas and information ratios of funds that use leverage with those that do not, we find that the two are statistically indistinguishable in an overwhelming majority of the cases. This indicates that levered funds do not necessarily perform better or worse compared to funds that do not use leverage.

Benchmarking of hedge funds is an important area of research. Investing in hedge fund involves significant costs for the investor and selecting the right manager is crucial in case of hedge funds. Hence, a benchmark that accounts for the linear and non-linear risk exposures of hedge funds is necessary for their performance evaluation. Our study contributes by providing a simple yet powerful approach to design a benchmark for hedge funds and to evaluate their performance. It would be interesting to examine whether such a risk-adjusted performance is related to characteristic features of hedge funds such as size, lockup period, incentive fees, etc. as well as to investigate the determinants of intertemporal variation in the alphas of hedge funds. These issues are being investigated as a part of ongoing research.

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Appendix A

Non-directional Strategies: These strategies have less correlation with any specific market. They are commonly referred to as 'market neutral' strategies. These strategies aim to exploit short term pricing discrepancies and market inefficiencies between related securities while keeping the market exposure to a minimum. As most of the times, liquidity is limited in such strategies, they frequently run smaller pools of capital than their counterparts following directional strategies. Included in this group are the following strategies:

1. Event Arbitrage - A strategy of purchasing securities of a company being acquired, and shorting that of the acquiring company. The risk associated with such strategies is more of a "deal" risk rather than market risk.

2. Event Driven - A strategy which hopes to benefit from mispricing arising in different events such as merger arbitrage, restructurings etc. Manager takes a position in an undervalued security that is anticipated to rise in value because of events such as mergers, reorganizations, or takeovers. The main risk in such strategies is non-realization of the event.

3. Equity Hedge – A strategy of investing in equity or equity-like instruments where the net exposure (gross long minus gross short) is generally low. Also referred to as Long-Short strategy. The manager may invest globally, or have a more defined geographic, industry or capitalization focus. The risk primarily pertains to the specific risk of the long and short positions.

4. Restructuring - A strategy of buying and occasionally shorting securities of companies under Chapter 11 and/or ones which are undergoing some form of reorganization. The securities range from senior secured debt to common stock. The liquidation of financially distressed company is the main source of risk in these strategies.

5. Fixed Income Arbitrage - A strategy having long and short bond positions via cash or derivatives markets in government, corporate and/or asset-backed securities. The risk of these strategies varies depending on duration, credit exposure and the degree of leverage employed.

6. <u>Capital Structure Arbitrage</u> - A strategy of buying and selling different securities of the same issuer (e.g. convertibles/common stock) seeking to obtain low volatility returns by arbitraging the relative mispricing of these securities.

Directional Strategies: These strategies hope to benefit from broad market movements. Some popular directional strategies are:

1. <u>Macro</u> - A strategy that seeks to capitalize on country, regional and/or economic change affecting securities, commodities, interest rates and currency rates. Asset allocation can be aggressive, and leverage and derivatives may be utilized. The method and degree of hedging can vary significantly.

2. <u>Long</u> - A strategy which employs a "growth" or "value" approach to investing in equities with no shorting or hedging to minimize inherent market risk. These funds mainly invest in the emerging markets where there may be restrictions on short sales.

3. <u>Hedge (Long Bias)</u> - A strategy similar to equity hedge with significant net long exposure.

4. <u>Short</u> - A strategy that focuses on selling short over-valued securities, with the hope of repurchasing them in the future at a lower price.

Table 1. Summary Statistics

This table shows the mean returns, standard deviations (SD), medians, skewness (Skew), Min-Max skewness (MM Skew), kurtosis, minimum and maximum realizations & Sharpe Ratios (SR) for the individual Hedge Funds following ten different Hedge Fund Strategies and the twelve Passive investment strategies (Location Factors) during January 1990 to October 1998. In Panel A, N represents the number of funds following a particular strategy. We calculate the Sharpe Ratio considering a risk-free rate of 5% p.a. with the only exception of default spread, where it is not applicable (NA). Min-Max skewness is computed as {(Maximum + Minimum - (2*Mean)) / (Maximum - Minimum)}

Panel A: **Hedge Fund Strategies**

Hedge fund strategy	N	Mean	SD	Median	Skew	MM Skew	Kurtosis	Min.	Max.	SR
Non-Directional										
Event Arbitrage	22	0.96	1.81	1.04	-1.20	-0.26	7.56	-5.89	5.03	0.37
Event Driven	48	1.33	3.55	1.45	-0.96	-0.21	7.51	-11.06	9.78	0.31
Equity Hedge	180	1.68	5.28	1.61	-0.22	-0.07	4.56	-12.42	13.74	0.29
Restructuring	26	0.72	3.11	0.99	-1.23	-0.26	9.23	-11.13	7.48	0.18
Fixed Income Arbitrage	17	0.52	2.35	0.99	-1.28	-0.24	8.25	-6.55	3.77	0.34
Capital Structure Arbitrage	46	1.05	1.92	1.25	-0.65	-0.14	5.43	-4.13	4.79	0.39
Average		**1.04**	**3.00**	**1.22**	**-0.92**	**-0.20**	**7.09**	**-8.53**	**7.43**	**0.31**
Directional										
Macro	44	1.08	4.69	1.00	0.07	0.01	4.85	-11.24	13.45	0.18
Long	37	-0.07	7.37	0.95	-1.74	-0.32	10.44	-26.15	12.75	-0.04
Hedge (Long Bias)	155	1.48	6.17	1.58	-0.39	-0.12	5.23	-16.59	16.24	0.19
Short	11	1.01	7.45	0.69	0.62	0.15	4.53	-16.48	24.10	0.10
Average		**0.87**	**6.42**	**1.06**	**-0.36**	**-0.07**	**6.27**	**-17.62**	**16.64**	**0.11**

Panel B: **Passive Strategies**

Passive strategy index	Mean	SD	Median	Skew	MM Skew	Kurtosis	Min.	Max.	SR
Equity									
Russell 3000 index	1.12	3.67	0.86	-0.26	-0.05	1.83	-11.71	12.68	0.19
MSCI World Excluding US	0.48	4.96	0.63	-0.11	0.01	3.52	-13.47	14.67	0.01
MSCI Emerging Markets	0.18	6.76	0.94	-0.76	-0.19	5.80	-27.69	19.26	-0.03
Fama-French SMB factor	-0.25	2.74	-0.26	0.28	0.20	3.59	-6.36	8.83	-0.24
Fama-French HML factor	0.19	2.48	-0.04	0.48	0.15	2.87	-4.50	6.55	-0.09
Momentum factor	0.43	6.38	1.26	-3.04	-0.44	16.65	-34.45	14.13	0.00
Bond									
SB Government and Corporate Bond	0.72	1.27	0.85	-0.06	0.12	3.14	-2.37	4.65	0.24
SB World Government Bond	0.78	1.78	0.92	0.28	0.09	3.40	-3.63	6.11	0.21
Lehman High Yield	-0.08	3.37	0.13	-4.11	-0.43	32.75	-25.47	10.16	-0.15
Default Spread	0.27	0.11	0.24	0.30	0.17	1.67	0.11	0.49	NA
Currency									
Federal Reserve Bank Trade-Weighted Dollar	0.03	2.49	-0.34	0.74	0.27	3.84	-4.69	8.31	-0.15
Commodity									
Goldman Sachs Commodity Index	0.38	4.64	0.23	0.71	0.27	2.28	-9.96	18.52	-0.01

Table 2. Summary of Number of Funds and Number of significant Location Factors, Trading Strategy Factors and both in the regressions of Individual Hedge Fund Excess Returns on the Excess Returns of the Location Factors and Trading Strategy Factors

This table shows the summary of the number of hedge funds in each strategy showing significant exposures to 1, 2, 3, 4, 5 and more Location Factor, Trading Strategy Factor and both in the stepwise regression of the excess returns of the individual hedge funds following six non-directional strategies and four directional strategies on the excess returns of the option-based strategies (Trading Strategy Factors) and the buy-and-hold strategies (Location Factors) during the entire sample period from January 1990 to October 1998. N represents the total number of funds in each strategy.

