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IS THERE EVIDENCE FOR A CAPACITY CONSTRAINT IN HEDGE FUND STRATEGIES?

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ABSTRACT

This paper examines whether hedge fund strategies are constrained by a capacity effect. Given that hedge funds pursue specialised investment strategies, which may not be readily scalable, there is a widely held view in the asset management industry that increases in assets invested in certain hedge fund strategies can be expected to lead to a crowding effect as more money chases the limited investment opportunities available. We make use of three performance measures to investigate the relationship between investment into hedge funds and excess returns. Using performance data, assets under management, and fund flows from 1991 to 2004, we examine whether returns for nine strategic categories and three groups of strategies were affected by asset flows and assets under management. The results indicate that strategies which may be subject to execution constraints are Equity Market Neutral, Equity Long-Short, and Merger Arbitrage. There is no evidence for constraints at the industry level or for the other strategy groups analysed. We conclude that, given existing data on hedge fund definitions, inflows, and performance measures, there is only limited support for the capacity constraint hypothesis.

IS THERE EVIDENCE FOR A CAPACITY CONSTRAINT IN HEDGE FUND STRATEGIES?

INTRODUCTION

Over the last fifteen years there has been a large increase in the assets under management committed to hedge fund strategies as well as the number of hedge funds engaged in a particular strategy. The rapid growth and increasing market impact of hedge funds has attracted academic interest, not least the proposition put forward by the hedge fund industry that they are able to engage in investment strategies that provide consistent above-average absolute returns without undue risk. This paper has a simple aim to examine whether the expansion of the industry has been subject to a capacity effect. That is, it addresses the question whether for the specific investment strategies pursued by hedge funds there is a crowding effect (Sillam, 2005). The proposition is that, as the industry has expanded, returns are reduced as the number and funds committed to particular strategies exhaust the limited investment opportunities that exist for particular strategies.

It is important to understand the way funds operate and why there may well be a capacity effect. Martin Leibowitz (2005) makes the analogy that hedge funds are like alpha hunters while traditional asset management firms are beta grazers.[1] The key element in this typography is that hedge funds are seen as highly pro-active investors constantly on the lookout for new investment opportunities. The assumption is that opportunities to earn enhanced return without commensurate risk are transient and hard to pin down. The analogy also suggests that when hedge funds are seen as game seekers, the existence of too many hunters in a particular location leads to rapid exhaustion of investment opportunities as well as crowding of the territory.

Agarwal & Naik (1999) define two main groups of hedge fund strategies: directional and non-directional. However, Brooks & Kat (2001) and several others, especially

[1] William Goetzmann uses a similar analogy, where hedge funds are explorers and traditional asset managers are farmers. (personal communication with William Goetzmann).

people reporting for the financial press, divide hedge fund strategies into three broad groups: directional or market trend strategies, arbitrage or market neutral strategies, and event-driven strategies. Directional strategies, the group of strategies covering most hedge funds, aim to profit from changes in macroeconomic factors. Arbitrage strategies exploit market inefficiencies. Event-driven strategies are informational-driven by particular corporate events, and can be seen as a specialised sub-group consisting of both directional and arbitrage strategies. However, given the way hedge funds operate, the specific strategies within each group can be difficult to define categorically, as hedge fund data vendors and fund managers have their own special ways of determining strategies. However there is some general agreement as to the major strategies and these are shown in Table 1.

[Insert Table 1 about here]

LITERATURE REVIEW

Early studies of hedge fund performance were hindered by poor availability of data and its quality. More recent studies have been able to make use of better databases and categorisations. Ackermann et al. (1999), Liang (1999), Agarwal & Naik (2000) and Amenc et al. (2003) find evidence that hedge funds do produce risk-adjusted excess returns, which indicates superior investment skill.

Clunie & Ashton (2005) in a study similar to this paper calculate returns attributable to manager skill for different hedge funds strategies, using four different performance models: simple excess returns, the Sharpe Ratio, Jensen's alpha, and a multifactor alpha model.[2] They then compare the results and look at the correlation between the calculated returns and asset flows. They find that the performance of distressed securities and global macro strategies are significantly affected by asset flows. They also find that the ranking of strategies by alpha, as defined by the returns attributable

[2] Clunie & Ashton (2005) run regressions for their performance measures against annual net and gross asset flows over a ten-year period and hence only have ten data-points in their regressions. However, because of the scarcity of hedge fund data, it is difficult to get around this problem.

to manager skill, is the same regardless of the method of calculation, with the short selling strategy the only exception. This finding is in accord with those of Edwards & Caglayan (2001), Amenc et al. (2003), and Alexander & Dimitriu (2005). This means that even though performance models produce different excess risk-adjusted return estimates, the different models agree on which strategies are the best performers. A useful survey is provided by Géhin (2004),

Loeys & Fransolet (2004) address a similar question to Clunie & Ashton (2005) since they are asking if the growth in the hedge fund industry is making it harder for hedge fund managers to find arbitrage opportunities. When looking at well-known arbitrage opportunities, they find that the returns on these have eroded most where hedge funds are major market participants. This suggests that hedge funds do make an impact on arbitrage opportunities, are increasing the level of market efficiency, and as a result are eroding the opportunities to earn excess returns. This fits with the Leibowitz (2005) thesis that as more hedge funds exploit market opportunities market efficiency will increase.[3] Mitchell & Pulvino (2001) look specifically at merger arbitrage and point out the severe limitations under which most such funds operate, including severe market impact, illiquidity, transaction costs, and limitations in the amount of capital available to undertake particular transactions. Loeys & Fransolet conclude that the recent low returns in the hedge fund industry could be a result of fewer opportunities. However, they accept that this still cannot be proved and that more time and research is needed to be able to conclude whether the hedge fund industry has grown to any kind of maximum size, or still retains the capacity to deliver excess returns.

