Generalised Style Analysis of Hedge Funds

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Abstract

This paper attempts to shed light on the 'black-box' called hedge funds via style analysis technique developed by Sharpe (1992). The conventional style analysis cannot be directly applied to hedge funds as it imposes two constraints: first, the style weights have to be non-negative and second, they have to add up to a hundred percent. In addition, the conventional style analysis does not provide any information about the statistical significance of the style weights. In this paper, we conduct a *generalised* style analysis of various hedge fund strategies by relaxing the constraints of the conventional style analysis, and examine the significance of style weights, *a la* Lobosco and DiBartolomeo (1997). We find that the generalised style analysis approach is more robust for estimating the risk exposures of hedge funds that take short positions in various asset classes and typically hold significant part of their portfolio in cash.

Generalised Style Analysis of Hedge Funds

I. Introduction

The summer of 1998 will be remembered for the Russian debt default that triggered the major correction of all stock markets in the world. It will also be remembered for the (near) bankruptcy of Long Term Capital Management, liquidation of several hedge funds and reporting of major losses by several banks arising out of their dealings with hedge funds. Interestingly, although hedge fund is almost a trillion-dollar industry today, there is little awareness of the true risk exposures of hedge funds. This is partly due to less stringent disclosure requirements and partly due to the freedom granted to the manager about investment strategy. As a result, hedge funds have largely remained a 'black-box' to outside investors. This paper attempts to shed light on this black-box by conducting a generalised style analysis of hedge funds.

Style analysis plays a key role in inferring the risk exposures of fund managers. This helps in classifying them and determining an appropriate benchmark for evaluating their performance. Style analysis can be performed using data on holdings of the manager [e.g., Chan, Chen and Lakonishok (1999)] or using data on returns achieved by the fund manager [e.g., Sharpe (1992)]. Traditionally, it has been used for classifying and evaluating the performance of mutual funds [e.g., Brown and Goetzmann (1997)]. Unfortunately, due to less stringent disclosure requirements, especially in the case of offshore hedge funds, it is difficult to obtain data on holdings of hedge funds. Even if one were to obtain holdings data for hedge funds on a monthly or a quarterly basis, it would not provide a good picture of their risks due to the dynamic nature of their trading strategies [e.g., Fung and Hsieh

(1997)]. Therefore, the only recourse one has is to conduct a returns-based style analysis to understand average style exposures of different hedge fund strategies. Although one does not expect the high R-squares Sharpe (1992) obtains in case of mutual funds, some information on risk exposures of hedge funds is better than no information at all.

It is important to note that the returns-based style analysis used by Sharpe (1992) cannot be applied to hedge funds in its conventional form. This is because Sharpe constrains the style weights to be non-negative and forces them to add up to a hundred percent. This makes perfect sense in case of mutual funds. However, most hedge fund strategies take short positions in different asset classes and hold the collateral in the form of cash (money market instruments). Thus, the style analysis can not be applied to hedge funds in its conventional form. Therefore, we generalise the conventional style analysis in two ways: first, we allow the style weights of assets in which one can take a short position to be positive or negative, and second, we relax the constraint that the style weights have to add up to a hundred percent.

In addition, the conventional style analysis does not distinguish significant style weights from the insignificant ones. This can pose a problem while inferring significant risk exposures of different hedge fund strategies. Therefore, we follow the two-step procedure proposed by Lobosco and DiBartolomeo (1997) and compute the confidence intervals associated with the style weights. When we find an insignificant style weight, we drop that index and recompute the style weights and their revised standard errors. We repeat this procedure until we are left only with indices having significant style weights. In order to understand the

importance of this approach, we report results obtained with and without using this procedure.

We use the database of indices compiled by Hedge Fund Research (HFR) to style analyse the different hedge fund strategies. HFR data set provides information about hedge funds both living and dead, and is known to have lower attrition rate compared to other databases such as TASS (see Liang (2000)). The lower attrition rate in HFR suggests that it includes fewer number of funds that fail as compared to other databases. This potentially exacerbates survivorship bias related problem in studies that employ HFR database. It is extremely difficult to completely eliminate the problem of survivorship bias in hedge fund databases as information reporting is at the discretion of the managers and collectively all the databases do not cover the entire universe of hedge funds. This potentially is a problem in studies that focus on persistence in the performance of hedge fund managers (Brown, Goetzmann and Ibbotson (1999) and Agarwal and Naik (2000a)). Fortunately, this issue less affects studies focusing on style analysis of hedge funds as these involve estimation of style weights over a relatively long period. Since funds that go belly up exhibit returns similar to those that survive until a few months before their death, and since the style-based return regression is based typically on 36 to 48 monthly observations, arguably the effect of exclusion of funds that did not survive becomes relatively small.

We segregate hedge fund strategies in two categories: funds that take directional bets and funds that take relative value bets (non-directional). This distinction is important, as researchers have found that these two categories exhibit very different risk-return tradeoffs

(see, e.g., Agarwal and Naik (2000b)). In addition, these two categories potentially have very different applications: the directional strategies helping one achieve the desired asset allocation while the non-directional strategies enabling one to profit from security selection.