Hedge Fund Strategy	N	Number of significant Location Factors						Number of significant Trading Strategy Factors						Number of significant Total Factors					
		1	2	3	4	5	More	1	2	3	4	5	More	1	2	3	4	5	More
Non-Directional																			
Event Arbitrage	22	20	2	0	0	0	0	18	4	0	0	0	0	8	12	2	0	0	0
Event Driven	48	29	11	6	1	1	0	30	9	8	1	0	0	8	14	11	8	3	4
Equity Hedge	179	106	50	19	4	0	0	103	56	16	3	0	1	31	58	40	31	10	9
Restructuring	26	19	6	1	0	0	0	7	9	7	1	2	0	1	8	6	5	4	2
Fixed Income Arbitrage	17	15	1	0	1	0	0	6	6	3	0	2	0	4	2	6	2	1	2
Capital Structure Arbitrage	46	41	3	1	0	1	0	27	15	4	0	0	0	8	24	11	1	2	0
Sub-Total	*338*	*230*	*73*	*27*	*6*	*2*	*0*	*191*	*99*	*38*	*5*	*4*	*1*	*60*	*118*	*76*	*47*	*20*	*17*
Percentage		**68%**	**22%**	**8%**	**2%**	**1%**	**0%**	**57%**	**29%**	**11%**	**1%**	**1%**	**0%**	**18%**	**35%**	**22%**	**14%**	**6%**	**5%**
Directional																			
Macro	44	28	9	6	0	1	0	23	12	4	3	0	2	8	16	3	9	2	6
Long	36	29	5	2	0	0	0	16	7	6	4	2	1	8	8	7	8	3	2
Hedge (Long Bias)	155	84	35	24	7	5	0	88	36	21	8	2	0	16	42	42	26	13	16
Short	11	2	4	5	0	0	0	9	2	0	0	0	0	2	0	5	3	1	0
Sub-Total	*246*	*143*	*53*	*37*	*7*	*6*	*0*	*136*	*57*	*31*	*15*	*4*	*3*	*34*	*66*	*57*	*46*	*19*	*24*
Percentage		**58%**	**22%**	**15%**	**3%**	**2%**	**0%**	**55%**	**23%**	**13%**	**6%**	**2%**	**1%**	**14%**	**27%**	**23%**	**19%**	**8%**	**10%**
Grand Total	*584*	*373*	*126*	*64*	*13*	*8*	*0*	*327*	*156*	*69*	*20*	*8*	*4*	*94*	*184*	*133*	*93*	*39*	*41*
Percentage		**64%**	**22%**	**11%**	**2%**	**1%**	**0%**	**56%**	**27%**	**12%**	**3%**	**1%**	**1%**	**16%**	**32%**	**23%**	**16%**	**7%**	**7%**

Table 3. Regression results of Individual Hedge Fund Excess Returns on the Excess Returns of the Buy-and-Hold Trading Strategies (Location Factors) and Call-Option-Based and Put-Option-Based Trading Strategies (Trading Strategy Factors)

The following tables show the results of the stepwise regression of the excess returns of the individual hedge funds following six non-directional strategies and four directional strategies on the excess returns of the call-option-based trading strategies (C_a, C_o and C_d), put-option-based trading strategies (P_a, P_o and P_d) – the Trading Strategy Factors, and the buy-and-hold trading strategies (Location Factors) during the entire sample period from January 1990 to October 1998. For the three call and put option-based trading strategies, subscripts a, o and d refer to at-the-money, out-of-money and deep out-of-money respectively. The tables show the five most significant factors in the multi-factor model for each hedge fund strategy. We report the statistics of the intercept – alpha (α), slope coefficients, total R^2 (TR^2), R^2 from the first factor (FR^2), R^2 from the Location factors (LR^2), R^2 from the Trading Strategy factors (TSR^2), the number of cases where the first significant factor is a Trading Strategy Factor (#TS) and the percentage of funds in each strategy, where the first significant factor is a Trading Strategy Factor (%TS) . We report various statistics of these parameters including the total number of cases (N), total number of positive cases (N^+), number of positive cases significantly different from zero (N^{*+}), number of positive cases significantly different from an estimated survivorship-bias figure of 0.3% per month ($N^{#+}$), mean of total number of cases (μ), mean of the total number of positive cases (μ^+), mean of the number of positive cases significantly different from zero (μ^{*+}), mean of the number of positive cases significantly different from an estimated survivorship-bias figure of 0.3% per month ($\mu^{#+}$), median of the total number of positive cases (ι^+), median of the number of positive cases significantly different from zero (ι^{*+}), median of the number of positive cases significantly different from an estimated survivorship-bias figure of 0.3% per month ($\iota^{#+}$), mean and median order of entry in the stepwise regression procedure (OE ($\mu \mid \iota$)) indicating the importance of the factor in explaining the hedge fund returns, the mean and median of the total R^2 and R^2 from the first factor, TR^2 $\mu \mid \iota$ and FR^2 $\mu \mid \iota$, respectively and the mean and median of the R^2 from the Location Factors and R^2 from the Trading Strategy Factors, LR^2 $\mu \mid \iota$ and TSR^2 $\mu \mid \iota$, respectively. The eleven Location Factors are Russell 3000 index (RUS3000), MSCI excluding the US index (MXUS), MSCI Emerging Markets index (MEM), Fama-French factors (SMB & HML), Momentum factor (MOM), Salomon Brothers Government and Corporate Bond index (SBG), Salomon Brothers World Government Bond index (SBW), Lehman High Yield composite index (LHY), Federal Reserve Bank Trade-Weighted Dollar index (FRB) and the Goldman Sachs Commodity index (GSCI). For the Fixed Income Arbitrage strategy, we include an additional location factor, default spread (DEFSPR), i.e., the difference in the returns on Moody's US BAA-rated corporate bond index and the risk-free rate. The Trading Strategy Factors include the at-the-money, out-of-money and deep-out-of-money call and put options on the Russell 3000 index ($RUSC_{a/o/d}$ and $RUSP_{a/o/d}$), MSCI Emerging Markets index ($MEMC_{a/o/d}$ and $MEMP_{a/o/d}$), Salomon Brothers World Government Bond index ($SBWC_{a/o/d}$ and $SBWP_{a/o/d}$), Lehman High Yield composite index ($LHYC_{a/o/d}$ and $LHYP_{a/o/d}$) and Federal Reserve Bank Trade-Weighted Dollar index ($FRBC_{a/o/d}$ and $FRBP_{a/o/d}$).