Getmansky (2005) looks at the life cycle of hedge funds. By defining a so-called Favourable Positioning Metric system, she is able to measure a fund category's proportional increase in net dollar fund flows. She also runs lagged regressions for up to one year and finds that as competition within a strategy increases, liquidation by funds in this strategy increases as well. She also finds that better performing strategies attract a higher asset flow in the next time period. This means that when a strategy is

[3] This is a view shared by industry commentators. For example, in a report on trends in the asset management industry, UBS (2005) states that fund managers' skills will have to evolve if not they will lose their competitive advantage. See also Borrus (2005) and Watson Wyatt (2005).

performing well, more assets are being invested in the strategy, either through already established funds or by the creation of new funds. The increasing number of liquidations could be taken as an indication of a lower level of returns within the strategy, and that market opportunities therefore erode as the competition within a strategy increases.

However, not everyone agrees there is a capacity effect. Géhin & Vaissié (2005) looking at a data sample for the period 1997 to 2004 argue that alpha or manager skill is being overestimated as a return factor, and that returns coming from exposure to beta, in the form of rewarded market risk as well as other systematic risk factors, are being neglected. They find that pure alpha only accounts for around 4 per cent of hedge fund returns, and that 96 per cent is accounted for by static and dynamic betas. Hence changes in the beta environment, as experienced in recent years with markets experiencing low levels of volatility, could be considered the cause of the decline in hedge fund performance, and not a fall-off in alpha, which would have been the result of eroding excess return opportunities. Their findings also mean that hedge fund returns will by cyclical, following the changes in beta environments. Furthermore, Géhin & Vaissié find no clear evidence of a downward trend in alphas and conclude that the hedge fund industry is limited more by the availability of superior managers than market capacity.

Another area which has received interest by researchers is the case of the performance of small versus large funds. With this, as with the other areas of research, there have been differences in the evidence and conclusions. Amenc et al. (2003) find larger funds outperform smaller funds. In contrast, Ammann & Moerth (2005) show some evidence of a negative relationship between fund size and performance.[4] However, they also conclude that very small funds underperform on average compared to larger funds which they attribute to a higher total expense ratio. Support for their views is provided by Edwards & Caglayan (2001) who find that performance increases at a declining rate as size of assets under management increases. Ineichen (2002) suggests that good performance followed by bad performance could be blamed on an increase in asset flows. Gregoriou & Rouah (2002) conclude that they cannot find any size-

[4] Agerwal et al (2004, 2005) examines these issues within the context of managers' incentives.

performance relationship. However, they state that an increase in size could decrease the fund's speed in trading operations, and as a result have a negative effect in the long run. They conclude that further research is needed in this area.

Liang (2003) argues that the wide range of asset classes held by hedge funds, their use of leverage, and different incentive management fees make the return calculation problematic. Building on the work by Fung & Hsieh (1997), Agarwal & Naik (2000) use an option-based performance measure. As a result they examine both linear and non-linear risk exposures. They find that by using option-based and buy-and-hold strategies as factors in their model, they are able to explain a significant higher proportion of the variation in hedge fund returns over time. Therefore, non-linear factors could prove to be important when assessing hedge fund performance (Gupta et al, 2003). Schneeweis (1999) argues that no conclusion can be reached as to how alpha should be measured. However, he points out that the risk-free rate is probably not the correct benchmark as any investment strategy involves some kind of risk. Alexander & Dimitriu (2005) use four different factor models to estimate the alpha for hedge funds, including both linear and non-linear factors. They conclude that there are large differences in alpha estimations by the different factor models, and that the ranking of alpha will be a better way of evaluating performance. In the same way Amenc et al. (2003) test a large range of models and conclude that differences in the way the models rank performance are one of the important findings of their study.

DATA AND METHODOLOGY

This paper uses net-of-fee returns, assets under management, together with details on funds and strategies, from the HFR and CISDM databases. [5] The HFR database consists of approximately 4300 dead and live hedge funds and 1200 funds of funds. These are divided into 20 strategies. Funds in the CISDM database normally report

[5] The HFR database, which will be used throughout this paper, was used by Liang (1999) Agarwal & Naik (1999, 2000), Agarwal (2001) and Loeys and Fransolet (2004) The CISDM database has also been used in several research papers, including those of Fung & Hsieh (1997), Amin & Kat (2001) and Clunie & Ashton (2005). This paper will make use of the CISDM database for comparison with HFR data only. Schneeweis & Spurgin (1997) and Capocci (2001) both used a combination of the HFR and the CISDM databases.

their asset under management figures in US dollars. For other currencies, to provide comparability, these are converted to US dollars using end of month foreign exchange rates. Several of the funds listed in the CISDM database have incomplete data. Funds that only report returns have been eliminated from the database as have funds not reporting assets under management or missing returns data for more than three months have also been eliminated, as have funds of funds.