We examine monthly returns of eight popular hedge fund strategies: four of these are non-directional while four are directional[1]. The non-directional strategies are designed to exploit short term market inefficiencies while hedging out as much of the market exposure as possible. We select Event Driven, Equity Hedge, Restructuring, and Capital Structure Arbitrage strategies from this category. In contrast, the directional strategies are designed to benefit from broad market movements. We select Macro, Long, Hedge (Long Bias) and Short strategies from this category. We capture the returns on these eight strategies through the corresponding HFR indices, which are equally weighted performance summary of funds from the HFR database. It is important to note that equal weighting of returns of hedge funds gives more weight to the smaller funds that may be better positioned to exploit opportunities with only limited liquidity. This can artificially boost the performance of hedge funds which is a problem in studies on benchmarking of hedge funds. It affects our work to the extent that the inferred style exposures represent the risk exposures of smaller funds to a greater extent as compared to those of the larger funds.

Our sample period runs from January 1994 to September 1998, a period that covers market up and downturns and times of high and low volatility. In order to obtain a general idea of how the performance of different hedge fund strategies in good and bad times, we

[1] For definitions of the various strategies, please refer to the Glossary at the end of this article.

report the returns on the eight different hedge fund strategies during seven large up moves and seven large down moves of the S&P500 composite index over the sample period (see Table I). On average, we find that none of the non-directional strategies are truly "market-neutral". They gain less than the S&P 500 index during market up-moves but they also loose less than the S&P 500 index during market down-moves. Among the different non-directional strategies, Equity Hedge and Event Driven strategies deliver higher returns during the good times relative to the rest. However, these strategies also loose more money during the bad times. This suggests that the so-called non-directional strategies differ in terms of the extent of their market neutrality, Equity Hedge being least market neutral. In contrast, the directional strategies tend to move with the market, performing significantly better than the non-directional ones during market upturns and significantly worse during market downturns. The only exception being the Short strategy which moves in direction opposite to that of the market.

II. Risk-Return Characteristics of Hedge Fund Strategies

Table II reports the summary statistics for the eight HFR indices. In general, it appears that the non-directional strategies perform better than the directional ones based on various risk-return characteristics. For example, during the sample period, the average return on the non-directional strategies was 1.03% per month, which is almost 50% higher than that on the directional strategies (0.71% per month). On different measures of variability of returns, again the non-directional strategies exhibit lower variability. The non-directional strategies have a standard deviation of about 1.8% per month while those of directional strategies

equals 4.2% per month. We also measure variability by downside deviation (s_{DD}) using the Eurodollar rate as the target rate[2]. We define downside deviation s_{DD} as:

$$s_{DD} = \frac{\sum_{i=1}^{m} excess - return_i^2}{m+1} \quad for\ i = 1,2,3,.....,m, \qquad \textbf{(1)}$$

where m represents the total number of months, t_i is the target rate for month i, and r_i is the return for a fund in month i and *excess-return* in month i equals $t_i - r_i$ when $t_i - r_i$ is positive and zero otherwise.

When we look at the downside deviation, we find that, similar to the standard deviation, the downside deviation is also lower for the non-directional strategies (0.5% per month) compared to that for the directional ones (1.9% per month). When we examine the proportion of times these strategies exhibited positive and negative returns, we find that the non-directional strategies show more positive returns (79%) than the directional ones (60%). In terms of Sharpe ratio as well, the non-directional strategies exhibit better risk-return tradeoffs compared to the directional ones[3]. For instance, the non-directional strategies exhibit an average realised Sharpe ratio of 0.3 that is three times that for the directional ones and almost equals that of the S&P500 composite index. Thus, overall the non-directional strategies seem to have delivered better risk-return tradeoff compared to the directional strategies across a wide range of risk-return metrics during the January 94 to September 98 period.

[2] Unlike the variance measure that equally penalises the good and the bad realisations, the downside deviation measure focuses only on return realisations below a target rate.

[3] Due to non-normality of returns, Sharpe ratio needs to be interpreted with caution. Bernardo and Ledoit (2000) propose Gain-Loss ratio as an alternative metric. Agarwal and Naik (2000c) find that the

Having examined the risk-return characteristics of the various hedge fund strategies, we proceed with our generalised version of Sharpe's (1992) style analysis.

III. Generalised Style Analysis of the Hedge Fund Strategies

The conventional returns-based Sharpe's (1992) style analysis involves running the following regression:

$$R_t = \sum_{k=1}^{K} w_k F_{kt} + e_t \qquad \textbf{(2)}$$

where, R_t = Return on the HFR index for a particular strategy for period t,

F_{kt} = return on k^{th} asset class index for period t, (k=1,.....,8)

w_k = style weights where $\sum_{k=1}^{K} w_k = 1$, and e_t = error term.

The conventional style analysis attempts to minimise the variance of the error term subject to the constraints that all the style weights are non-negative and add to one, i.e. a hundred percent. The R-square of such a regression indicates the proportion of the variance of returns attributable to manager style, the balance being attributable to manager judgement.

The genesis of non-negative style weights lies in the use of style analysis to understand risk exposure of conventional mutual funds that typically take only long positions. Since some of the hedge funds use shorting techniques to exploit arbitrage opportunities, one

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non-directional hedge funds also exhibit higher Gain-Loss ratios compared to the directional ones.

needs to specifically allow for non-negative style weights. For instance, the hedge fund managers can easily take short positions in S&P 500, US Government Bonds, Currencies etc. through futures contracts. Hence, we allow such indices to have negative style weights. Further to account for the fact that hedge funds can hold significant proportion of their portfolio in cash, we relax the constraint that the style weights have to add up to a hundred percent and compare and contrast the findings to understand the severity of this constraint.