Table 3 (contd.) Regression results of Individual Hedge Fund Excess Returns on the Excess Returns of the Buy-and-Hold Trading Strategies (Location Factors) and Call-Option-Based and Put-Option-Based Trading Strategies (Trading Strategy Factors) – Non-Directional Strategies (I)

Statistics	Sig. Factors	Event Arbitrage	Sig. Factors	Event Driven	Sig. Factors	Equity Hedge
$N \mid N^+ \mid N^{*+} \mid N^{\#+}$	α	22 | 18 | 10 | 2		48 | 37 | 25 | 18		179 | 149 | 99 | 84
$\mu \mid \mu^+ \mid \mu^{*+} \mid \mu^{\#+}$		0.24 | 0.36 | 0.47 | 0.49	α	1.03 | 1.64 | 2.25 | 2.84	α	1.20 | 1.84 | 2.37 | 2.56
$\iota^+ \mid \iota^{*+} \mid \iota^{\#+}$		0.30 | 0.39 | 0.49		0.85 | 1.49 | 2.25		1.57 | 2.09 | 2.26
$N\ (N^+)$	$RUSP_a$	13 (0)		23 (23)		85 (79)
$\mu\ (\mu^+)$		-0.44 (-)	SMB	0.47 (0.47)	SMB	0.57 (0.69)
ι		-0.31		0.40		0.55
OE $(\mu \mid \iota)$		1.08 | 1.00		2.35 | 2.00		1.98 | 2.00
$N\ (N^+)$	GSCI	4 (0)		15 (0)		50 (17)
$\mu\ (\mu^+)$		-0.11 (-)	$RUSP_a$	-0.77 (-)	HML	-0.48 (0.74)
ι		-0.11		-0.61		-0.70
OE $(\mu \mid \iota)$		2.00 | 2.00		1.07 | 1.00		1.92 | 2.00
$N\ (N^+)$	HML	3 (2)		8 (7)		39 (4)
$\mu\ (\mu^+)$		0.00 (0.17)	HML	0.38 (0.55)	$RUSP_d$	-0.70 (1.12)
ι		0.15		0.34		-0.78
OE $(\mu \mid \iota)$		2.00 | 2.00		2.25 | 2.50		1.72 | 1.00
$N\ (N^+)$	$RUSP_o$	2 (0)		8 (1)		29 (19)
$\mu\ (\mu^+)$		-0.37 (-)	GSCI	-0.11 (0.36)	MOM	0.15 (0.54)
ι		-0.37		-0.12		0.34
OE $(\mu \mid \iota)$		1.00 | 1.00		3.75 | 3.50		2.79 | 3.00
$N\ (N^+)$	$RUSP_d$	2 (0)		7 (0)		28 (3)
$\mu\ (\mu^+)$		-0.21 (-)	$RUSP_d$	-0.35 (-)	$RUSP_a$	-1.57 (0.76)
ι		-0.21		-0.39		-0.81
OE $(\mu \mid \iota)$		1.00 | 1.00		1.57 | 1.00		1.36 | 1.00
	$TR^2\ \mu \mid \iota$	37.16 | 30.71	$TR^2\ \mu \mid \iota$	52.56 | 52.12	$TR^2\ \mu \mid \iota$	55.04 | 54.34
	$FR^2\ \mu \mid \iota$	29.91 | 25.77	$FR^2\ \mu \mid \iota$	38.85 | 38.37	$FR^2\ \mu \mid \iota$	39.77 | 35.15
	$LR^2\ \mu \mid \iota$	7.08 | 4.55	$LR^2\ \mu \mid \iota$	20.01 | 12.88	$LR^2\ \mu \mid \iota$	26.92 | 20.25
	$TSR^2\ \mu \mid \iota$	30.08 | 24.26	$TSR^2\ \mu \mid \iota$	32.55 | 32.46	$TSR^2\ \mu \mid \iota$	28.12 | 20.79
	#TS (%TS)	19 (86%)	#TS (%TS)	33 (69%)	#TS (%TS)	92 (51%)

Table 3 (contd.) Regression results of Individual Hedge Fund Excess Returns on the Excess Returns of the Buy-and-Hold Trading Strategies (Location Factors) and Call-Option-Based and Put-Option-Based Trading Strategies (Trading Strategy Factors) – Non-Directional Strategies (II)

Statistics	Sig. Factors	Restructuring	Sig. Factors	Fixed Income Arbitrage	Sig. Factors	Capital Structure Arbitrage
$N \mid N^+ \mid N^{*+} \mid N^{\#+}$		26 | 13 | 7 | 4	α	17 | 8 | 4 | 3		46 | 36 | 22 | 12
$\mu \mid \mu^+ \mid \mu^{*+} \mid \mu^{\#+}$	α	-0.26 | 0.90 | 1.47 | 1.91		-1.07 | 0.53 | 0.71 | 0.63	α	0.68 | 0.99 | 1.20 | 1.67
$\iota^+ \mid \iota^{*+} \mid \iota^{\#+}$		0.50 | 0.92 | 1.06		0.50 | 0.81 | 0.81		0.46 | 1.05 | 1.34
$N\,(N^+)$		11 (11)	$SBWC_d$	8 (1)		13 (1)
$\mu\,(\mu^+)$	SMB	0.32 (0.32)		-1.74 (0.74)	$SBWC_d$	-0.84 (1.67)
ι		0.27		-1.20		-0.78
$OE\,(\mu \mid \iota)$		2.64 | 2.00		2.50 | 2.00		2.00 | 2.00
$N\,(N^+)$		11 (1)	$RUSC_d$	6 (0)		11 (11)
$\mu\,(\mu^+)$	$SBWC_d$	-2.08 (0.78)		-1.91 (-)	SMB	0.31 (0.31)
ι		-1.03		-1.46		0.17
$OE\,(\mu \mid \iota)$		2.91 | 3.00		1.00 | 1.00		2.09 | 2.00
$N\,(N^+)$		10 (0)	$MEMP_a$	5 (3)		10 (0)
$\mu\,(\mu^+)$	$LHYP_a$	-0.87 (-)		0.03 (0.13)	$LHYP_a$	-0.55 (-)
ι		-0.77		0.06		-0.53
$OE\,(\mu \mid \iota)$		1.90 | 2.00		3.00 | 3.00		1.20 | 1.00
$N\,(N^+)$		7 (0)	$DEFSPR$	4 (4)		7 (0)
$\mu\,(\mu^+)$	$RUSP_a$	-1.00 (-)		18.21 (18.21)	$LHYP_d$	-1.26 (-)
ι		-0.38		18.07		-1.79
$OE\,(\mu \mid \iota)$		1.57 | 1.00		1.75 | 1.00		1.14 | 1.00
$N\,(N^+)$		7 (0)	SBG	4 (2)		5 (1)
$\mu\,(\mu^+)$	$MEMP_a$	-0.17 (-)		0.06 (0.66)	$RUSC_d$	-0.06 (1.94)
ι		-0.15		0.16		-0.43
$OE\,(\mu \mid \iota)$		2.00 | 2.00		2.00 | 2.00		1.40 | 1.00
	$TR^2\,\mu \mid \iota$	57.39 | 52.92	$TR^2\,\mu \mid \iota$	61.15 | 67.73	$TR^2\,\mu \mid \iota$	44.95 | 39.51
	$FR^2\,\mu \mid \iota$	39.16 | 34.55	$FR^2\,\mu \mid \iota$	40.40 | 39.01	$FR^2\,\mu \mid \iota$	31.71 | 28.43
	$LR^2\,\mu \mid \iota$	10.06 | 7.77	$LR^2\,\mu \mid \iota$	14.52 | 6.27	$LR^2\,\mu \mid \iota$	15.22 | 10.02
	$TSR^2\,\mu \mid \iota$	47.32 | 46.93	$TSR^2\,\mu \mid \iota$	46.63 | 41.75	$TSR^2\,\mu \mid \iota$	29.72 | 24.35
	#TS (%TS)	20 (77%)	#TS (%TS)	12 (71%)	#TS (%TS)	34 (74%)

