The performance and diversification benefits of funds of hedge funds

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Abstract

We examine the performance and diversification potential of 332 funds of hedge funds (FOHFs) for the period from January 1990 to May 2003. Consistent with prior studies, we find that FOHFs appear to underperform the hedge fund index on a risk-adjusted basis. However, FOHFs have characteristics that offset their apparent underperformance. Their returns do not suffer from negative skewness that is a feature of many hedge fund strategies. In addition, we find that FOHFs have lower correlations (than the hedge fund index) with stock indices in both bull and bear markets, making them a better diversification tool in equity portfolios. For bond portfolios, however, FOHFs have no diversification advantage over hedge fund indexing.

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1. Introduction

The growth in funds of hedge funds (FOHFs), which are vehicles offering pooled investments in hedge funds, has been phenomenal in recent years. The number of FOHFs increased by 40 percent between 2001 and 2003,[1] and now comprises almost one-third of the $650 billion invested in hedge funds. The boom in hedge fund investment has been matched by a burgeoning academic literature on hedge fund performance. FOHFs have received less attention, and have mainly been studied as a sub-strategy of the hedge fund universe. They are, however, quite different entities from hedge funds, and we argue that they should be examined separately, for a number of reasons. *First*, relative to hedge fund managers, FOHF managers require a different set of skills. They are portfolio managers, and like active mutual funds must try to 'pick winners.' In order to do this, they sometimes go to extraordinary lengths. According to *The Economist*, FOHF managers "…not only tour the world assessing funds, but also might hire private investigators and delve into the private lives of hedge-fund managers (might that impending divorce be a distraction?)"[2] The FOHF industry claims several other advantages *vis-à-vis* investing directly in hedge funds. As well as diversification, FOHF managers claim ongoing monitoring of hedge funds, access to good funds that are closed to new investors, lower minimum investments and more flexible redemption policies. For these services, FOHFs charge a management fee and usually a cut of performance.[3]

Second, FOHFs are available to a wider range of potential investors than hedge funds. While most regulation around the world restricts direct investment in hedge funds to institutions and high net-worth individuals, recent changes to regulations in many countries have opened investment in FOHFs to retail investors.[4] Indeed, one of the claimed benefits of FOHFs is that small and moderately wealthy investors are able to

[1] *Financial Times* 29th October, 2003.
[2] *The Economist*, 18th September, 2003.
[3] The most visible FOHFs fees are management fees which are usually set at 1 percent of the total of assets under management and performance fees which are usually set at 10 percent of return. This is on top of standard hedge fund fees of typically 2 percent of assets under management and 20 percent of return (Jaffer, 2003).
[4] In the US, registered funds of funds are permitted to offer minimum investments as small as $25,000. In the UK, funds of funds are listed on the London Stock exchange, and many specifically target the retail market. Funds of funds are available to the retail public in Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Sweden and Switzerland, and in most of these countries there is no stipulated minimum investment amount (PriceWaterhouseCoopers, 2003).

participate in hedge funds without the risks associated with investing in only one or two. For this reason FOHFs should be subject to greater academic and regulatory scrutiny than hedge funds. *Third*, being portfolios of hedge funds, FOHFs may have different risk and return characteristics from hedge funds, and these characteristics are not well understood. Prior studies have concluded that the 'double fee structure' inherent in funds of funds (that is, the FOHF as well as the underlying hedge funds charge fees) offsets any diversification benefit, and that funds of funds underperform hedge funds on a risk-adjusted basis (Amin and Kat, 2003, Brown, Goetzmann and Ibbotson, 1999, Brown, Goetzmann and Liang, 2002, Kat and Lu, 2002)