Since the hedge funds can invest in a broad range of asset classes across the world, we use global indices covering equities, bonds, currencies and commodities as asset class indices in the style regression described in equation (2). To incorporate the exposure to global equities, we include the S&P 500 composite index, the MSCI world index excluding the US (developed markets besides the US), and the MSCI emerging markets index. To assess exposure to bonds, we use the Salomon Brothers (henceforth, SB) Government and Corporate Bond index, and the SB World Government Bond index[4]. We also include Lehman High Yield composite index to incorporate returns available from investing in distressed securities. To account for returns arising from exposure to currencies and commodities, we include the Federal Reserve Trade-Weighted Dollar index and UK gold price index (see Table III).

We report the results of the generalised style analysis while constraining the style weights to add up to a hundred percent in Panel A of Table IV. We find that six of the eight hedge

[4] We also use JP Morgan US government bond and JP Morgan non-US government bond indices used by Fung & Hsieh (1997) and find qualitatively similar results (not reported).

fund strategies show non-zero style weights on all eight indices. The remaining two strategies show non-zero style weights on six indices. As hedge funds invest in a broad range of asset classes, it is not surprising to observe non-zero style weights on a large number of indices. However, non-zero style weights on all eight indices provide a fuzzy picture of the significant style exposures of different hedge fund strategies.

One potential problem with the conventional style analysis is that it fails to distinguish significant style weights from insignificant ones. We therefore employ the two-step procedure proposed by Lobosco and DiBartolomeo (1997) to determine the statistical significance of style weights. First, we calculate the standard deviations of the returns for each of the eight hedge fund strategies left unexplained by the eight indices. Second, we conduct style analysis of each of the eight indices using the remaining seven indices as explanatory variables. The objective here is to obtain the standard deviation of the residuals from style analysis of each index relative to the remaining seven indices.

Lobosco and DiBartolomeo (1997) show that the standard error of the style weight on index i is given by $\frac{s_a}{s_i\sqrt{N-k-1}}$, where s_a is the standard deviation of the residuals from style analysis of hedge fund strategy a using the eight indices, s_i is the standard deviation of the residuals from the style analysis of the index i relative to the remaining seven indices, N equals the number of observations in the time series of returns (e.g., 57 months for the full sample period) and k denotes the number of indices with non-zero style weights.

We determine the statistical significance of the style weights (reported in panel A of Table IV) by estimating their standard errors and report the same in panel B of Table IV. As can be seen, although some of the style weights are non-zero, they are not significantly different from zero at the 5% level. For example, the Long strategy shows a style weight of -61% on Salomon Brothers Government and Corporate bond index which seems large and may lead one to conclude that these strategies involve taking large short positions in US government and corporate bonds. However, when compared with the standard error, we find that this weight is not statistically different from zero. To overcome this kind of problem, we drop those indices that exhibit style weights that are insignificant at 5% level and repeat the two-step procedure until all such indices with insignificant style weights are eliminated.

We report the final results from this iterative procedure in panel C of Table IV. In contrast to the results of Panel A of Table IV, we find that the non-directional strategies show significant style weights on US equity, all three bond indices, and currency index while the directional strategies show significant style weights on equities across the world, high yield bonds and currency index. In particular, all the four non-directional strategies show negative style weight on US government bond index but positive weight on world government and corporate bond index, high yield index and currency index. This suggests that strategies like Event Driven and Restructuring borrow in the domestic market (possibly via the repo market) and invest in financially distressed firms internationally thereby acquiring currency exposure. Similarly, Event Driven and Equity Hedge strategies show significant positive exposure to the S&P 500 index in addition to their exposure to domestic and international bonds and currencies. Equity Hedge strategy, one that is closest in investment

style to the original hedge fund started by Alfred Winslow Jones in 1949 (Caldwell, 1995), involves taking long positions in the undervalued securities and short positions in the overvalued securities. Hence, a positive exposure to the S&P 500 is not surprising as they may not be perfectly market-neutral and may have a net long exposure to equities. Similarly, Event Driven managers take position in the undervalued securities that are expected to rise due to various events like mergers, reorganisations and takeovers. These securities carry some net market exposure that gets captured by the positive style weight on the S&P 500 index.

In contrast, the four directional strategies show much more variability in terms of their style exposures to various asset classes like equities, bonds and currencies. With the sole exception of Hedge (Long Bias), the remaining three directional strategies show significant positive style weight on the currency index. This indicates that these managers operate in international markets in addition to their exposure to the domestic US equities. This notion is confirmed by the significant positive style weight on the MSCI World Excluding the US index in case of Macro strategy and on the MSCI Emerging Markets index in case of Long and Hedge (Long Bias) strategies. Long strategy shows significant exposure to currency index and emerging market equity index. This is consistent with their stated objective of investing in emerging markets, which typically have restrictions on short selling. The fact that short selling is not allowed in emerging markets is confirmed by Short strategy having no significant exposure to the emerging market equities. Thus, overall we find that the risk exposures of the different hedge fund strategies are broadly consistent with their investment objectives.