Table 3 (contd.) Regression results of Individual Hedge Fund Excess Returns on the Excess Returns of the Buy-and-Hold Trading Strategies (Location Factors) and Call-Option-Based and Put-Option-Based Trading Strategies (Trading Strategy Factors) –Directional Strategies

Statistics	Sig. Factors	Macro	Sig. Factors	Long	Sig. Factors	Hedge (Long Bias)	Sig. Factors	Short
$N \mid N^+ \mid N^{*+} \mid N^{\#+}$		44 | 31 | 20 | 12		36 | 17 | 5 | 3		155 | 130 | 88 | 67		11 | 9 | 5 | 2
$\mu \mid \mu^+ \mid \mu^{*+} \mid \mu^{\#+}$	α	0.72 | 1.48 | 2.05 | 2.27	α	-0.21 | 1.56 | 4.02 | 5.84	α	1.31 | 1.94 | 2.40 | 2.80	α	0.80 | 1.33 | 1.79 | 3.05
$\iota^+ \mid \iota^{*+} \mid \iota^{\#+}$		1.02 | 1.64 | 2.22		0.59 | 4.30 | 4.71		1.35 | 1.63 | 2.08		1.12 | 1.19 | 3.05
$N\ (N^+)$		9 (5)		13 (0)		70 (68)		8 (1)
$\mu\ (\mu^+)$	$RUSC_d$	0.66 (1.84)	$MEMP_a$	-0.71 (-)	SMB	0.81 (0.85)	SMB	-0.42 (1.06)
ι		0.69		-0.76		0.75		-0.61
$OE\ (\mu \mid \iota)$		2.78 | 2.00		1.08 | 1.00		2.09 | 2.00		2.38 | 2.00
$N\ (N^+)$		9 (8)		10 (0)		42 (12)		7 (1)
$\mu\ (\mu^+)$	SMB	0.41 (0.53)	$SBWC_d$	-3.87 (-)	HML	-0.58 (0.57)	RUS3000	-0.05 (5.69)
ι		0.28		-2.56		-0.50		-0.99
$OE\ (\mu \mid \iota)$		2.89 | 2.00		2.20 | 2.00		2.86 | 2.50		1.00 | 1.00
$N\ (N^+)$		8 (8)		9 (0)		35 (34)		5 (5)
$\mu\ (\mu^+)$	$FRBC_a$	1.17 (1.17)	$LHYP_a$	-2.07 (-)	RUS3000	0.80 (0.83)	HML	0.89 (0.89)
ι		1.03		-2.24		0.79		0.61
$OE\ (\mu \mid \iota)$		1.75 | 1.00		2.44 | 2.00		1.57 | 1.00		2.80 | 3.00
$N\ (N^+)$		8 (7)		7 (1)		35 (2)		2 (1)
$\mu\ (\mu^+)$	MXUS	0.31 (0.43)	$MEMP_o$	-0.24 (1.93)	$RUSP_d$	-1.00 (0.96)	$RUSP_d$	-0.81 (0.31)
ι		0.32		-0.63		-0.92		-0.81
$OE\ (\mu \mid \iota)$		2.13 | 2.00		1.14 | 1.00		1.51 | 1.00		1.00 | 1.00
$N\ (N^+)$		8 (7)		6 (6)		27 (25)		2 (1)
$\mu\ (\mu^+)$	SBG	0.40 (0.99)	MEM	0.99 (0.99)	MXUS	0.54 (0.61)	MXUS	-0.55 (0.18)
ι		0.73		0.72		0.53		-0.55
$OE\ (\mu \mid \iota)$		2.25 | 2.00		1.33 | 1.00		1.93 | 1.00		2.00 | 2.00
	$TR^2\ \mu \mid \iota$	47.59 | 45.69	$TR^2\ \mu \mid \iota$	74.28 | 78.06	$TR^2\ \mu \mid \iota$	64.90 | 66.65	$TR^2\ \mu \mid \iota$	69.64 | 69.36
	$FR^2\ \mu \mid \iota$	32.76 | 30.16	$FR^2\ \mu \mid \iota$	60.77 | 60.18	$FR^2\ \mu \mid \iota$	47.47 | 45.49	$FR^2\ \mu \mid \iota$	55.19 | 52.97
	$LR^2\ \mu \mid \iota$	17.03 | 10.00	$LR^2\ \mu \mid \iota$	16.92 | 6.74	$LR^2\ \mu \mid \iota$	31.72 | 23.06	$LR^2\ \mu \mid \iota$	60.75 | 63.69
	$TSR^2\ \mu \mid \iota$	30.56 | 26.74	$TSR^2\ \mu \mid \iota$	57.36 | 68.24	$TSR^2\ \mu \mid \iota$	33.17 | 31.01	$TSR^2\ \mu \mid \iota$	8.88 | 5.67
	#TS (%TS)	28 (64%)	#TS (%TS)	29 (81%)	#TS (%TS)	82 (53%)	#TS (%TS)	2 (18%)

Table 4. Sub-Period Analysis: Regression results of Individual Hedge Fund Excess Returns on the Excess Returns of the Buy-and-Hold Trading Strategies (Location Factors) and Call-Option-Based and Put-Option-Based Trading Strategies (Trading Strategy Factors)

The tables show the no. of funds in each strategy (N), no. of funds with positive alphas (N^+), no. of funds with positive alphas significantly different from zero (N^{*+}), no. of funds with positive alphas significantly different from an estimated survivorship-bias (SB) figure of 0.3% per month ($N^{\#+}$), average alphas (μ), average of positive alphas (μ^+), average of positive alphas significantly different from zero (μ^{*+}), average of positive alphas significantly different from a SB figure of 0.3% per month ($\mu^{\#+}$), median of positive alphas (ι^+), median of positive alphas significantly different from zero (ι^{*+}), median of positive alphas significantly different from a SB figure of 0.3% per month ($\iota^{\#+}$), mean and median of the total R^2 (TR^2 $\mu\,|\,\iota$), mean & median of R^2 from the first factor (FR^2 $\mu\,|\,\iota$), mean & median of the R^2 from the Location Factors (LR^2 $\mu\,|\,\iota$), mean & median of R^2 from the Trading Strategy Factors (TSR^2 $\mu\,|\,\iota$), the no. of cases where the first significant factor is a Trading Strategy Factor (#TS) and the percentage of funds in each strategy, where the first significant factor is a Trading Strategy Factor (%TS).