HFR and CISDM started collecting data in 1994 and 1990 respectively and as this study covers the period 1991 to 2004 to give the longest possible time series, it is susceptible to backfilling bias, due to funds providing past data when entering the database.[6] The number of unique funds in the two databases is unknown but a correlation of the monthly returns of the HFR Fund Weighted Composite Index (HFR Index) and the CISDM Equally Weighted Hedge Fund Index (CISDM Index) for the period from January 1995 to December 2004 resulted in a correlation of .9939. Brooks & Kat (2001) find that indices which are supposed to cover the same type of strategy often have a high level of heterogeneity, which implies low correlation. The high correlation between the HFRI Index and the CISDM Index could imply that this is not the case for these two indices. However, the correlation between single strategies between the two databases is lower.[7]

Three tests were undertaken to see if decreasing excess risk-adjusted returns are affected by asset flows and assets under management. There is little consensus in the literature on which method is best to determine abnormal risk-adjusted returns. Simple excess return models (which compute fund returns less the risk free interest rate), as well as linear and non-linear multi-factor models have been used (Amenc et al., 2003). In the first test, simple excess returns for the hedge fund strategies and groups of strategies are calculated and then used as the dependent variables in time-

[6] Ackermann et al. (1999) study instant history bias. With regards to backfilling, the paper states that normal practice in empirical testing is to eliminate the first two years of reported data. However, the paper concludes that since hedge fund data is so limited, while desirable, this should not be done. In addition, instant history bias will always be present. The fact that both HFR and CISDM include dead and alive funds means the sample base has reduced survivorship bias. For the purposes of this paper and in order to give as long a time period as possible, the possibility of hindsight bias will have to be accepted. and this should be taken into consideration in the results.

[7] The findings show that the correlation was between .60, for the fixed income arbitrage indices, and .95 for the equity long-short indices. Unfortunately, it is not clear the extent to which this reflects differences in classification or different populations in the databases.

series regressions. In the second test, Jensen's Alpha is used as the dependent variable.

The third test uses a multifactor alpha performance measure derived from a linear multifactor model. As several studies have shown, multifactor models tend to be better at explaining hedge fund returns. One reason for this could be the wide range and hence heterogeneity of hedge funds strategies and hence the number of different factors that could explain their returns. Agarwal & Naik (1999) set up a multifactor model to evaluate hedge fund performance, using eight asset class factors. Liang (1999) uses the same number of asset classes when trying to assess abnormal returns in the hedge fund industry, using the following model:

$$R_t = \alpha + \sum_k \beta_k F_{k,t} + \varepsilon_t \qquad (1)$$

where $F_{k,t}$ is the k^{th} factor value at time t.

In regard to multifactor models, Schneeweis et al. (2003) argue that recent work undertaken to understand drivers of hedge fund return have made such models even more appropriate. However, the paper also concludes that, for many uses, single-factor models may also be used. A single-factor model is what Brown et al. (1999) and Ackermann et al. (1999) use when analysing performance. In their paper, Ackermann et al. (1999) use the traditional Sharpe ratio to compare the hedge fund industry with the mutual fund industry.

The fact that our models are linear should be commented upon. Non-linear models proposed by Agarwal & Naik (2000) among others, seem to explain a higher level of the returns obtained by hedge funds. However, there is still no general agreement among researchers on this. Meredith et al. (2005) use a larger number of factors than Agarwal & Naik. However, they choose not to include non-linear factors. Because of the high level of complexity in finding suitable factors, this paper does not use non-linear factors in the performance models since the aim is to test the effect of changes in assets under management on performance rather than to explain the way excess returns are being generated (Capocci, 2001).

Getmansky (2005) states that fund flows into funds accrue at the end of each month. As a result one would expect parts of the asset flow effect on returns to be evident after the month the asset flow is reported. Therefore we also run regressions with lagged returns. Clunie & Ashton (2005) incorporate a one-year lag for returns in their model. They also check for correlation with lagged asset flows and find a lower correlation. This test actually checks if returns have any impact on asset flows, and not the other way around. Given this, we examine lagged returns up to two years only, and not lagged asset flows.

To be able to run regressions with alphas and excess risk-adjusted returns as dependent variables, we need more than one figure for the time period in our tests. As our data from HFR goes back to 1991, we are able to run regressions with 14 data points. Clunie & Ashton (2005) use only asset growth as their independent variable in their regression. As a robustness test, we also run regressions of our performance measures against lagged assets under management. This should lead to a higher degree of significance in our results.

Finally, the strategies we analyse are Distressed Securities, Merger Arbitrage, Event-Driven Multi Strategy, Equity Market Neutral, Fixed Income Arbitrage, Convertible Arbitrage, Equity Long-Short, Global Macro and Emerging Markets (Table 1 provides an explanation of these strategies). These nine strategies are representative of the directional, arbitrage, and event-driven groups of strategies with three strategies chosen from each group. The three groups of strategies will show if a particular group is more heavily affected by asset flows. The HFR Index will also be tested, as a proxy for the hedge fund universe, to check for industry-wide effects of the increase in asset flows.

RESULTS

We first review the three tests individually and then compare the results from the different tests. For the three tests in this paper, six different regressions were

undertaken. In the first test, simple excess returns, defined as return of strategy less risk-free rate, were calculated and regressed against asset flows and assets under management with and without lags. For each test, we show the correlation between the performance variable (excess returns, Jensen's Alpha, or multivariate alpha) and contemporaneous and lagged fund flows.

Our first test takes simple excess returns over the risk-free benchmark and fund flows and assets under management. The correlation between strategies and fund flows is given in Table 2. At the industry level there is no indication that flows have any relationship to fund returns as measured by the HFR index. However, this is not the case when viewing the individual strategies. The Event-Driven Multi Strategy, Equity Long-Short and Global Macro are correlated to flows. When lagged, Merger Arbitrage is also significant. In Table 3, we use a simple regression model of flows and assets under management lagged by one year, and find significant coefficients for Equity Long-Short for flows and Merger Arbitrage for flows as well as assets under management. Equity Market Neutral is also significant for lagged assets under management. If we relax the normal 95 per cent confidence limit to 90 per cent, we also get significant coefficients for the Event Driven Multi Strategy.