In order to determine the effect of imposing the constraint of the weights adding up to a hundred percent, we repeat the procedure after removing the corresponding constraint. We report the corresponding results in Panels A, B and C of Table V. We find many interesting differences between results reported in Table IV and V. First, if we compare the results in Panel A, the percentage increase in R^2 ranges between 1% for Long Strategy to 16% for Capital Structure Arbitrage Strategy. This implies that constraining the style weights to add up to a hundred percent affect directional strategies very differently compared to the non-directional strategies. In general, the non-directional strategies get hurt more than the directional strategies. This is intuitive since non-directional strategies involve shorting some asset classes and carrying of the collateral against their short position in the form of cash[5]. Second, the number of significant asset classes falls down in all the hedge fund strategies except Long. This again confirms the notion that imposing the constraint of weights adding up to one may be too restrictive and may, at times, result in some exposures that do not exist in reality. Finally, in Panel A of Tables IV and V, we noted an increase in the R-square due to the removal of the constraint. However, this does not *always* carry through when one eliminates the non-significant style weights. This is because in some strategies (e.g., Capital Structure Arbitrage and Macro) a large number of non-significant asset classes get eliminated during the iterative procedure thereby lowering the R-square.

It is important to note that compared to the style analysis of mutual funds, the R^2 from the generalised style regression are somewhat lower. A similar result has been documented

[5] See Appendix A for an illustration of a typical balance sheet of an ungeared and a 100% geared Equity Hedge fund taking long and short positions in correlated equities.

in the Fung and Hsieh (1997) study as well. This is to be expected given the wide range of asset classes available to the fund managers to invest in, and the dynamic nature of the trading strategies they typically engage in[6]. Nevertheless, manager style explains from 44% to 84% of the total variance of returns, the rest being attributable to manager judgement. This clearly highlights the importance of manager judgement and explains why investors think of "manager-risk" before investing in hedge funds. Also, given the significant systematic style exposures of the so-called "market-neutral" strategies, the "alpha" of these strategies should be measured vis-à-vis a style adjusted benchmark and not the risk free rate.

One may argue that the non-directional funds are close to market-neutral and therefore should have near-zero style weights on various asset classes. For example, a market-neutral long-short portfolio of US equities is expected to have zero beta vis-à-vis the S&P 500 Index (or any proxy of US equity market). Obviously, this can not be captured in a regression framework, as constraining the style weight on the S&P 500 Index to zero becomes equivalent to exclusion of that index from the regression. Nevertheless, for the sake of completeness, we constrain the style weights of the non-directional strategies to sum to zero and report the results in Table VI. We find that the R^2 values decrease universally. This fall is especially severe in case of Capital Structure Arbitrage Strategy and the Equity Hedge Strategy. Moreover, the style weights become difficult to interpret. For example, the style weights of Equity Hedge Strategy now show a short position in US equities and an

[6] An alternative way to capture the dynamic nature of trading strategies employed by hedge funds would be to include option-based asset classes in the passive portfolio (see Agarwal and Naik (2000d) for benchmarking of hedge funds using passive and option-based strategies.

equal and opposite long position in Emerging Market equities, a risk exposure very different from that obtained in Panel C of Table V for the same strategy. Therefore, we believe that the extent of market-neutral nature of the non-directional strategies should be assessed via the unconstrained style regression (as reported in Table V Panel C). In such a case, the number of statistically insignificant style weights indicate the number of asset classes that particular hedge fund strategy is "neutral" to.

III. Concluding Remarks

In this paper, we use HFR indices to examine the risk-return tradeoffs of investing in directional and non-directional hedge fund strategies. We observe that, in general, the non-directional strategies exhibit higher Sharpe ratios and lower downside risk as compared to the directional strategies. We infer the risk exposures of different hedge fund strategies and assess their significance through confidence intervals using the generalised style analysis that allows for negative style weights and does not constrain the weights to add up to a hundred percent. We find that no two strategies show exposure to identical set of asset classes suggesting that although two strategies may appear similar, there are important differences and these may provide diversification benefits in a fund of funds situation. Moreover, none of the strategies exhibit significant style exposure towards MSCI World excluding US Index, SB World Government Bond Index and the UK Gold Price Index.

Overall, we find that the risk exposures are broadly consistent with the investment objectives of the different hedge fund strategies. For example, among the directional

strategies, Macro exhibits substantial positive currency exposure while Short exhibits significant negative US equity exposure. In contrast, among the non-directional strategies, Event Driven shows significant positive exposures to US equities, Emerging Market equities and High Yield bonds. Finally, we find that constraining the style weights to add up to a hundred percent for all strategies, or a zero percent for non-directional strategies worsens our understanding of the true risk exposures of different hedge fund strategies.

Taken together, these results considerably improve our understanding of the risk-return tradeoffs involved in allocating funds to alternative investment vehicles such as hedge funds. Also, our empirical results provide the first exploration of the true risk-return characteristics of hedge fund strategies through generalised style analysis, a topic that needs more attention in the field of investment management.

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Glossary: Definitions of hedge fund strategies

Non-directional Strategies:

1. 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.
2. Equity Hedge - A strategy of investing in equity or equity-like instruments where the net exposure (gross long minus gross short) is generally low. 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.
3. 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.
4. Capital Structure Arbitrage - 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:

1. Macro - 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. Long - 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. Hedge (Long Bias) - A strategy similar to equity hedge with significant net long exposure.
4. Short - A strategy that focuses on selling short over-valued securities, with the hope of repurchasing them in the future at a lower price.

Table I. Performance of different hedge fund strategies during large upturns and downturns in the US equity market

This table shows the returns on ten different hedge fund strategies during the seven large up and down moves of the S&P 500 Composite index during January 1994 to September 1998.