Panel A: Sub-Period I: January 1990 to May 1994

Hedge Fund Strategy	N	N^+	N^{*+}	$N^{\#+}$	μ	μ^+	μ^{*+}	$\mu^{\#+}$	ι^+	ι^{*+}	$\iota^{\#+}$	TR^2 $\mu\,|\,\iota$	FR^2 $\mu\,|\,\iota$	LR^2 $\mu\,|\,\iota$	TSR^2 $\mu\,|\,\iota$	#TS (%TS)
Non-Directional																
Event Arbitrage	11	9	3	3	0.23	0.37	0.86	0.65	0.26	0.87	0.87	27 | 25	24 | 25	5 | 0	21 | 19	9 (82%)
Event Driven	21	18	13	6	0.99	1.33	1.56	2.42	1.08	1.19	2.39	43 | 48	34 | 29	12 | 0	31 | 35	16 (76%)
Equity Hedge	65	47	24	19	1.07	1.99	2.80	3.13	1.08	1.81	2.38	51 | 51	39 | 37	23 | 16	28 | 23	35 (54%)
Restructuring	9	9	5	4	0.87	0.87	1.23	1.34	0.97	1.25	1.39	58 | 56	40 | 28	28 | 13	31 | 34	5 (56%)
Fixed Income Arbitrage	4	2	2	2	0.28	0.63	0.63	0.63	0.63	0.63	0.63	73 | 76	55 | 55	6 | 0	67 | 64	4 (100%)
Capital Structure Arbitrage	12	9	4	1	0.38	0.59	0.84	1.21	0.36	0.88	1.21	49 | 38	35 | 34	21 | 13	29 | 22	7 (58%)
Directional																
Macro	20	15	10	11	0.87	1.86	2.62	2.38	0.91	2.71	2.56	58 | 56	45 | 40	26 | 8	32 | 31	13 (65%)
Long	8	6	3	3	0.81	1.74	2.23	2.23	1.50	2.12	2.12	71 | 80	60 | 62	32 | 14	40 | 26	4 (50%)
Hedge (Long Bias)	63	57	35	32	1.42	1.82	2.47	2.61	1.29	1.91	2.02	63 | 69	48 | 48	41 | 44	22 | 15	24 (38%)
Short	5	2	1	1	0.82	3.95	7.65	7.65	3.95	7.65	7.65	70 | 74	53 | 60	43 | 61	27 | 12	1 (20%)

Panel B: Sub-Period II: June 1994 to October 1998

Hedge Fund Strategy	N	N^+	N^{*+}	$N^{\#+}$	μ	μ^+	μ^{*+}	$\mu^{\#+}$	ι^+	ι^{*+}	$\iota^{\#+}$	TR^2 $\mu\,|\,\iota$	FR^2 $\mu\,|\,\iota$	LR^2 $\mu\,|\,\iota$	TSR^2 $\mu\,|\,\iota$	#TS (%TS)
Non-Directional																
Event Arbitrage	21	18	5	0	0.21	0.30	0.39	-	0.27	0.37	-	46 | 44	35 | 34	10 | 8	36 | 38	18 (86%)
Event Driven	45	31	18	9	0.90	1.67	2.32	3.02	0.75	1.04	1.32	58 | 59	43 | 43	21 | 14	37 | 41	31 (69%)
Equity Hedge	170	135	86	75	1.16	1.82	2.46	2.59	1.54	2.13	2.28	58 | 57	42 | 39	28 | 22	29 | 24	85 (50%)
Restructuring	26	10	6	2	-0.56	0.70	1.05	1.70	0.51	0.79	1.70	62 | 55	43 | 37	12 | 9	50 | 49	22 (85%)
Fixed Income Arbitrage	16	6	3	2	-1.30	0.55	0.68	0.88	0.50	0.81	0.88	66 | 71	45 | 44	15 | 4	52 | 55	12 (75%)
Capital Structure Arbitrage	44	32	18	10	0.71	1.37	1.90	2.30	0.55	1.19	1.56	49 | 50	35 | 32	13 | 11	36 | 35	35 (80%)
Directional																
Macro	43	30	12	10	0.47	1.23	2.31	1.97	0.64	2.21	2.21	49 | 49	35 | 30	14 | 7	34 | 33	31 (72%)
Long	37	16	5	2	-0.67	1.21	2.47	4.51	0.70	1.31	4.51	76 | 79	62 | 61	19 | 8	57 | 69	30 (81%)
Hedge (Long Bias)	146	120	67	47	1.22	1.84	2.53	3.13	1.31	1.79	2.56	69 | 72	51 | 51	35 | 25	34 | 33	75 (51%)
Short	11	8	4	2	0.53	1.40	2.10	3.05	1.16	1.23	3.05	73 | 76	59 | 59	62 | 63	11 | 10	2 (18%)

Table 5. Summary Statistics of Alphas in the regressions of Individual Hedge Fund Excess Returns on the Excess Returns of the Location Factors and Trading Strategy Factors

This table shows the summary statistics of the alphas for each strategy in the stepwise regression of the excess returns of the individual hedge funds on the excess returns of the Trading Strategy Factors and the Location Factors during the entire sample period from January 1990 to October 1998 (Full), the first sub-period from January 1990 to May 1994 (Sub 1) and the second sub-period from June 1994 to October 1998 (Sub 2). We report various statistics of alphas including the number of funds in each strategy for different time periods (N), the percentage of cases of positive alphas in each strategy (α^+), the percentage of cases of negative alphas in each strategy (α^-), the percentage of cases of positive alphas significantly different from zero in each strategy (α^{*+}), the percentage of cases of negative alphas significantly different from zero in each strategy (α^{*-}), the percentage of cases of positive alphas significantly different from a survivorship-bias (SB) figure of 0.3% per month in each strategy ($\alpha^{\#+}$) and the percentage of cases of negative alphas significantly different from a SB figure of 0.3% per month in each strategy ($\alpha^{\#-}$).

Hedge Fund Strategy	Period	N	α^+	α^-	α^{*+}	α^{*-}	$\alpha^{\#+}$	$\alpha^{\#-}$
Event Arbitrage	Full	22	82	18	45	0	9	9
	Sub 1	11	82	18	27	0	27	9
	Sub 2	21	86	14	24	0	0	5
Event Driven	Full	48	77	23	52	8	38	15
	Sub 1	21	86	14	62	10	29	10
	Sub 2	45	69	31	40	4	20	16
Equity Hedge	Full	179	83	17	55	4	47	6
	Sub 1	65	72	28	37	8	29	9
	Sub 2	170	79	21	51	5	44	6
Restructuring	Full	26	50	50	27	38	15	46
	Sub 1	9	100	0	56	0	44	0
	Sub 2	26	38	62	23	46	8	50
Fixed Income Arbitrage	Full	17	47	53	24	47	18	53
	Sub 1	4	50	50	50	0	50	50
	Sub 2	16	38	63	19	63	13	63
Capital Structure Arbitrage	Full	46	78	22	48	9	26	15
	Sub 1	12	75	25	33	8	8	17
	Sub 2	44	73	27	41	11	23	23
Non-Directional	Full	338	77	23	49	10	36	14
	Sub 1	122	77	23	42	7	29	11
	Sub 2	322	72	28	42	11	30	16
Macro	Full	44	70	30	45	9	27	9
	Sub 1	20	75	25	50	15	55	25
	Sub 2	43	70	30	28	7	23	9
Long	Full	36	47	53	14	19	8	28
	Sub 1	8	75	25	38	13	38	13
	Sub 2	37	43	57	14	24	5	32
Hedge (Long Bias)	Full	155	84	16	57	5	43	7
	Sub 1	63	90	10	56	3	51	5
	Sub 2	146	82	18	46	5	32	8
Short	Full	11	82	18	45	9	18	9
	Sub 1	5	40	60	20	20	20	20
	Sub 2	11	73	27	36	9	18	18
Directional	Full	246	76	24	48	8	34	11
	Sub 1	96	83	17	51	7	49	10
	Sub 2	237	73	27	37	9	26	13
Overall	Full	584	77	23	49	9	35	13
	Sub 1	218	80	20	46	7	38	11
	Sub 2	559	73	27	40	10	28	14

Table 6. Levered Vs Unlevered Funds: Summary Statistics of Alphas in the regressions of Individual Hedge Fund Excess Returns on the Excess Returns of the Buy-and-Hold Trading Strategies (Location Factors) and the Option-Based Trading Strategies (Trading Strategy Factors)

This table shows the summary statistics of the alphas for the levered and the unlevered funds for each strategy in the stepwise regression of the excess returns of the individual hedge funds following different strategies on the excess returns of the Trading Strategy Factors and the Location Factors during the entire sample period from January 1990 to October 1998 (Panel A), first sub-period from January 1990 to May 1994 (Panel B) and the second sub-period from June 1994 to October 1998 (Panel C). We report various statistics of alphas including the total no. of cases in each strategy (No.), average alpha for each strategy (μ), median alpha for each strategy (ι), total no. of positive cases in each strategy (N^+), total no. of negative cases in each strategy (N^-), average of positive alphas in each strategy (μ^+) and average of negative alphas in each strategy (μ^-).