Using data for 332 FOHFs for the period from January 1990 to May 2003, we find, in common with prior research, that FOHFs on average underperform hedge funds. There are, however, several features of FOHF returns that offset their apparent poor performance vis-à-vis hedge funds. FOHFs do not suffer from negative skewness to the extent that hedge funds do. While it has been found that combining hedge funds into portfolios does not reduce the negative skewness that tends to be a feature of hedge fund return distributions (Fung and Hsieh, 2002a), we show that most FOHF distributions are not negatively skewed. We also show that drawing inferences from averaging the skewness statistic across a large sample can lead to erroneous inferences about the true nature of skewness, because the distribution of the skewness statistic is itself non-normal. A second advantage of FOHFs vis-à-vis hedge funds relates to diversification benefits. Relative to the hedge fund index, FOHFs have lower correlations with equity indices, and therefore provide not only the benefit of diversification across hedge funds, but are valuable additions to equity portfolios. We do not, however, find that FOHFs have lower correlations with bond indices. A further benefit of FOHFs relates to the issue of asymmetric correlation. One of the apparent disadvantages of hedge funds as a portfolio tool is that correlations with other asset classes tend to increase during market declines and crashes. We find that including FOHFs in an investment portfolio ameliorates this problem. FOHFs have lower correlations with the S&P 500 compared to the hedge fund index in bull as well as bear markets. In contrast to previous studies of this issue, our data has a more complete set of bear market observations, covering the extended bear market of the early 2000s. Lastly, we argue that because FOHFs data are considerably more reliable than hedge fund data, the apparent underperformance reported in previous

studies may be exaggerated. This is because FOHF data do not suffer to the same extent as hedge fund data from survivorship, stale pricing and other data conditioning biases.

The remainder of our paper is structured as follows. In the next section we review the evidence on biases in hedge fund and FOHF data. In section 3, we describe the data set and present summary performance information for the sample. Section 4 examines skewness issues, and in section 5 we investigate the correlation structure of FOHFs with several standard asset class indices. In the final section we summarise the paper and conclude.

2. Biases in hedge fund and FOHF data

Most extant research has found that hedge funds exhibit superior performance on a risk-adjusted basis relative to standard asset classes such as equity and bonds (Ackerman, McEnally and Ravenscraft, 1999, Asness, Krail and Liew, 2001, Brown, Goetzmann and Ibbotson, 1999, and others). On the face of it, hedge funds in general earn excellent returns relative to the risk that they bear. It is becoming increasingly well understood, however, that research on hedge fund performance is hampered by several shortcomings. The main obstacle to gaining reliable insights into hedge fund performance is that the data suffer from several conditioning biases. Most of these biases result from the fact that hedge funds are largely unregulated, and thus (unlike mutual funds) are not required to report performance. Hedge funds report voluntarily to several commercial hedge fund data providers such as CSFB/Tremont, Hedge Fund Research (HFR), Managed Account Reports (now Zurich Capital Markets), and Van Hedge Fund Advisors. While most of these providers claim to control for *survivorship bias* by retaining the data on defunct and withdrawn funds in their databases and in their various performance indices, there are several related biases that are more difficult to correct. *Liquidation bias* occurs when underperforming funds withdraw from reporting in the lead up to their liquidation. Assuming liquidation follows poor or possibly catastrophically poor performance (a lá Long-Term Capital Management) the effect of this bias is clearly to overestimate hedge fund returns and underestimate their risk. *Termination bias* usually refers to funds that disappear through mergers and reorganisations, and *self-selection bias* is caused

by funds that cease reporting voluntarily or do not report at all. These biases have been estimated by various studies to lead to the overestimation of hedge fund returns in the range 1.4 to 3.4 percent annually (Amin and Kat, 2002a, Brown, Goetzmann and Ibbotson, 1999, Fung and Hsieh, 1997b, 2000, and Liang, 2001).

Many hedge funds hold assets for which regular arm's length market prices are not available, such as securities traded in illiquid markets, and over-the-counter products such as swaps. An additional bias results from the necessity for many hedge funds to estimate net asset value at month end. Kao (2002) argues that the 'marking to market' and 'marking to model' techniques used by hedge funds are questionable, and probably contribute to their apparent small return volatilities and low correlations with other asset classes. Asness, Krail and Liew (2001) argue that hedge funds have an incentive to 'smooth' their reported return series, and find that when returns are adjusted for stale prices, many of the return and diversification benefits of hedge fund investing disappear.