[Insert Table 2 about here]

[Insert Table 3 about here]

This first test uses excess returns as an indicator of alpha performance. While this has been used in other studies, it suffers from the problem that it cannot distinguish true alpha performance. It is therefore preferable to use a clean measure of alpha, namely Jensen's alpha measure, which we do in our second test. Table 4 shows the correlation of Jensen's alpha with flows. When performance is measured with Jensen's alpha, we find that Global Macro is the only strategy that has a significant coefficient. As with test one, we also compute regressions for Jensen's alpha against flows and lagged assets and the results are shown in Table 5. The significant strategies are Merger Arbitrage, Global Macro, and Equity Market Neutral when analysed for lagged assets under management. If we relax the significance to 90 per cent, then Global Macro when flows are not lagged also becomes significant.

[Insert Table 4 about here]

[Insert Table 5 about here]

One possibility for the poor results is that Jensen alphas are insignificant. However, this does not appear to be the case. We report the performance measure in Table 6 for each of the years of our study as well as the summary value for each of the strategies. With few exceptions, the values are positive and quite significant.[8] Poor alpha performance does not seem to lie behind the lack of significance between asset flows and assets under management measures. Nor does a fall-off in alpha over time, as suggested by Géhin & Vaissié (2005), help explain the lack of significance in our results. The results from this test therefore indicate that hedge funds are not subject to capacity constraints, as commonly suggested.

[Insert Table 6 about here]

In our third test we use multifactor alphas as our indicator of performance. Since these are akin to style alphas used in performance attribution, they can be considered refinements of Jensen's approach that allow for hedge fund returns to have a multiplicity of return factors (Fama & French, 1996). As such, the multifactor alpha may correct for inaccuracies in the first two estimates of return used in our earlier tests and in particular the alpha estimates derived from a single market factor using Jensen's methodology. Table 7 reports the correlation between the multifactor alpha for the different strategies and the asset flows. This shows that without any lag, the Event-Driven Multi Strategy and Equity Long-Short categories are significant at the 5

[8] As regards performance, 1998 stands out as the worst year for the majority of strategies, which accords with the findings in the Clunie & Ashton (2005) paper. They state that this period coincided with the Russian currency crises in 1998 which led to both a devaluation of the rouble and defaults on both private and public debt, and the near collapse of Long Term Management (LTCM). The poor hedge fund performance seen in 1998 would indicate that it was not only LTCM that experienced rough times because of the adverse market environment, which saw extreme credit spreads and general illiquidity in the financial markets at this time. This would support the Géhin & Vaissié (2005) argument that hedge fund returns will follow changes in beta environments.

per cent and 1 per cent levels respectively. Interestingly enough the Directional Group of strategies is also significant at the 5 per cent level, but with the wrong sign. It is also significant at the 1 per cent level with the right sign when lagged by one year. Of the strategies only the Equity Long-Short strategy is significant for one year lagged flows, but only at the 10 per cent level.

[Insert Table 7 about here]

When analysing the regression equations, as shown in Table 8, we find that for flows that are not lagged, the Event-Drive Multi Strategy and Equity Long-Short strategies are significant at the 5 per cent level. The Directional Group is also significant, but has the wrong sign. When flows are lagged, then only the Equity Long Short strategy is significant (at the 1 per cent level). When lagged assets under management are used, then Equity Long-Short and Convertible Arbitrage are both significant at the 5 per cent level and Equity Market Neutral at the 1 per cent level. Merger Arbitrage is significant at the 10 per cent level.

[Insert Table 8 about here]

Finally, we compare the results from the three different tests. Table 9 shows the significant regressions for the nine strategies and the three strategy groups. There is no clear pattern across the different tests or strong evidence for a capacity effect. The strategies which have significant results across some of the three tests are Merger Arbitrage, Equity Long-Short, and Equity Market Neutral. However, the evidence is not particularly compelling even allowing for the noisy nature of our data and tests. Interestingly Jensen's alpha measure provides the least support for the capacity effect. If we accept that multifactor alpha is a more appropriate performance measure given the nature of hedge fund strategies, then this test indicates that it is only the Event-Driven Multi Strategy and Equity Long-Short strategies that suffer from capacity effects.

[Insert Table 9 about here]

Table 9 does not lead much credence to the idea that there may be a delayed effect. There are fewer significant results from our lagged tests. One possible explanation is possible misspecification. When using assets under management as an alternative measure of capacity, we find three significant strategies, one of which Equity Long-Short is also significant when flows are used, whereas Convertible Arbitrage and Equity-Market Neutral are not significant when flows are used. A possible explanation is that there is a combination effect where some strategies experience an almost immediate impact from inflows while others, as suggested by Gregoriou & Rouah (2002) there is a lagged effect.

Turning to those strategies which have significant results, if capacity constraints exist we would expect Merger Arbitrage to suffer from this problem. The strategy benefits from a clearly limited type of market anomaly that exists only before and after mergers and takeovers. Mitchell and Pulvino (2001) conclusively make the case that such capacity constraints should exist. This also applies to the Equity Market Neutral strategy which is a pure arbitrage strategy that seeks to benefit from differences in the prices of related securities. There are likely to be a limited number of these opportunities available. So both these strategies are likely to be negatively affected by increases in the funds devoted to these strategies. However, there does not seem to be such a strong rationale for the significant results for the Equity Long-Short strategy. This relies on stock selection and portfolio construction and hence should have no market constraint. That said, it is possible that institutional factors in markets (availability of stock to borrow, cost of borrowing, haircuts, and other frictions) limit the capacity of hedge funds to operate effectively.