Hedge Fund Strategy	Leverage	Panel A: Full Sample Period (January 1990 to October 1998)							Panel B: First Sub-Period (January 1990 to May 1994)							Panel C: Second Sub-Period (June 1994 to October 1998)						
		No.	μ	ι	N^+	N^-	μ^+	μ^-	No.	μ	ι	N^+	N^-	μ^+	μ^-	No.	μ	ι	N^+	N^-	μ^+	μ^-
Non-Directional																						
Event Arbitrage	Yes	20	0.26	0.23	17	3	0.37	-0.35	11	0.23	0.09	9	2	0.37	-0.41	19	0.23	0.23	17	2	0.31	-0.43
	No	2	0.07	0.07	1	1	0.30	-0.17	0	-	-	0	0	-	-	2	0.07	0.07	1	1	0.30	-0.17
Event Driven	Yes	40	1.07	0.47	29	11	1.86	-1.01	18	0.98	1.04	16	2	1.30	-1.56	38	0.86	0.36	25	13	1.73	-0.82
	No	8	0.84	0.69	8	0	0.84	-	3	1.05	0.79	2	1	1.61	-0.08	7	1.11	0.69	6	1	1.44	-0.89
Equity Hedge	Yes	137	1.04	1.15	112	25	1.79	-2.31	52	0.71	0.51	36	16	1.68	-1.46	133	1.14	1.20	104	29	1.89	-1.55
	No	42	1.70	1.65	37	5	1.99	-0.40	13	2.50	1.55	11	2	3.01	-0.25	37	1.22	1.29	31	6	1.57	-0.62
Restructuring	Yes	16	0.07	0.17	10	6	1.00	-1.47	5	0.87	0.77	5	0	0.87	-	16	-0.37	-0.17	7	9	0.85	-1.31
	No	10	-0.78	-0.66	3	7	0.59	-1.36	4	0.86	1.03	4	0	0.86	-	10	-0.87	-0.76	3	7	0.36	-1.39
Fixed Income Arbitrage	Yes	11	-1.95	-1.31	3	8	0.25	-2.77	2	0.63	0.63	2	0	0.63	-	10	-2.21	-1.77	2	8	0.31	-2.84
	No	6	0.54	0.73	5	1	0.70	-0.23	2	-0.06	-0.06	0	2	-	-0.06	6	0.23	0.46	4	2	0.67	-0.65
Capital Structure Arbitrage	Yes	38	0.76	0.38	29	9	1.14	-0.47	9	0.47	0.32	7	2	0.64	-0.14	36	0.60	0.36	27	9	1.16	-1.09
	No	8	0.31	0.22	7	1	0.37	-0.10	3	0.13	0.31	2	1	0.43	-0.48	8	1.20	0.15	5	3	2.49	-0.95
Directional																						
Macro	Yes	30	0.66	0.48	21	9	1.36	-0.97	13	0.72	0.64	8	5	2.48	-2.08	30	0.39	0.39	23	7	0.96	-1.49
	No	14	0.85	0.38	10	4	1.74	-1.39	7	1.15	0.67	7	0	1.15	-	13	0.65	0.10	7	6	2.11	-1.06
Long	Yes	23	-0.01	0.10	12	11	1.64	-1.80	7	0.40	0.85	5	2	1.35	-1.98	24	-0.83	-0.41	10	14	1.16	-2.25
	No	13	-0.58	-0.52	5	8	1.36	-1.79	1	3.69	3.69	1	0	3.69	-	13	-0.36	-0.42	6	7	1.29	-1.78
Hedge (Long Bias)	Yes	91	1.47	1.29	77	14	2.02	-1.53	35	1.35	1.48	32	3	1.79	-3.37	86	1.31	1.09	71	15	1.86	-1.26
	No	64	1.09	1.07	53	11	1.83	-2.47	28	1.51	0.98	25	3	1.87	-1.52	60	1.08	0.89	49	11	1.82	-2.23
Short	Yes	8	0.27	0.86	6	2	0.89	-1.58	4	1.80	0.09	2	2	3.95	-0.36	8	0.17	0.73	6	2	0.85	-1.89
	No	3	2.21	1.26	3	0	2.21	-	1	-3.07	-3.07	0	1	-	-3.07	3	1.51	1.26	2	1	3.05	-1.57
Overall Summary	*Yes*	*414*	*0.86*	*-*	*316*	*98*	*1.62*	*-1.62*	*156*	*0.86*	*-*	*122*	*34*	*1.53*	*-1.55*	*400*	*0.72*	*-*	*292*	*108*	*1.55*	*-1.53*
	No	*170*	*0.92*	*-*	*132*	*38*	*1.64*	*-1.55*	*62*	*1.46*	*-*	*52*	*10*	*1.91*	*-0.88*	*159*	*0.81*	*-*	*114*	*45*	*1.68*	*-1.41*

Table 7. Levered Vs Unlevered Funds: Summary Statistics of Information ratios in the regressions of Individual Hedge Fund Excess Returns on the Excess Returns of the Buy-and-Hold Trading Strategies (Location Factors) and the Option-Based Trading Strategies (Trading Strategy Factors)

This table shows the summary statistics of the information ratios for the levered and the unlevered funds for each strategy in the stepwise regression of the excess returns of the individual hedge funds on the excess returns of the Trading Strategy Factors, and the Location Factors during the entire sample period from January 1990 to October 1998 (Panel A), the first sub-period from January 1990 to May 1994 (Panel B) and the second sub-period from June 1994 to October 1998 (Panel C). We report various statistics of information ratios including the total number of cases in each strategy (No.), average information ratio for each strategy (μ), median information ratio for each strategy (ι), total number of positive cases in each strategy (N^+), total number of negative cases in each strategy (N^-), average of positive information ratios in each strategy (μ^+) and average of negative information ratios in each strategy (μ^-).