One explanation that is seldom advanced for the apparent underperformance of FOHFs is that their reported returns do not suffer to the same extent from these biases. Because FOHFs are clients of hedge funds, their returns reflect the full range of hedge fund performance, from the poor performers who eventually liquidate to the best outperformers. Survivorship and liquidation biases should be absent from the track record of an individual FOHF (Fung and Hsieh, 2002a), and because FOHFs are less likely to fail than hedge funds, the rate of attrition and therefore survivorship bias is lower. Fung and Hsieh (2000) estimate survivorship bias for FOHFs at 1.4 percent annually, and Amin and Kat (2002a) estimate it at 0.63 percent compared to 1.89 percent for hedge funds. In addition, FOHFs report more accurately than other categories of hedge funds, so the stale pricing bias is less in evidence in FOHFs relative to hedge funds (Liang, 2003). For all these reasons, FOHF data are more reliable than hedge fund data. Their apparent underperformance may not be explained by the double fee structure inherent in FOHFs, but rather on the overstatement of hedge fund returns together with underestimation of their risk.

Non-normality is being increasingly recognised as a feature of hedge fund return distributions (Agarwal and Naik, 2001, Amin and Kat, 2003, Fung and Hsieh, 1999,

and Lo, 2001), which are characterised by excess kurtosis, and generally speaking, negative skewness (Brooks and Kat, 2001, Lamm, 2003). The findings on skewness in FOHFs is mixed. Brown, Goetzmann and Liang (2002) find that FOHF returns for the period 1995 to March 2000 have greater left skewness (a mean of -0.307) than hedge funds (-0.126). Using the same data extended to May 2001, however, Kat and Lu (2002) find a much lower skewness for the FOHFs (-0.16), and Gupta, Cerrahoglu and Daglioglu (2003) report a similar skewness statistic of –0.17 for a constructed portfolio of 657 FOHFs.

3. Data and summary performance information

Data for this study were obtained from Hedge Fund Research, Inc. (HFR), who provided US dollar returns for 525 FOHFs, net of all fees and expenses, for the period from January 1988 to May 2003. Returns are monthly and represent the change in net asset value month to month. HFR data include both domestic (US) and offshore funds, and to avoid survivorship bias include defunct funds.[5] We use the 3-month T-bill rate as a proxy for the risk free rate of interest. The mean (median) fund age is 57 (45) months, and over half (53 percent) are less than 4 years old, with only 10 percent being more than 10 years old. As the hedge fund indices are available only from January 1990, we eliminate observations before this date. Due to data limitations we also remove funds less than 2½ years old, leaving a data set of 332 funds. The attrition rate for the sample is low. Of the 525 FOHFs in the data set, 14 had ceased reporting by March 2003.[6] Of these, 10 were older than 2½ years, leaving more than 70 percent of the defunct funds in the sample.

Indices

HFR produces an equally weighted composite FOHF index comprising funds of various ages and asset sizes. It also produces 4 equally-weighted sub-indices: *conservative*, *diversified*, *market defensive* and *strategic*. A FOHF is classified as *conservative* if its constituent funds conduct market-neutral (low volatility) strategies.

[5] According to Ackerman, McEnally and Ravenscraft (1999), HFR began keeping data on funds that ceased reporting, in December 1992. This should not affect our findings unduly, however, because FOHFs were rare between January 1990 (the start of our data period) and December 1992.

[6] Some funds had missing observations for April and May 2003. We assume that these funds were simply late reporting their asset values rather than had ceased reporting.

Diversified funds invest in hedge funds with a variety of strategies, and are designed for minimal loss in down-markets and superior returns in up-markets. *Market defensive* FOHFs invest in short-biased hedge funds and are constructed to be negatively correlated with the returns on standard asset classes. Lastly, *strategic* funds invest in hedge funds with opportunistic strategies such as 'emerging markets,' and are expected to perform well in up-markets and underperform in down-markets. Seventy-four funds in our sample are classified as conservative, 153 are diversified, 34 are market defensive and 71 are strategic.