Panel A: S&P 500 Composite Index: 7 Large Up Moves

	Nov-96	Jul-97	Jan-97	Sep-97	May-97	Mar-98	Sep-96	Mean
S&P 500 Composite	7.68	6.45	6.39	6.37	6.16	5.90	5.88	6.40
Non-directional Strategies								
Fixed Income Arbitrage	0.37	0.58	1.43	0.51	0.34	1.34	0.52	0.73
Event Driven	2.03	2.72	2.84	3.59	4.36	2.93	1.97	2.92
Equity Hedge	1.66	5.50	2.78	5.69	5.04	4.54	2.18	3.85
Restructuring	0.88	2.11	1.88	2.84	1.74	2.17	1.82	1.92
Event Arbitrage	1.38	1.60	1.04	2.31	1.92	1.05	0.81	1.42
Capital Structure Arbitrage	1.40	1.61	1.01	1.11	1.40	1.58	1.23	1.33
Directional Strategies								
Macro	4.72	5.90	5.14	3.05	1.83	5.05	2.01	3.96
Long	2.85	4.64	7.83	0.61	3.80	2.94	1.38	3.44
Hedge (Long Bias)	2.96	5.56	3.39	6.36	8.98	3.98	3.97	5.03
Short	-2.95	-2.94	-1.02	-2.58	-8.23	0.06	-7.53	-3.60

Panel B: S&P 500 Composite Index: 7 Large Down Moves

	Aug-98	Aug-97	Mar-97	Nov-94	Mar-94	Jul-96	Jul-98	Mean
S&P 500 Composite	-10.52	-4.91	-4.34	-3.93	-3.78	-3.63	-3.03	-4.88
Non-directional Strategies								
Fixed Income Arbitrage	-1.18	0.40	0.54	0.76	0.93	1.30	1.69	0.63
Event Driven	-8.87	0.52	-0.53	-1.27	-0.55	-0.50	-0.57	-1.68
Equity Hedge	-7.69	1.35	-0.73	-1.48	-2.08	-2.87	-0.67	-2.02
Restructuring	-8.55	1.08	0.22	-1.71	-0.93	0.21	-0.40	-1.44
Event Arbitrage	-6.09	1.04	1.05	-0.22	1.37	0.81	-0.57	-0.37
Capital Structure Arbitrage	-3.11	1.14	0.59	-0.79	-2.11	-0.37	0.49	-0.59
Directional Strategies								
Macro	-3.94	-1.25	-1.24	0.39	-3.43	-3.04	0.23	-1.75
Long	-20.98	-2.08	1.48	-2.81	-4.38	-2.65	-0.30	-4.53
Hedge (Long Bias)	-13.31	0.86	-5.04	-2.43	-3.07	-6.79	-2.87	-4.66

Short	19.53	-1.77	6.75	4.70	11.32	9.00	3.04	7.51

Table II. Summary Statistics of different hedge fund strategies

The table below shows the mean returns, standard deviations, downside deviations, medians, skewness, kurtosis, minimum and maximum realisations, proportion of positive realisations and Sharpe Ratios for ten different hedge fund strategies during January 1994 to September 1998. The Sharpe Ratio is calculated assuming a risk-free rate of 5% p.a.

Hedge fund strategy[#]	**No.**	**Mean**	**SD**	**DD**	**Median**	**Skewness**	**Kurtosis**	**Min.**	**Max.**	**NP**	**SR**
Non-Directional											
Event Driven	67	1.14	2.07	0.41	1.45	-2.32	11.69	-9.56	5.01	77	0.35
Equity Hedge	212	1.32	2.31	0.71	1.35	-0.72	2.45	-7.41	5.69	72	0.39
Restructuring	36	0.90	1.74	0.37	1.15	-3.19	16.36	-8.74	3.82	82	0.28
Capital Structure Arbitrage	56	0.76	1.13	0.61	1.11	-1.51	2.30	-2.79	2.32	84	0.31
Average	**69**	**0.94**	**1.65**	**0.46**	**1.18**	**-2.52**	**12.05**	**-7.05**	**3.63**	**81**	**0.31**
Directional											
Macro	53	0.96	2.47	1.32	0.57	-0.23	0.57	-6.40	5.90	67	0.22
Long	126	0.13	4.65	1.51	0.61	-1.45	4.75	-19.73	7.87	56	-0.06
Hedge (Long Bias)	201	1.28	3.69	1.49	1.68	-1.04	3.07	-13.08	8.98	67	0.23
Short	14	0.45	5.85	3.27	0.06	0.97	2.24	-9.96	22.11	51	0.01
Average	**99**	**0.71**	**4.17**	**1.90**	**0.73**	**-0.44**	**2.66**	**-12.29**	**11.22**	**60**	**0.10**

[#]The HFR indices corresponding to these strategies are: Fixed Income Arbitrage; Event Driven; Equity Hedge; Distressed Securities; Merger Arbitrage; Convertible Arbitrage; Macro; Emerging Markets (Total); Equity Non-Hedge and Short Selling.

No.: Number of funds in the HFR index
SD: Standard deviation
DD: Downside deviation defined in equation (1) in the text
NP: Percentage of months with positive returns
SR: Sharpe ratio

Table III. Various asset classes and the corresponding indices used for Mean-Variance Analysis, Asset Class Factor Model and Generalised Style Analysis

Asset Class	Indices
Equity	S&P 500 Composite Index
Equity	MSCI World Equity Index excluding US*
Equity	MSCI Emerging Markets Index
Bond	Salomon Brothers World Government Bond Index
Bond	Salomon Brothers Government & Corporate Bond Index
Bond	Lehman High Yield Composite Index
Currency	Federal Reserve Bank Trade-Weighted Dollar Index#
Commodity	UK Market Price Index for Gold

Source: Datastream

* Morgan Stanley Capital International (M.S.C.I.) World Equity index excludes the US and the emerging markets.