Hedge Fund Strategy	Leverage	Panel A: Full Sample Period (January 1990 to October 1998)							Panel B: First Sub-Period (January 1990 to May 1994)							Panel C: Second Sub-Period (June 1994 to October 1998)						
		No.	μ	ι	N^+	N^-	μ^+	μ^-	No.	μ	ι	N^+	N^-	μ^+	μ^-	No.	μ	ι	N^+	N^-	μ^+	μ^-
Non-Directional																						
Event Arbitrage	Yes	20	0.14	0.15	17	3	0.19	-0.11	11	0.14	0.07	9	2	0.21	-0.16	19	0.18	0.15	17	2	0.22	-0.17
	No	2	0.13	0.13	1	1	0.29	-0.04	0	-	-	0	0	-	-	2	0.18	0.18	1	1	0.42	-0.06
Event Driven	Yes	40	0.19	0.19	29	11	0.33	-0.16	18	0.29	0.35	16	2	0.40	-0.54	38	0.17	0.17	25	13	0.36	-0.19
	No	8	0.32	0.27	8	0	0.32	-	3	0.53	0.33	2	1	0.81	-0.05	7	0.28	0.26	6	1	0.35	-0.14
Equity Hedge	Yes	137	0.20	0.23	112	25	0.28	-0.15	52	-0.24	0.13	36	16	0.32	-1.51	133	0.25	0.25	104	29	0.37	-0.17
	No	42	0.28	0.27	37	5	0.33	-0.06	13	0.40	0.31	11	2	0.49	-0.06	37	0.39	0.42	31	6	0.49	-0.16
Restructuring	Yes	16	0.00	0.07	10	6	0.22	-0.37	5	0.35	0.35	5	0	0.35	-	16	-0.10	-0.07	7	9	0.35	-0.45
	No	10	-0.17	-0.25	3	7	0.19	-0.33	4	0.30	0.34	4	0	0.30	-	10	-0.75	-0.60	3	7	0.19	-0.16
Fixed Income Arbitrage	Yes	11	-0.29	-0.37	3	8	0.12	-0.44	2	0.97	0.97	2	0	0.97	-	10	-0.48	-0.55	2	8	0.15	-0.63
	No	6	0.35	0.26	5	1	0.45	-0.15	2	-0.07	-0.07	0	2	-	-0.07	6	0.31	0.32	4	2	0.74	-0.54
Capital Structure Arbitrage	Yes	38	0.18	0.19	29	9	0.29	-0.18	9	0.15	0.16	7	2	0.21	-0.08	36	0.23	0.21	27	9	0.39	-0.26
	No	8	0.26	0.25	7	1	0.31	-0.06	3	0.14	0.35	2	1	0.40	-0.38	8	0.18	0.21	5	3	0.39	-0.17
Directional																						
Macro	Yes	30	0.16	0.13	21	9	0.28	-0.11	13	0.25	0.19	8	5	0.61	-0.31	30	0.17	0.12	23	7	0.27	-0.14
	No	14	0.16	0.20	10	4	0.33	-0.25	7	0.44	0.53	7	0	0.44	-	13	0.07	0.06	7	6	0.37	-0.27
Long	Yes	23	-0.17	0.01	12	11	0.13	-0.49	7	0.23	0.18	5	2	0.45	-0.33	24	-0.33	-0.11	10	14	0.18	-0.70
	No	13	-0.06	-0.09	5	8	0.16	-0.20	1	0.59	0.59	1	0	0.59	-	13	-0.05	-0.08	6	7	0.25	-0.30
Hedge (Long Bias)	Yes	91	0.22	0.23	77	14	0.29	-0.16	35	0.32	0.36	32	3	0.37	-0.18	86	0.25	0.25	71	15	0.35	-0.23
	No	64	0.22	0.24	53	11	0.30	-0.16	28	0.33	0.28	25	3	0.39	-0.19	60	0.32	0.29	49	11	0.44	-0.23
Short	Yes	8	0.07	0.12	6	2	0.14	-0.14	4	0.06	0.02	2	2	0.20	-0.08	8	0.09	0.12	6	2	0.18	-0.20
	No	3	0.28	0.27	3	0	0.28	-	1	-0.60	-0.60	0	1	-	-0.60	3	0.20	0.39	2	1	0.45	-0.30
Overall Summary	*Yes*	*414*	*0.15*	*-*	*316*	*98*	*0.27*	*-0.22*	*156*	*0.10*	*-*	*122*	*34*	*0.36*	*-0.84*	*400*	*0.16*	*-*	*292*	*108*	*0.34*	*-0.31*
	No	*170*	*0.20*	*-*	*132*	*38*	*0.31*	*-0.19*	*62*	*0.33*	*-*	*52*	*10*	*0.43*	*-0.19*	*159*	*0.20*	*-*	*114*	*45*	*0.44*	*-0.23*

Table 8: T-test of difference of average Alphas and Information Ratios of Levered and Unlevered Funds

This table shows the results of the t-test for the difference between the average alphas and information ratios of the levered and the unlevered funds for the entire sample period (Full), first sub-period (Sub 1) and the second sub-period (Sub 2). We report the no. of levered and unlevered funds, t-statistic (t-stat), p-value (1-tailed) (p-val(1)) and p-value (2-tailed) (p-val (2)) assuming equal and unequal variances. The figures in bold and italic indicate significance at 5% and 10% level respectively.

Hedge Fund Strategy	Period	No. of Levered Funds	No. of Unlevered Funds	Assuming equal variances						Assuming unequal variances					
				Alphas			Information Ratios			Alphas			Information Ratios		
				t-stat	p-val (1)	p-val (2)	t-stat	p-val (1)	p-val (2)	t-stat	p-val (1)	p-val (2)	t-stat	p-val (1)	p-val (2)
Non-Directional															
Event Arbitrage	Full	20	2	0.65	0.26	0.52	0.13	0.45	0.90	0.78	0.29	0.58	0.10	0.47	0.94
	Sub 1	11	0	-	-	-	-	-	-	-	-	-	-	-	-
	Sub 2	19	2	0.62	0.27	0.54	-0.04	0.49	0.97	0.66	0.32	0.63	-0.02	0.49	0.99
Event Driven	Full	40	8	0.30	0.38	0.77	-1.20	0.12	0.24	0.56	0.29	0.58	-1.23	0.12	0.25
	Sub 1	18	3	-0.08	0.47	0.93	-0.91	0.19	0.37	-0.08	0.47	0.94	-0.57	0.31	0.62
	Sub 2	38	7	-0.26	0.40	0.80	-0.80	0.21	0.43	-0.31	0.38	0.77	-0.96	0.18	0.36
Equity Hedge	Full	137	42	-1.66	**0.05**	*0.10*	-1.86	**0.03**	*0.06*	-2.12	**0.02**	**0.04**	-1.84	**0.04**	*0.07*
	Sub 1	52	13	-2.36	**0.01**	**0.02**	-0.78	0.22	0.44	-2.32	**0.02**	**0.03**	-1.53	*0.07*	0.13
	Sub 2	133	37	-0.19	0.42	0.85	-2.01	**0.02**	**0.05**	-0.26	0.40	0.80	-1.71	**0.05**	*0.09*
Restructuring	Full	16	10	1.21	0.12	0.24	1.34	*0.10*	0.19	1.31	*0.10*	0.20	1.40	*0.09*	0.18
	Sub 1	5	4	0.03	0.49	0.98	0.33	0.37	0.75	0.03	0.49	0.98	0.34	0.37	0.74
	Sub 2	16	10	0.81	0.21	0.42	2.21	**0.02**	**0.04**	0.87	0.20	0.40	1.91	**0.04**	*0.08*
Fixed Income Arbitrage	Full	11	6	-2.52	**0.01**	**0.02**	-3.58	**0.00**	**0.00**	-3.39	**0.00**	**0.01**	-3.15	**0.01**	**0.02**
	Sub 1	2	2	9.34	**0.01**	**0.01**	6.95	**0.01**	**0.02**	9.34	**0.03**	*0.07*	6.95	**0.05**	*0.09*
	Sub 2	10	6	-2.42	**0.01**	**0.03**	-2.63	**0.01**	**0.02**	-3.03	**0.01**	**0.01**	-2.20	**0.03**	*0.07*
Capital Structure Arbitrage	Full	38	8	0.82	0.21	0.42	-0.80	0.21	0.43	1.58	*0.06*	0.12	-0.86	0.21	0.41
	Sub 1	9	3	0.88	0.20	0.40	0.05	0.48	0.96	0.92	0.21	0.41	0.04	0.49	0.97
	Sub 2	36	8	-0.73	0.24	0.47	0.36	0.36	0.72	-0.55	0.30	0.60	0.37	0.36	0.72
Directional															
Macro	Full	30	18	-0.29	0.39	0.77	-0.02	0.49	0.98	-0.25	0.40	0.80	-0.02	0.49	0.99
	Sub 1	13	7	-0.38	0.35	0.71	-0.77	0.23	0.45	-0.45	0.33	0.66	-0.86	0.20	0.40
	Sub 2	30	13	-0.42	0.34	0.68	0.97	0.17	0.34	-0.33	0.37	0.74	0.82	0.21	0.42
Long	Full	23	13	0.67	0.25	0.51	-0.58	0.28	0.57	0.71	0.24	0.48	-0.72	0.24	0.48
	Sub 1	7	1	-1.61	*0.08*	0.16	-0.64	0.27	0.55	-1.61	-	-	-0.46	-	-
	Sub 2	24	13	-0.60	0.27	0.55	-1.02	0.16	0.31	-0.62	0.27	0.54	-1.29	*0.10*	0.21
Hedge (Long Bias)	Full	91	64	1.03	0.15	0.30	0.10	0.46	0.92	1.01	0.16	0.31	0.11	0.46	0.91
	Sub 1	35	28	-0.28	0.39	0.78	-0.11	0.46	0.92	-0.28	0.39	0.78	-0.10	0.46	0.92
	Sub 2	86	60	0.63	0.26	0.53	-1.12	0.13	0.27	0.62	0.27	0.54	-1.08	0.14	0.28
Short	Full	8	3	-1.73	*0.06*	0.12	-2.21	**0.03**	**0.05**	-1.36	0.13	0.27	-3.07	**0.01**	**0.02**
	Sub 1	4	1	1.11	0.17	0.35	3.03	**0.03**	*0.06*	-	-	-	-	-	-
	Sub 2	8	3	-0.96	0.18	0.36	-0.59	0.28	0.57	-0.69	0.28	0.56	-0.43	0.35	0.71