Conclusions

Hedge fund industry commentators suggest that there may be a limit to the size of the industry due to a capacity effect. This may be due to a lack of opportunities created by large amounts of money chasing elusive alpha opportunities or the result of a dilution of talent as more funds are set up or–or a combination of these effects. Our results do

not support the capacity constraint hypothesis, but equally do not categorically reject it outright either. Our findings are tantalising in that, for some strategies, we do see significant results but these are not particularly consistent across the different tests. Also, it is difficult to explain the presence of the Equity Long-Short group as a constrained strategy. There should be no capacity effect for directional strategies since there are few clear scale limitations. That said the directional group of strategies has experienced the highest inflow of capital during the last 15 years and hence dilution of manager capability could be an explanation.

Our results are constrained by both data limitations and our performance statistics. A potential line of future research would involve more detailed funds flow data combined with refined performance measures. There is the fact that, as industry observers attest, the current size of the hedge industry is many times that which existed at the start of our data. It may be the fact therefore that the industry is only now seeing the emergence of limits to capacity. This might be diluting the results from our study and a focus on more recent performance data would provide stronger evidence one way or the other.

Finally, when arguing for and against the existence of an effect of changes in assets under management on returns in the hedge fund industry, it is crucial to take into account the expansion in underlying opportunities. The performance of the industry, which is affected by a wide range of markets and factors, has depended on the exploration and exploitation of what Leibowitz (2005) calls “chronic inefficiencies”. Therefore it would be interesting to look at the scale of these inefficiencies compared to increases in the amount of assets invested in the relevant strategies in a similar approach to that of Loeys & Fransolet (2004). If the scope for opportunities is greater than the amount of money going after these opportunities, then it is unlikely these strategies will be subject to a capacity constraint.

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Table 1: Categorisation of hedge fund strategies

Event-Driven Strategies

- Distressed Securities – Strategy trying to benefit from shares of companies which for any reason have found themselves in a distressed situation. Reasons involve reorganisations, bankruptcies or other restructurings. The fund may go long or short and investments could be of many types, including corporate debt, stocks and warrants. Leverage may also be used.
- Event-Driven Multi Strategy – Strategy trying to benefit from mispricing arising before, during or after significant transactional events. These could involve mergers and acquisitions, share buybacks, recapitalisations and financial distress situations. Funds may use both short and long positions in stocks, debt securities and options. Leverage is also typical for this strategy.
- Merger Arbitrage – A similar strategy to the Event-Driven Multi Strategy, however this one focuses merely on mispricing occurring around mergers or takeovers.

Directional Strategies

- Emerging Markets – Strategy trying to benefit from investments in emerging markets usually the less-developed countries, by investing in debt or equity. Usually, short selling is not possible in these markets which makes effective hedging difficult to obtain and volatility is also higher, which makes the strategy riskier than some other hedge fund strategies.
- Global Macro – Strategy trying to benefit from global economic movements caused by for example shifts in government policies or shifts in global supply and demand for resources. Funds making use of this strategy may use any financial instruments, invest in any major market and are often highly leveraged.
- Equity Long-Short – Strategy where the fund manager is trying to neutralise market risk. This strategy demands high stock picking skill and fund managers often make use of leverage. In spite of the name, the strategy at times could invest in other types of securities.

Arbitrage Strategies

- Convertible Arbitrage – Strategy trying to profit from buying convertible securities and shorting the common underlying stock. Doing this reduces the equity risk of the security.
- Equity Market Neutral – Strategy trying to benefit from mispricing of related securities, by making use of both short and long positions. This could mean investing in only one type of industry to try to become sector neutral.

- Fixed Income Arbitrage – Strategy trying to benefit from market inefficiencies in the bond market, which implies taking up short and long positions. Both corporate and government bonds can be used.

Table 2: Correlation of flows with excess returns by strategy

	Not lagged	Lagged 1 year	Lagged 2 years
Distressed Securities	-0.265[x]	0.250[x]	0.279[x]
Merger Arbitrage	0.028	-0.567***	-0.510***
Event-Driven Multi Strategy	-0.511**	-0.077	0.033
Event-Driven Group	-0.520**	-0.055	0.023
Emerging Markets	0.247[x]	0.045	-0.020
Equity Long-Short	-0.533***	-0.340*	-0.507**
Global Macro	0.541***	-0.111	0.103
Directional Group	0.645***	-0.392*	-0.023
Convertible Arbitrage	0.033	-0.107	-0.201
Fixed Income Arbitrage	0.138	0.200[x]	-0.297[x]
Equity Market Neutral	0.161	-0.054	-0.245[x]
Arbitrage Group	-0.236[x]	-0.234[x]	-0.148
HFRI Index	-0.013	-0.380*	0.075

Symbols indicate x 25 per cent; * 10 per cent,** 5 per cent, and *** 1 per cent significance levels

Table 3: Test 1 results for excess returns and asset flows

Panel A: Excess returns against asset flows (not lagged)

	Distressed securities	Merger arbitrage	Event-driven multi-strategy	Emerging markets	Equity long-short	Global macro	Convertible arbitrage	Fixed income arbitrage	Equity market neutral	Event-driven group	Directional group	Arbitrage group
Intercept	.0108	.0056	.0127	.0094	.0158	.0098	.0048	.0030	.0038	.0108	.0043	.0053
T stat	3.9552***	4.1003***	5.2677***	1.6054	4.8589***	3.5836	3.5496***	1.5278	4.3074***	5.256***	1.282	4.0496***
Beta	-5.74E-13	7.87E-14	-5.3E-13	1.38E-12	-3.5E-13	2.27E-13	4.21E-14	3.84E-13	1.35E-13	-2.9E-13	3.97E-13	-1.52E-13
T-stat	-.9507	.0985	-2.0599*	.8826	-2.1836**	2.2289	.1156	.4829	.5657	-2.1115*	2.9270**	-.8421
Adj R^2	-.0008	-.0825	.1997	-.0173	.2247 **	.2339	-.0821	-.0627	-.0552	.2101	.3679 **	-.0229