The Federal Reserve Bank Trade-Weighted Dollar index is calculated by weighting each country's dollar exchange rate by that country's share of total U.S. trade (exports plus imports).

Table IV. Generalised Style Analysis of hedge fund strategies

This table shows the results for the following regression for January 1994 to September 1998: $R_t = \sum_{k=1}^{K} w_k F_{kt} + e_t$, where R_t = Return on the HFR index for a particular strategy for period *t*, w_k =style weights where $\sum_{k=1}^{K} w_k = 1$, F_{kt} = return on k^{th} index for period *t*, (k=1,.....,8) and e_t = error term. This regression attempts to minimise the variance of the error term subject to the constraint that all the style weights add to one (or a hundred percent). The R^2 of such a regression indicates the style attributable to the eight benchmark indices: S&P 500 composite index, MSCI world index excluding US, MSCI emerging markets index, Salomon Brothers government and corporate bond index, Salomon Brothers world government bond index, Lehman high yield composite index, Federal Reserve Bank trade-weighted dollar index and UK market price index for gold. The eight hedge fund strategies are: Event Driven, Equity Hedge, Restructuring, Capital Structure Arbitrage, Macro, Long, Hedge (Long Bias) and Short. Panel A shows the results for style weights on the eight indices with only the non-shortable assets (MSCI emerging markets index, Salomon Brothers world government bond index and Lehman high yield composite index) having weights constrained to lie between 0% and 100% while the others having style weights constrained to lie between -200% and 200%. All style weights are required to add up to 100%. Panel B shows the same results with the standard errors for the different style weights where weights significant at 5% level are expressed in bold face. Panel C shows the results for statistically significant style weights at 5% level after eliminating the non-significant ones through the iterative procedure. Active standard deviation (ASD) is the standard deviation of the monthly returns of the fund unexplained by the various benchmark indices. Figure in brackets indicates standard error.

Panel A

Strategy	S&P 500 Composite Index	MSCI World Excluding US Index	MSCI Emerging Markets Index	Salomon Brothers Govt. & Corporate Bond Index	Salomon Brothers World Govt. Bond Index	Lehman High Yield Composite Index	Federal Reserve Bank Trade-Weighted Dollar Index	UK Market Price Index for Gold	R^2
Non-Directional Strategies									
Event Driven	16.9	1.4	6.9	-51.0	37.6	55.9	36.9	-4.4	0.63
Equity Hedge	30.7	-7.9	9.6	-80.8	59.6	50.7	33.3	4.9	0.50
Restructuring	5.9	9.3	1.1	-65.3	36.0	75.6	37.4	0.1	0.64
Capital Structure Arbitrage	0.4	-0.8	1.3	-41.9	49.0	53.1	39.3	-0.4	0.43
Directional Strategies									
Macro	19.7	3.3	9.5	22.6	0.0	0.0	36.8	8.0	0.62
Long	1.0	-8.4	54.7	-60.5	2.4	81.2	37.6	-8.1	0.83
Hedge (Long Bias)	58.9	-12.5	17.9	-114.6	59.6	64.7	20.8	5.2	0.68
Short	-110.9	-8.5	0.0	34.2	81.0	0.0	89.7	14.5	0.43

Panel B

Strategy	S&P 500 Composite Index	MSCI World Excluding US Index	MSCI Emerging Markets Index	Salomon Brothers Govt. & Corporate Bond Index	Salomon Brothers World Govt. Bond Index	Lehman High Yield Composite Index	Federal Reserve Bank Trade-Weighted Dollar Index	UK Market Price Index for Gold	ASD	R^2
Non-Directional Strategies										
Event Driven	**16.9** (8.2)	1.4 (8.2)	6.9 (3.7)	**-51.0** (25.0)	**37.6** (16.8)	**55.9** (17.5)	**36.9** (8.0)	-4.4 (9.1)	0.63	
Equity Hedge	**30.7** (11.6)	-7.9 (11.7)	9.6 (5.3)	**-80.8** (35.5)	**59.6** (23.9)	**50.7** (24.8)	**33.3** (11.3)	4.9 (12.9)	0.50	
Restructuring	5.9 (7.2)	9.3 (7.2)	1.1 (3.3)	**-65.3** (21.9)	**36.0** (14.7)	**75.6** (15.3)	**37.4** (7.0)	0.1 (8.0)	0.64	
Capital Structure Arbitrage	0.4 (5.8)	-0.8 (5.8)	1.3 (2.7)	**-41.9** (17.7)	**49.0** (11.9)	**53.1** (12.4)	**39.3** (5.7)	-0.4 (6.5)	0.43	
Directional Strategies										
Macro	19.7 (10.1)	3.3 (10.2)	**9.5** (4.6)	22.6 (30.9)	0.0 (20.8)	0.0 (21.6)	**36.8** (9.9)	8.0 (11.3)	0.62	
Long	1.0 (13.0)	-8.4 (13.1)	**54.7** (6.0)	-60.5 (39.8)	2.4 (26.8)	**81.2** (27.9)	**37.6** (12.7)	-8.1 (14.5)	0.83	
Hedge (Long Bias)	**58.9** (14.2)	-12.5 (14.2)	**17.9** (6.5)	**-114.6** (43.3)	**59.6** (29.2)	**64.7** (30.3)	20.8 (13.8)	5.2 (15.8)	0.68	
Short	**-110.9** (28.1)	-8.5 (28.2)	0.0 (12.9)	34.2 (85.9)	81.0 (57.8)	0.0 (60.1)	**89.7** (27.4)	14.5 (31.3)	0.43	