Table 1 presents descriptive statistics for the S&P 500, the HFR hedge fund weighted composite index ('hedge fund'), the FOF composite and the 4 sub-indices. Consistent with prior studies, the hedge fund index appears to generate higher returns (13.9 percent versus 10.9 percent) and lower volatility (a standard deviation of 7.22 percent compared with 15.25 percent) than the S&P 500. All the FOHF indices show lower annual average returns than the hedge fund index, offset by lower standard deviations for all of the sub-indices except for *strategic*. Relative to the hedge fund index, smaller average annual returns for FOHFs do not seem to be compensated by lower standard deviations. This is confirmed by the Sharpe ratios (column [9]) and Jensen's alphas (column [10]); for the FOHF composite index the alpha is about 60 percent the size of the alpha for the hedge fund index, and the comparable proportion for the Sharpe ratio is 70 percent. On this evidence, it appears that FOHFs underperform hedge funds on a risk-adjusted basis. As an indicator of the diversification benefits of FOHFs, however, the betas for the FOHF indices are smaller than for the hedge fund index, although all but the market defensive indices are significantly different from zero at standard levels. We return to the diversification issue in section 5.

Column [8] of Table 1 reports the results of the Jarque-Bera test for normality. For the FOHF indices, the null hypothesis of normality is rejected. The index return distributions all show significant excess kurtosis, but the findings for skewness differ. While the hedge fund index is significantly left-skewed, the FOHF composite is negatively skewed but not significantly so, and two out of four of the sub-indices are also not significantly skewed. This is consistent with Brooks and Kat (2001) who found that out of 5 FOHF indices from different data providers, 4 were not

significantly skewed. The apparently inferior risk-return tradeoff amongst FOHFs may therefore be at least partially offset by fewer small or negative values.

Individual FOHFs

Table 2 presents average summary statistics and performance measures for the 332 FOHFs. It is perhaps instructive to compare the mean FOHF findings with those for the hedge fund index reported in Table 2. The FOHFs earn an average return of 9.48 percent with an annualised standard deviation of 7.76 percent, compared to a 13.94 percent return with a standard deviation of 7.22 percent for the hedge fund index. FOHFs on average underperform and at the same time appear to be riskier than the aggregate hedge fund index. Kat and Lu (2002) report similar findings, and argue that this may be the result of the 'double fee' structure, but may also be due to under-diversification on the part of FOHF managers.

The mean Sharpe ratio for the full sample is 0.27, which is the same as the Sharpe ratio for the FOHF composite index reported in Table 3. All of the significant alphas – 56 percent of the sample – are positive. Six percent of the alphas are negative, but the majority fall between 0 and 1. These figures show performance that is superior to the FOHFs sub-sample in Capocci and Hubner (2004), who used data for the period January 1994 to June 2000. They report a much lower Sharpe ratio of 0.12, and a smaller proportion of significantly positive alphas (20 percent). This is probably because our data set extends an additional 3 years to May 2003 – a period of unusually low benchmark interest rates in the US. The average beta for the sample is a small 0.14, but the majority of FOHFs (67 percent) demonstrate a significant (if weak) relation to the S&P 500.

The lower part of Table 2 presents the summary statistics for the FOHFs separated into the four sub-strategies. The average returns and standard deviations for the conservative, diversified and market defensive sub-strategies are comparable to the statistics for the equivalent indices. For the strategic sub-strategy, however, the average return is much lower than the strategic sub-index and the standard deviation

much higher.[7] The Sharpe ratios and alphas are higher and the betas lower than for the equivalent indices for the conservative, diversified and market defensive sub-strategies.