Symbols indicate: * 10 per cent,** 5 per cent, and *** 1 per cent significance levels

Panel B: Excess returns against asset flows (lagged 1 year)

	Distressed securities	Merger arbitrage	Event-driven multi-strategy	Emerging markets	Equity long-short	Global macro	Convertible arbitrage	Fixed income arbitrage	Equity market neutral	Event-driven group	Directional group	Arbitrage group
Intercept	.0077	.0069	.0095	.0093	.01266	.0085	.0060	.0027	.0038	.0079.	.0126	.0050
T stat	2.88411***	5.5989***	3.3084***	1.4912	3.6079***	2.7339**	3.5723***	1.3194	4.0953***	3.5609***	3.1771***	3.7775***
Beta	5.27E-13	-1.6E-12	-7.81E-14	2.57E-13	-2.09E-13	-4.15E-14	-1.32E-13	5.75E-13	-4.29E-14	-2.89E-14	-2.28E-13	-1.46E-13
T-stat	.8554	-2.2829**	-.2548	.1503	-1.1980	-.3716	-.3566	.6781	-.1806	-.1826	-1.4113	-.8000
Adj R^2	-.0229	..2598 **	-.0845	-.0887	.0350	-.0774	-.0784	-.0471	-.0877	-.0876	.0763	-.0309

Symbols indicate: * 10 per cent,** 5 per cent, and *** 1 per cent significance levels

Panel C: Excess returns against assets under management (lagged 1 year)

	Distressed securities	Merger arbitrage	Event-driven multi-strategy	Emerging markets	Equity long-short	Global macro	Convertible arbitrage	Fixed income arbitrage	Equity market neutral	Event-driven group	Directional group	Arbitrage group
Intercept	.00769	.0078	.0101	.0273	.0145	.0293	.0066	.0051	.0057	.0088	.0230	.0053
T stat	2.2787**	6.5359***	3.6315***	2.3197**	4.5307***	4.6334	4.5326***	2.0177*	5.5717***	3.9037***	3.4940***	4.5407***
Beta	2.02E-13	-4.9E-13	-2.48E-14	-1.12E-12	-5.38E-14	-1.8E-13	-7.98E-14	-2.93E-13	-2.0E-13	-1.36E-14	-6.7E-14	-3.81E-14
T-stat	.8554	-2.8536**	-.3438	-1.5725	-1.7784	-3.3030	-.8897	-.8442	-2.3147**	-.3548	-2.1213*	-1.1028
Adj R^2	-.0127	..3546 **	-.0728	.1018	.1426	.4326	-.0163	-.0226	.2511 **	-.0721	.2121	.0164

Symbols indicate: * 10 per cent,** 5 per cent, and *** 1 per cent significance levels

Table 4: Correlation between Jensen's Alphas and flows by strategy

	Not Lagged	Lagged 1 Year	Lagged 2 Years
Distressed Securities	-0.052	0.308[x]	0.185
Merger Arbitrage	0.134	-0.240[x]	-0.320[x]
Event-Driven Multi Strategy	-0.099	0.112	0.011
Event-Driven Group	-0.156	0.139	-0.001
Emerging Markets	0.051	-0.068	-0.186
Equity Long-Short	-0.314[x]	0.037	-0.270[x]
Global Macro	0.475**	-0.183[x]	0.108
Directional Group	0.512*[*]	-0.290[x]	-0.229[x]
Convertible Arbitrage	0.303[x]	0.099	-0.051
Fixed Income Arbitrage	0.159	0.239[x]	-0.327[x]
Equity Market Neutral	0.108	-0.043	-0.169
Arbitrage Group	-0.117	-0.125	-0.115
HFRI Index	-0.027	0.122	-0.331[x]

Symbols indicate x 25 per cent, * 10 per cent, and ** 5 per cent significance levels

Table 5: Test 2, results for Jensen's Alpha against asset flows and assets under management

Panel A: Jensen's alpha against asset flows (not lagged)

	Distressed securities	Merger arbitrage	Event-driven multi-strategy	Emerging markets	Equity long-short	Global macro	Convertible arbitrage	Fixed income arbitrage	Equity market neutral	Event-driven group	Directional group	Arbitrage group
Intercept	.0076	.0048	.0082	.0061	.0096	.0077	.0040	.0029	.0031	.00774	.0032	.0044
T stat	2.5896**	3.6980***	3.3246***	.8805	3.7492***	2.8561**	2.6245**	1.3067	3.2734***	3.4717***	.9570	2.9014**
Beta	-1.16E-13	3.5565	-9.0E-14	3.3E-13	-1.5E-13	1.88E-13	3.76E-13	4.98E-13	9.69E-14	-8.24E-14	2.79E-14	-8.6E-14
T-stat	-.1805	.4671	-.3444	.1756	-1.1459	1.8709*	.2926	.5582	.3776	-.5483	2.0665*	-.4086
Adj R^2	-.0804	-.0840	-.0727	-.0806	.0235	.1613	.0160	-.0559	-.0706	-.05686	.2010	-.0585

Symbols indicate: * 10 per cent,** 5 per cent, and *** 1 per cent significance levels

Panel B: Jensen's alpha against asset flows (lagged 1 year)