Panel C

Strategy	S&P 500 Composite Index	MSCI World Excluding US Index	MSCI Emerging Markets Index	Salomon Brothers Govt. & Corporate Bond Index	Salomon Brothers World Govt. Bond Index	Lehman High Yield Composite Index	Federal Reserve Bank Trade-Weighted Dollar Index	UK Market Price Index for Gold	ASD	R^2
Non-Directional Strategies										
Event Driven	23.4 (6.8)			-66.2 (21.8)	38.7 (14.8)	66.5 (16.0)	37.6 (7.7)		1.26	0.60
Equity Hedge	32.9 (9.6)			-86.2 (30.8)	58.9 (21.0)	57.9 (22.7)	36.5 (10.9)		1.78	0.47
Restructuring				-74.9 (19.1)	37.4 (12.4)	100.0 (11.0)	37.5 (6.8)		1.13	0.59
Capital Structure Arbitrage				-42.4 (14.5)	47.9 (9.5)	55.4 (8.4)	39.2 (5.2)		0.86	0.43
Directional Strategies										
Macro		18.6 (4.0)					81.4 (4.0)		1.94	0.40
Long			60.8 (4.4)				39.2 (4.4)		2.14	0.80
Hedge (Long Bias)	43.3 (12.9)		20.7 (5.6)			36.0 (11.9)			2.26	0.63
Short	-73.0 (21.4)						173.0 (21.4)		5.60	0.01

Table V. Generalised Style Analysis of hedge fund strategies

This table shows the results for the following regression for January 1994 to September 1998: $R_t = \sum_{k=1}^{K} w_k F_{kt} + e_t$, where R_t = Return on the HFR index for a particular strategy for period *t*, w_k =style weights, F_{kt} = return on k^{th} index for period *t*, (k=1,.....,8) and e_t = error term. This regression attempts to minimise the variance of the error term subject *without* the constraint of all the style weights adding up to one (or a hundred percent). The R^2 of such a regression indicates the style attributable to the eight benchmark indices: S&P 500 composite index, MSCI world index excluding US, MSCI emerging markets index, Salomon Brothers government and corporate bond index, Salomon Brothers world government bond index, Lehman high yield composite index, Federal Reserve Bank trade-weighted dollar index and UK market price index for gold. The eight hedge fund strategies are: Event Driven, Equity Hedge, Restructuring, Capital Structure Arbitrage, Macro, Long, Hedge (Long Bias) and Short. Panel A shows the results for style weights on the eight indices with only the non-shortable assets (MSCI emerging markets index, Salomon Brothers world government bond index and Lehman high yield composite index) having weights constrained to lie between 0% and 100% while the others having style weights constrained to lie between -200% and 200%. Panel B shows the same results with the standard errors for the different style weights where weights significant at 5% level are expressed in bold face. Panel C shows the results for statistically significant style weights at 5% level after eliminating the non-significant ones through the iterative procedure. Active standard deviation (ASD) is the standard deviation of the monthly returns of the fund unexplained by the various benchmark indices. Figure in brackets indicates standard error.

Panel A

Strategy	S&P 500 Composite Index	MSCI World Excluding US Index	MSCI Emerging Markets Index	Salomon Brothers Govt. & Corporate Bond Index	Salomon Brothers World Govt. Bond Index	Lehman High Yield Composite Index	Federal Reserve Bank Trade-Weighted Dollar Index	UK Market Price Index for Gold	R^2
Non-Directional Strategies									
Event Driven	22.6	-0.8	7.5	-35.7	0.0	45.0	5.6	-9.0	0.67
Equity Hedge	30.7	-5.6	10.4	-46.8	12.2	38.4	-1.6	1.9	0.56
Restructuring	13.7	5.5	2.0	-54.6	0.0	61.7	4.5	-5.9	0.73
Capital Structure Arbitrage	4.0	-1.7	1.6	-22.9	12.1	45.2	10.9	-3.5	0.50
Directional Strategies									
Macro	11.7	11.2	8.4	34.6	20.5	0.0	64.0	16.0	0.65
Long	12.2	-15.7	54.3	-79.4	0.0	80.6	28.0	-10.0	0.84
Hedge (Long Bias)	61.6	-13.2	18.2	-100.4	32.5	58.7	-0.1	3.0	0.68
Short	-105.0	-12.7	0.0	67.0	0.0	0.0	26.0	8.4	0.44