Performance relative to the hedge fund index

As FOHFs are essentially actively managed portfolios of hedge funds, it is perhaps appropriate to compare their performance to an index of hedge funds rather than to the return on a risk-free asset or to the S&P 500, just as in assessing mutual fund returns we would compare their performance to a benchmark stock market index. Have any of the FOHFs consistently and significantly outperformed their peers over time? In addition to the data bias problems discussed in section 2, there are two issues to be borne in mind when using the hedge fund index as a performance benchmark. *First*, the various hedge fund data providers construct indices differently, and broad-based indices will reflect trends in hedge fund investing (Fung and Hsieh, 2002a). *Second*, for this comparison to be meaningful, it is important that index products are available so that a representative sample of hedge funds can be 'passively' held. There are unique problems that make it difficult for fund managers to accurately track an index. Indexing is associated with inherently large tracking error because indices may contain funds that are closed to new investors, and as a result of barriers to rebalancing such as redemption restrictions (Fung and Hsieh, 2002a). Acknowledging these problems, and recognising that indexing is a potentially popular route to hedge fund investment, CSFB/Tremont introduced an investable hedge fund index in July 2003. This index is weighted, and it includes only funds that have no lock-up period, are accepting new investments, and allow frequent redemptions.[8] Unfortunately, the investable index is available only from January 2000 onward, and therefore has too short a performance history to be used in this analysis. As a proxy we use HFR's weighted hedge fund index.

[7] To check for errors, we double-checked out calculations for the strategic funds. They are not over-represented in the newer funds which have been removed from the sample (they represent 21 percent of the deleted young funds), nor are these young strategic funds particularly good performers (the average annual return for these 37 funds is 5.68 percent, which is even lower than that for the included strategic funds of 8.05 percent). They are also not over-represented in the defunct funds (of which they comprise 20 percent). This issue is the subject of future research.

Table 3 breaks down the mean monthly excess return for each FOHF into the number greater than and less than the mean, and within standard deviation intervals either side of the mean. Figure 1 is a histogram of mean monthly excess returns. The majority of observations (55 percent) are lower than the zero mean, with 44 percent of the sample within one standard deviation below the mean. Clearly, a large proportion of the sample slightly underperforms the hedge fund index. However, almost a third (31 percent) of the sample lies within one standard deviation to the right of the mean; a significant proportion of FOHFs slightly *outperform* the hedge fund index, despite their 'double fee' structure. Impressive outperformers (12 funds with average returns greater than 2 standard deviations above the mean) outnumber very poor performers (6 funds with average returns less than 2 standard deviations below the mean) at a ratio of 2 to 1.

Few FOHFs, however, earn statistically significant excess returns. Only 22 funds (6.6 percent) significantly outperform the hedge fund index, while 29 (8.8 percent) significantly underperform. The apparent difference between the proportion of the sample found to be significant versus the count of positives and negatives is due to the varying time frames for the sample FOHFs. Figure 2, which plots excess returns against fund age, shows that the best outperformers tend to be amongst the younger funds. An interesting feature of the FOHFs' relative performance visible in the figure is the narrowing of dispersion around the mean as the funds age. There are two possible explanations for this. FOHF management techniques may have improved over time, in which case the newer funds' relative returns reflect this better performance. A more plausible explanation is that the young funds' impressive return histories may not be sustainable. It appears from the figure that over the longer term, FOHFs tend to revert to a performance level that mimics the hedge fund index less the second layer of FOHF fees. Alternatively, the apparent underperformance of the older funds results from a compounding of the biases found in hedge fund data that are much less evident in FOHF data.

[8] More and complete information about the construction of the investable index is available on the CSFB/Tremont website at www.hedgeindex.com.

4. Skewness

Table 4 presents the findings on the extent of return non-normality for the FOHFs. It reports Jarque-Bera statistics, skewness and kurtosis for the full period. In order to test for stability of skewness through changing stock market conditions, the table includes mean and proportion-of-sample summary information separated into two periods: *boom*, which runs from January 1990 to the high point of the stock market August 2000 (128 months), and *bust*, from September 2000 until the end of the data period in May 2003. More than two-thirds of the FOHFs (229/332 cases or 69 percent) have significantly non-normal return distributions according to the Jarque-Bera statistic. This is a smaller proportion than reported for hedge funds by Amin and Kat (2003), who found that 86 percent of their sample of 77 hedge funds had significantly non-normal return distributions.[9] Almost all the FOHFs (331/332) have return distributions with significant excess kurtosis. The findings on skewness are more varied. The mean (median) skewness statistic is –0.12 (0.01), which is considerably higher than the skewness of the hedge fund index of –0.62. The average FOHF appears to exhibit less negative skewness than the hedge funds index.