Table 9: Two-sample Wilcoxon rank-sum (Mann-Whitney) Test of Alphas and Information Ratios of funds using leverage and funds not using leverage

This table shows the results of the two-sample Wilcoxon rank-sum (Mann-Whitney) test to test whether the sample of levered and unlevered alphas and information ratios are from the populations with the same distribution for the entire sample period (Full), first sub-period (Sub 1) and the second sub-period (Sub 2). We report the no. of levered and unlevered funds, z-statistic (z-stat) and p-value (prob>|z|) for both the alphas and the information ratios. The figures in bold and italic indicate significance at 5% and 10% level respectively.

Hedge Fund Strategy	Period	No. of Levered Funds	No. of Unlevered Funds	Two-sample Wilcoxon rank-sum (Mann-Whitney) test			
				Alphas		Information Ratios	
				z-stat	Prob > |z|	z-stat	Prob > |z|
Non-Directional							
Event Arbitrage	Full	20	2	0.63	0.53	0.00	1.00
	Sub 1	11	0	-	-	-	-
	Sub 2	19	2	0.54	0.59	0.12	0.91
Event Driven	Full	40	8	-0.58	0.56	-0.90	0.37
	Sub 1	18	3	0.10	0.92	-0.15	0.88
	Sub 2	38	7	-0.94	0.35	-1.00	0.32
Equity Hedge	Full	137	42	-1.52	0.13	-1.56	0.12
	Sub 1	52	13	-2.18	**0.03**	-2.21	**0.03**
	Sub 2	133	37	-0.10	0.92	-1.54	0.12
Restructuring	Full	16	10	1.56	0.12	1.58	0.11
	Sub 1	5	4	0.25	0.81	0.37	0.71
	Sub 2	16	10	1.19	0.24	1.79	*0.07*
Fixed Income Arbitrage	Full	11	6	-2.87	**0.00**	-2.81	**0.01**
	Sub 1	2	2	1.55	0.12	1.55	0.12
	Sub 2	10	6	-2.33	**0.02**	-2.06	**0.04**
Capital Structure Arbitrage	Full	38	8	0.77	0.44	-0.67	0.51
	Sub 1	9	3	0.65	0.52	-0.46	0.64
	Sub 2	36	8	0.15	0.88	0.44	0.66
Directional							
Macro	Full	30	18	0.11	0.91	-0.27	0.79
	Sub 1	13	7	-0.36	0.72	-0.99	0.32
	Sub 2	30	13	0.81	0.42	0.75	0.45
Long	Full	23	13	0.68	0.50	0.54	0.59
	Sub 1	7	1	-1.53	0.13	-0.66	0.51
	Sub 2	24	13	-0.41	0.68	-0.54	0.59
Hedge (Long Bias)	Full	91	64	0.76	0.45	-0.26	0.80
	Sub 1	35	28	0.71	0.48	0.01	1.00
	Sub 2	86	60	0.01	0.99	-1.44	0.15
Short	Full	8	3	-1.23	0.22	-2.25	**0.02**
	Sub 1	4	1	1.41	0.16	1.41	0.16
	Sub 2	8	3	-0.82	0.41	-1.02	0.31

Figure 1: Payoffs from buying Call and Put Options on an asset

Admissible Trading Strategies
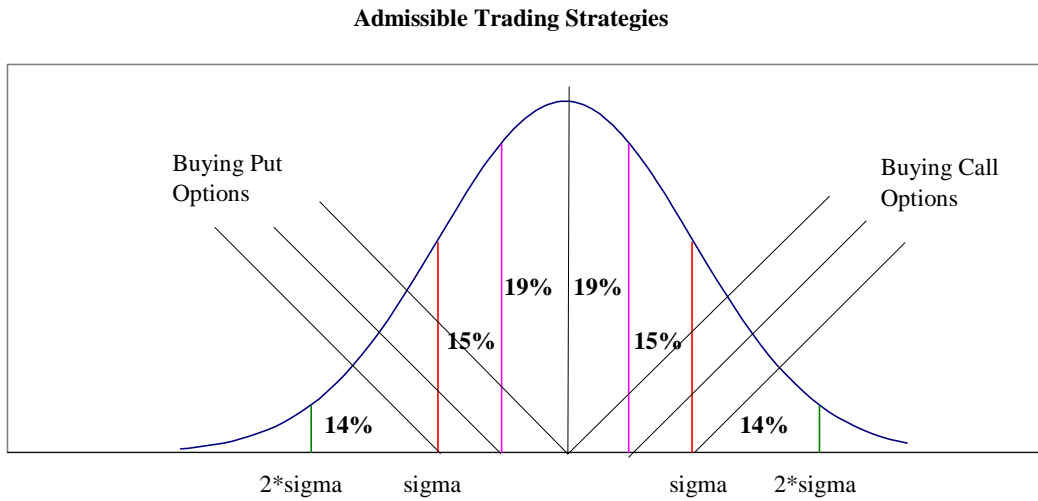
The figures in percentages have been rounded to whole numbers for illustration purpose.