Panel B

Strategy	S&P 500 Composite Index	MSCI World Excluding US Index	MSCI Emerging Markets Index	Salomon Brothers Govt. & Corporate Bond Index	Salomon Brothers World Govt. Bond Index	Lehman High Yield Composite Index	Federal Reserve Bank Trade-Weighted Dollar Index	UK Market Price Index for Gold	R^2
Non-Directional Strategies									
Event Driven	**22.6** (7.6)	-0.8 (7.7)	**7.5** (3.5)	-35.7 (23.3)	0.0 (15.7)	**45.0** (16.3)	5.6 (7.4)	-9.0 (8.5)	0.67
Equity Hedge	**30.7** (10.5)	-5.6 (10.5)	**10.4** (4.8)	-46.8 (32.0)	12.2 (21.5)	38.4 (22.4)	-1.6 (10.2)	1.9 (11.7)	0.56
Restructuring	**13.7** (6.1)	5.5 (6.2)	2.0 (2.8)	**-54.6** (18.8)	0.0 (12.6)	**61.7** (13.1)	4.5 (6.0)	-5.9 (6.9)	0.73
Capital Structure Arbitrage	4.0 (5.5)	-1.7 (5.5)	1.6 (2.5)	-22.9 (16.7)	12.1 (11.2)	**45.2** (11.7)	**10.9** (5.3)	-3.5 (6.1)	0.50
Directional Strategies									
Macro	11.7 (9.8)	11.2 (9.9)	8.4 (4.5)	34.6 (30.0)	20.5 (20.2)	0.0 (21.0)	**64.0** (9.6)	16.0 (10.9)	0.65
Long	12.2 (12.5)	-15.7 (12.5)	**54.3** (5.7)	**-79.4** (38.2)	0.0 (25.7)	**80.6** (26.7)	**28.0** (12.2)	-10.0 (13.9)	0.84
Hedge (Long Bias)	**61.6** (14.2)	-13.2 (14.2)	**18.2** (6.5)	**-100.4** (43.3)	32.5 (29.2)	58.7 (30.3)	-0.1 (13.8)	3.0 (15.8)	0.68
Short	**-105.0** (27.4)	-12.7 (27.6)	0.0 (12.6)	67.0 (83.8)	0.0 (56.4)	0.0 (58.7)	26.0 (26.8)	8.4 (30.6)	0.44

Panel C

Strategy	S&P 500 Composite Index	MSCI World Excluding US Index	MSCI Emerging Markets Index	Salomon Brothers Govt. & Corporate Bond Index	Salomon Brothers World Govt. Bond Index	Lehman High Yield Composite Index	Federal Reserve Bank Trade-Weighted Dollar Index	UK Market Price Index for Gold	ASD	R^2
Non-Directional Strategies										
Event Driven	20.1 (7.1)		9.6 (3.1)			30.7 (6.5)			1.24	0.62
Equity Hedge	29.7 (4.0)		12.8 (4.0)						1.62	0.52
Restructuring	19.6 (5.0)			-65.5 (8.4)		68.8 (10.8)			0.94	0.71
Capital Structure Arbitrage						47.6 (4.5)			0.85	0.44
Directional Strategi es										
Macro							60.9 (6.3)		2.13	0.27
Long			51.2 (4.5)	-70.7 (18.4)		78.8 (22.0)	37.5 (11.7)		1.92	0.84
Hedge (Long Bias)	62.9 (11.5)		18.9 (5.5)	-49.3 (9.3)					2.21	0.65
Short	-99.5 (4.7)								4.36	0.40

Table VI. Generalised Style Analysis of Non-Directional hedge fund strategies

This table shows the results for the following regression for January 1994 to September 1998: $R_t = \sum_{k=1}^{K} w_k F_{kt} + e_t$, where R_t = Return on the HFR index for a particular strategy for period *t*, w_k =style weights where $\sum_{k=1}^{K} w_k = 0$, F_{kt} = return on k^{th} index for period *t*, (k=1,.....,8) and e_t = error term. This regression attempts to minimise the variance of the error term subject *with* the constraint of all the style weights adding up to zero. The R^2 of such a regression indicates the style attributable to the eight benchmark indices: S&P 500 composite index, MSCI world index excluding US, MSCI emerging markets index, Salomon Brothers government and corporate bond index, Salomon Brothers world government bond index, Lehman high yield composite index, Federal Reserve Bank trade-weighted dollar index and UK market price index for gold. The four non-directional hedge fund strategies are: Event Driven, Equity Hedge, Restructuring and Capital Structure Arbitrage. The non-shortable assets (MSCI emerging markets index, Salomon Brothers world government bond index and Lehman high yield composite index) have weights constrained to lie between 0% and 100% while the others have style weights constrained to lie between -200% and 200%. The table below shows the results for statistically significant style weights at 5% level after eliminating the non-significant ones through the iterative procedure. Active standard deviation (ASD) is the standard deviation of the monthly returns of the fund unexplained by the various benchmark indices. Figure in brackets indicates standard error.

Non-Directional Strategy	S&P 500 Composite Index	MSCI World Excluding US Index	MSCI Emerging Markets Index	Salomon Brothers Govt. & Corporate Bond Index	Salomon Brothers World Govt. Bond Index	Lehman High Yield Composite Index	Federal Reserve Bank Trade-Weighted Dollar Index	UK Market Price Index for Gold	ASD	R^2
Event Driven	45.4 (5.6)			-45.4 (5.6)					1.34	0.55
Equity Hedge	-13.4 (5.5)		13.4 (5.5)						2.21	0.10
Restructuring	23.3 (5.1)			-79.7 (8.7)		56.4 (11.1)			0.97	0.69
Capital Structure Arbitrage									1.14	0.00

Appendix A

A. Typical Balance Sheet of an ungeared Equity Hedge fund taking long and short positions in different equities

Assets		Liabilities	
Long position	90	Short position	90
Cash	10	Equity	100
Collateral	90		
Total	190	Total	190

B. Typical Balance Sheet of a 100% geared Equity Hedge fund taking long and short positions in different equities

Assets		Liabilities	
Long position	180	Short position	180
Cash	20	Debt	100
Collateral	180	Equity	100
Total	380	Total	380

Note: For £100 of investor money, £90 is applied towards a long position and £10 is held as cash to cover margin calls. The market exposure of long is offset by approximately equal short exposure with the collateral held in money market instruments.