	Distressed securities	Merger arbitrage	Event-driven multi-strategy	Emerging markets	Equity long-short	Global macro	Convertible arbitrage	Fixed income arbitrage	Equity market neutral	Event-driven group	Directional group	Arbitrage group
Intercept	.0052	.0854	.0087	.0056	.0063	.0067	.0045	.00260	.0028	..0056	.0039	.0042
T stat	1.9002*	3.9284***	2.6500**	.7746	2.6938**	2.2228**	2.7077**	1.1351	3.1719***	2.6058**	2.3670**	2.6940**
Beta	6.84E-13	-6.41E-13	1.0E-13	-4.5E-13	1.42E-14	-6.66E-14	1.2E-13	7.78E-13	-3.25E-14	7.09E-14	-1.5E-13	-8.9E-14
T-stat	1.0748	-.6218	-3741	-.2250	.1222	-.6183	.3299	.8177	-.1412	.4655	-1.0048	-.4193
Adj R^2	.0128	-.0278	-.0772	-.0859	-.0894	-.0543	-.0802	-.0284	-.08893	-.0598	.0008	-.0738

Symbols indicate: * 10 per cent,** 5 per cent, and *** 1 per cent significance levels

Panel C: Jensen's alpha against assets under management (lagged 1 year)

	Distressed securities	Merger arbitrage	Event-driven multi-strategy	Emerging markets	Equity long-short	Global macro	Convertible arbitrage	Fixed income arbitrage	Equity market neutral	Event-driven group	Directional group	Arbitrage group
Intercept	.0060	.0068	.0079	.0241	.0093	.0273	.0054	.0056	.0049	.0069	.0158	.0048
T stat	1.9256	5.3329***	3.2238***	1.7293	3.8991***	4.8503***	3.6414***	1.9916*	4.4033***	3.1920***	2.5161**	3.4826***
Beta	1.60E-13	-3.8E-13	-1.1E-14	-1.19E-12	2.6E-14	-1.85E-13	-3.3E-14	-3.8E-13	-2.0E-13	-5.9E-15	-4.4E-14	-3.5E-14
T-stat	.6798	-2.1020**	-.1742	-1.4130	-1.1612	-3.7269***	-.3585	-.9861	-2.1010**	-.1610	-1.4714	-.8771
R^2	-.0432	.2082 **	-.0808	.0712	.0261	.4979 ***	-.0719	-.0021	.2080 **	-.0810	.0826	-.0181

Symbols indicate: * 10 per cent,** 5 per cent, and *** 1 per cent significance levels

Table 6: Yearly Jensen's Alpha by strategy and 14-year average performance

Per cent per year	1991	1992	1993	1994	1995	1996	1997	1998
Distressed Securities	1.80	1.14	2.09	0.11	0.02	1.17	0.47	-1.49
Merger Arbitrage	0.85	0.29	1.32	0.47	0.72	0.82	0.63	-0.23
Event-Driven Multi Strategy	1.27	0.87	1.62	0.33	1.19	1.30	0.52	-1.00
Event-Driven Group	1.31	0.76	1.67	0.30	0.64	1.10	0.54	-0.91
Emerging Markets	2.15	1.00	4.47	0.50	-2.57	1.52	-0.45	-5.32
Equity Long-Short	2.11	1.03	1.51	0.01	0.35	0.73	0.55	0.17
Global Macro	2.31	1.55	2.92	-0.45	2.16	0.21	0.30	-0.37
Directional Group	2.19	1.20	2.97	0.02	-0.02	0.82	0.13	-1.75
Convertible Arbitrage	0.84	0.88	0.90	-0.47	0.61	0.56	0.40	-0.23
Fixed Income Arbitrage	0.44	1.15	1.12	0.65	0.93	0.66	0.12	-1.64
Equity Market Neutral	0.92	0.41	0.37	-0.14	0.53	0.77	0.50	0.11
Arbitrage Group	0.73	0.81	0.80	0.01	0.69	0.66	0.34	-0.59
HFR Index	0.23	1.95	1.34	1.94	-0.66	1.52	1.71	1.05

	1999	2000	2001	2002	2003	2004	Average 1991- 2004
Distressed Securities	0.66	-0.09	0.92	0.74	1.75	0.96	0.73
Merger Arbitrage	0.65	0.97	0.18	0.10	0.36	0.04	0.51
Event-Driven Multi Strategy	1.06	0.17	1.04	0.36	1.39	0.59	0.76
Event-Driven Group	0.79	0.35	0.71	0.40	1.16	0.53	0.67
Emerging Markets	2.89	-0.86	1.41	1.20	2.20	0.93	0.65
Equity Long-Short	1.98	0.51	0.23	0.22	1.06	0.09	0.75
Global Macro	0.50	-0.52	0.28	0.55	1.42	0.07	0.78
Directional Group	1.13	0.52	0.70	0.80	1.42	0.45	0.76
Convertible Arbitrage	0.58	0.80	0.72	0.83	0.77	-0.08	0.51
Fixed Income Arbitrage	0.11	-0.21	0.25	0.43	0.62	0.31	0.35
Equity Market Neutral	0.17	0.70	0.08	-0.07	0.04	0.13	0.32
Arbitrage Group	0.29	0.43	0.35	0.40	0.48	0.12	0.39
HFR Index	0.19	1.69	0.53	0.45	0.11	1.51	0.97

Table 7: Correlation between multi-factor alpha and asset flows by strategy.