A closer look at the distribution of the skewness statistics reveals more interesting information. Skewness is significant in only half the sample (177 or 53 percent), and these significantly skewed FOHFs exhibit both positive and negative skewness in almost equal measure. Ninety-one (51 percent) are negatively skewed and 86 (49 percent) are positively skewed. Figure 3, which is a histogram of the skewness statistics, shows that the distribution is highly non-normal, with a long left tail. However, there is also a bunching of observations just to the right of the mean. The few negative outliers would have the effect of reducing the mean, outweighing the many funds with small positive skewness.

For the sub-strategies, skewness appears to be most evident amongst the conservative FOHFs: 58 percent are significantly skewed and most of these – 36 or 84 percent – are negatively skewed. However, as with the full sample, mean skewness statistics do not paint the full picture of the sub-strategy's asymmetry. Figure 4, which is a histogram of the skewness statistics for the conservative FOHFs, shows even greater

[9] Amin and Kat (2003) state that their sample is highly skewed but do not report skewness statistics.

evidence of non-normality than the distribution of skewness statistics for the full sample. While there are several negatively skewed conservative funds, the spikes to the right of the mean show that many exhibit the advantage of positive skewness. It is clear that making inferences from cross-sectional means of skewness – the approach that is usually taken in large-sample hedge fund studies – can lead to erroneous conclusions about hedge fund return outcomes.

For the 'boom' years, the skewness advantage of FOHFs vis-à-vis hedge funds stands. Mean skewness for the FOHFs remains generally lower than that of the hedge fund index, and the proportions significant and significantly negative are similar to the figures for the full period. In contrast, the skewness advantage of FOHFs appears to erode during the largely bear years of the early 2000s. For the 'bust' period, mean skewness is lower, and the proportion of skewness statistics significantly negative is higher, indicating greater left-skewness for the FOHFs than for the hedge fund index. However, while skewness for the FOHFs may be more negative on average, the proportion significant is lower than for the full period. This pattern of skewness statistics across the sample during the 'bust' years is consistent with a small number of funds reporting large negative returns. Clearly for some FOHFs, the constituent hedge funds perform very poorly during market downturns. The apparent reduction of the skewness benefit post-August 2000 may, however, be an artefact of reporting differences between hedge funds and FOHFs. Due to liquidation bias, some observations that would be in the left tail of hedge fund distributions are absent. Because FOHFs are less susceptible to such data conditioning biases, their data more fully reflects the poor performance of dying or failed hedge funds during troubled times.[10]

5. Diversification benefits

One of the main claims of the hedge fund industry is that their strategies yield returns that have low correlations with standard asset classes. This issue has received

[10] Hedge fund failure probably did increase during the bear market post-2000. Although actual failures and closures are seldom made public, the number of hedge funds reporting their performance to data providers decreased. This was particularly so during 2002. The magazine *Hedge Funds Review* (www.hedgefundsreview.com) reported that between year-end 2001 and 2002, the number of funds disclosing their results to CSFB/Tremont declined by 17.8%.

considerable empirical attention. Generally speaking, correlations between the returns of hedge funds and standard asset classes are small (Brooks and Kat 2001, Brown, Goetzmann and Ibbotson, 1999, Kat and Lu, 2002, and others). This low correlation benefit may disappear, however, when portfolios of hedge funds are formed. Fung and Hsieh (2002a) found that there is a much lower correlation between standard asset class indices and individual hedge funds than between asset class indices and hedge fund indices. They conclude that diversification amongst hedge funds – which may be advisable from the point of view of limiting exposure to any one hedge fund or hedge fund strategy – reduces the diversification benefit of hedge fund investing.