	Not Lagged	Lagged 1 Year	Lagged 2 Years
Distressed Securities	0.002	0.182	0.097
Merger Arbitrage	0.233[x]	-0.215[x]	-0.365*
Event-Driven Multi Strategy	-0.513**	-0.197[x]	-0.298[x]
Event-Driven Group	-0.359*	-0.031	-0.140
Emerging Markets	-0.130	-0.010	-0.216[x]
Equity Long-Short	-0.572***	-0.395*	-0.654***
Global Macro	0.258[x]	-0.151	0.377*
Directional Group	0.511**	-0.548***	0.065
Convertible Arbitrage	-0.147	-0.421**	-0.528**
Fixed Income Arbitrage	-0.280[x]	0.151	-0.463**
Equity Market Neutral	0.199[x]	-0.014	-0.094**
Arbitrage Group	-0.204[x]	-0.215	-0.125
HFRI Index	0.388*	-0.362*	-0.010

Symbols indicate [x] 25 per cent, * 10 per cent, ** 5 per cent, and *** 1 per cent significance levels

Table 8: Test 3 results for multiple alpha against asset flows and assets under management

Panel A: Multiple alpha against asset flows (not lagged)

	Distressed securities	Merger arbitrage	Event-driven multi-strategy	Emerging markets	Equity long-short	Global macro	Convertible arbitrage	Fixed income arbitrage	Equity market neutral	Event-driven group	Directional group	Arbitrage group
Intercept	.7199	-.2197	1.2218	.6095	1.2761	.5046	.8877	.9171	.5653	.5703	-.0665	.4909
T stat	5.1460***	-.2647	7.5759***	1.0972	5.2945***	2.0233*	4.9367***	4.7620***	4.0951***	4.7615***	-.1566	4.1666***
Beta	2.49E-13	7.61E-10	-3.6E-11	-6.77E-11	-2.9E-11	8.61E-12	-2.07E-11	-7.5E-11	2.62E-11	-1.12E-11	3.5E-11	-1.18E-11
T-stat	.0081	1.5736	-2.0691**	-.4545	-2.4186**	.9258	-.5139	-1.0119	.7036	-1.3342	2.0587**	-.7209
Adj R^2	-.0833	.1020	.2015 **	-.0650	.2717 **	-.0111	-.0600	.0018	-.0404	.05661	.1994 **	-.0384

Symbols indicate: * 10 per cent,** 5 per cent, and *** 1 per cent significance levels

Panel B: Multiple alpha against asset flows (lagged 1 year)

	Distressed securities	Merger arbitrage	Event-driven multi-strategy	Emerging markets	Equity long-short	Global macro	Convertible arbitrage	Fixed income arbitrage	Equity market neutral	Event-driven group	Directional group	Arbitrage group
Intercept	.6641	.6630	1.0489	.5370	1.2504	.5462	.9331	.6904	.5811	..4582	.8410	.4627
T stat	4.6623***	3.9942***	5.5949***	.9007	5.7829***	1.9953*	5.7350***	3.8642***	3.8304***	3.4700***	2.1190*	3.9760***
Beta	2.02E-11	-6.81E-11	-1.34E-11	-5.61E-12	-5.6E-12	-4.98E-12	-5.5E-11	3.76E-11	-1.81E-12	-9.7E-13	-3.5E-11	-1.18E-11
T-stat	.6146	-.7285	-.6675	-.0342	-2.7362***	-.5055	-1.5385	.5059	-.0460	-.1035	-2.1724*	-.7309
Adj R^2	-.0547	-.0407	-.0484	-.0908	.3329 ***	-.0662	.1026	-.0661	-.0907	-.0899	.2366	-.0404

Symbols indicate: * 10 per cent,** 5 per cent, and *** 1 per cent significance levels

Panel C: Multiple alpha against assets under management (lagged 1 year)

	Distressed securities	Merger arbitrage	Event-driven multi-strategy	Emerging markets	Equity long-short	Global macro	Convertible arbitrage	Fixed income arbitrage	Equity market neutral	Event-driven group	Directional group	Arbitrage group
Intercept	.6670	.8716	1.1572	1.4867	1.0729	1.3091	1.0097	1.1346	.8390	.5033	1.5187	.5127
T stat	4.4230***	5.450***	6.6340***	1.2731	5.1963***	2.0137*	7.2741***	4.8589***	5.1200***	3.9537***	1.9109*	4.8865***
Beta	6.71E-12	-4.9E-11	-6.08E-12	-6.38E-11	-1.4E-12	-7.61E-12	-2.0E-11	-5.75E-11	-2.9E-11	-9.3E-13	-5.53E-12	-3.67E-12
T-stat	.5949	-2.1432*	-1.3480	-.9057	-2.0602**	-1.3240	-2.3661**	-1.7983*	-2.0830***	.-4284	-1.4608	-1.1888
R^2	-.0523	.2166	.0591	-.0140	.1997 **	.0548	.2613 **	.1466	.2044 ***	-.0670	.0802	.0308

Symbols indicate: * 10 per cent,** 5 per cent, and *** 1 per cent significance levels

Table 9: Summary of test results

	Excess returns			Jensen's alpha			Multifactor alpha		
Strategy	**Flows no lag**	**Lagged flows**	**Lagged assets**	**Flows no lag**	**Lagged flows**	**Lagged assets**	**Flows no lag**	**Lagged flows**	**Lagged assets**
Distressed Securities									
Merger Arbitrage		**	**			**			
Event-Driven Multi Strategy							**		
Event-Driven Group									
Emerging Markets									
Equity Long-Short	**						**	***	**
Global Macro						**			
Directional Group[1]	**						**		
Convertible Arbitrage									**
Fixed Income Arbitrage									
Equity Market Neutral			**			**			***
Arbitrage Group									

[1] – The directional group is significant at the 5 per cent level, but has the wrong sign. All other significant variables reported in the table have the correct sign.