The professional literature (see, for example, Jaffer 2003) places considerable emphasis on the diversification potential of FOHFs. An important issue for hedge fund investors, therefore, is whether FOHFs have the same diversification disadvantage that appears to come about when a portfolio of hedge funds is constructed. Alternatively, are FOHF managers able to retain the low correlation benefits of individual hedge funds when constructing their funds? Table 5 presents the correlation matrix. As well as the hedge fund and FOHF indices, the correlation matrix includes 3 equity indices; the S&P 500, the S&P emerging markets index, and the Datastream world ex-US index, and 3 bond indices compiled by Lehman; the aggregate US bond index, the US treasury index and the G7 long treasuries index. The correlations between the hedge fund index and the equity indices are 0.70, 0.76 and 0.61 for the S&P 500, emerging markets and world ex-US indices respectively. The correlations between a large hedge fund portfolio – in this case the HFR hedge fund weighted index – and equities are indeed high. The correlations between the FOHF composite and the equity indices are, in contrast, between 20 and 40 percent lower. In addition, the correlations with the 3 equity indices for all of the sub-indices are lower than the equity indices with the hedge fund index. This confirms that FOHFs offer better diversification benefits when combined into an equity portfolio compared to the hedge fund index. In contrast, the correlations for the hedge fund and FOHF composite indices with the 3 bond indices are similar, and very small. For the US treasuries index, the correlation with the hedge fund index is zero and the correlation with the FOHF composite is 0.03. The correlations between the US bond index and the hedge fund and FOHF indices are the same at 0.09, and very close for

the G7 long treasury index at 0.12 and 0.13. It is clear that bonds offer tremendous diversification potential for hedge fund investors, but this can be achieved equally well by indexing or via investing in FOHFs.

FOHFs and asymmetric correlation

The key claim of the hedge funds industry is that hedge funds earn 'absolute returns' – that is, they yield positive returns irrespective of the state of the market. The academic evidence, however, does not support this claim (Edwards and Caglayan, 2001, Liew, 2003), although hedge funds tend to perform less poorly than stocks during bear markets. It is increasingly recognised that hedge funds have asymmetric correlations with standard asset classes; in particular, correlations tend to increase in times of financial market crisis. Lo (2001) notes that this phenomenon – what he calls 'phase-locking' – became particularly apparent in the aftermath of the Russian crisis in 1998.

We use two techniques to examine the extent of asymmetric correlation between FOHFs and the S&P 500. We first follow Edwards and Caglayan (2001), who compute correlations between hedge fund indices and stocks during bull versus bear months. Bull (bear) markets are defined as those in which the S&P 500 rises by 1 percent or more (falls by 1 percent or more) in a month. Table 6 presents the findings on bull and bear returns and correlations for the hedge fund and FOHF indices. For our sample period, January 1990 to May 2003, there were 85 bull months and 50 bear months. Hedge funds on average underperform the stock market in bull markets, with the average annualised return on the S&P 500 in bull markets (50.00 percent) nearly double that of the hedge fund index (27.30 percent). This bull market underperformance, however, is offset by far superior returns in bear markets: the hedge fund index earns an average annualised return of –7.80 percent, which is less than one-fifth the size of the mean annualised losses of –50.59 percent for the S&P 500. Comparing the hedge fund index with FOHFs, a similar pattern emerges: FOHFs underperform hedge funds in bull markets (16.47 percent versus 27.30 percent) but are subject to lower negative returns in bear markets (-1.24 percent versus -7.80 percent). This finding is consistent with the argument that FOHFs are structured to be closer to market-neutrality than the average hedge fund.

The correlations for the FOHF indices during bull markets are close to zero, and much lower than the correlation for the hedge fund index at 0.18. Correlations clearly increase during bear markets. The hedge fund index exhibits the highest correlation in both bull and bear markets, and increases by almost 0.4 from 0.18 to 0.67 from bull to bear. Similar increases are apparent for the sub-strategy indices, and the largest increase is from 0 to 0.56 for the strategic index. On this evidence, FOHFs are a better diversification tool during both bull and bear markets than hedge funds, providing evidence in support of the FOHF industry's claim that they have significant diversification benefits.

In order to corroborate these findings we follow Lo (2001), who amends the standard CAPM regression equation to examine asymmetric sensitivity to the market:

$$R_{it} = \alpha_i + \beta_i^+ \Lambda_t^+ + \beta_i^- \Lambda_t^- + \varepsilon_{it} \qquad [1]$$

where R_{it} is the return on index i at time t, α_i is the intercept, β_i is sensitivity to the market, ε_{it} is the idiosyncratic risk of index i a time t, and Λ_t is the return on the market index (S&P 500) at time t, with

$$\Lambda_t^+ = \begin{cases} \Lambda_t \text{ if } \Lambda_t > 0 \\ 0 \text{ otherwise} \end{cases} \qquad [2a]$$

$$\Lambda_t^- = \begin{cases} \Lambda_t \text{ if } \Lambda_t < 0 \\ 0 \text{ otherwise} \end{cases} \qquad [2b]$$

The results of these regressions with i equal to the hedge fund and FOHF indices can be found in Table 7. The hedge fund index, with a $\hat{\beta}^+$ of 0.18, is the only index for which $\hat{\beta}^+$ is significant at standard levels. Even in bull markets, therefore, the hedge fund index is significantly correlated with the S&P 500. This is not the case for the FOHF indices, where the absence of a significant relation between the FOHF indices and the S&P 500 confirms the superiority of FOHFs over the hedge fund index as an aid to diversification in bull markets. In bear markets, all but the market defensive $\hat{\beta}^-$ become highly significant, and the $\hat{\beta}^-$'s are all significantly larger (at the 1 percent

level, using a paired t-test) than the bull market betas. The hedge fund index has by far the highest $\hat{\beta}^{-}$ at 0.53, which is almost double that for the next highest $\hat{\beta}^{-}$ of 0.28 for the strategic index.

The hedge fund index is significantly positively related to the stock market in both bull and bear markets. Relative to the hedge fund index, however, FOHFs offer lower correlations with the market. In bull markets, the FOHF correlations with the S&P 500 are close to zero, and in bear markets the correlations remain considerably lower than those for the hedge fund index. These findings offer support to claims by the industry that FOHFs offer diversification benefits, and that FOHFs are constructed with this feature paramount. For equity portfolios, FOHFs clearly provide a better means of diversification than indexing.

6. Summary and conclusions

Using data for 332 funds for the period from January 1990 to May 2003, we examine the performance and diversification potential of funds of hedge funds. Consistent with prior studies, we find that the FOHF composite index and the indices for the sub-strategies appear to underperform the hedge fund index on a risk-adjusted basis. Mean figures for the full FOHF sample are comparable. These sorts of findings are usually explained by the 'double fee' structure inherent in FOHFs. However, it is increasingly well recognised that FOHF returns do not suffer to the same extent from several well-recognised data conditioning and other biases, and this may, at least to some extent, account for the FOHFs' apparent poor performance.

We find that FOHFs have valuable features vis-à-vis hedge funds. Their returns do not suffer to the same extent from the negative skewness that characterises the return distributions of hedge funds. Only half of the sample shows significant skewness in their returns series, and the significantly skewed cases are split 50/50 positive and negative. The skewness advantage appears to have disappeared since the start of the bear market August 2000. This, however, may be an artefact of liquidation bias in hedge fund data – a data conditioning bias that is largely absent from the returns series of FOHFs. Our analysis of skewness also underlines the importance of looking

more deeply into the distributional characteristics of alternative investment returns before making strong conclusions about their non-normality.

In addition, we find that FOHFs are useful in a portfolio context. They do not show the rise in correlation with standard asset classes when combined into portfolios that was demonstrated by Fung and Hsieh (2002a) for hedge funds. The correlations between FOHF indices and equity indices are considerably lower than correlations between equity indices and the hedge fund index. Further, FOHFs exhibit lower correlations with the S&P 500 in both bull and bear markets. For bond portfolios, it is clear that hedge fund products offer excellent diversification potential; both the hedge fund and the FOHF indices have low correlations with bond indices. In contrast to our findings on equity, however, FOHFs do not offer superior risk-reduction potential *vis-à-vis* hedge funds.

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