
Hedge funds: A summary of the literature

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Abstract The authors survey numerous hedge fund studies related to their institutional, historical and performance characteristics; their purpose and effectiveness in achieving balanced portfolios and the relationship of returns to manager skill, style, size and other characteristics. Also, a survey of statistical difficulties frequently encountered in evaluating databases of companies specialising in hedge funds including survival, selection and other biases; management selection methods and statistical methodologies used in asset selection for hedge funds and fund of funds is addressed.

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Introduction

The term ‘hedge fund’ was first used in 1949 by Alfred Winslow Jones to describe a private investment partnership whereby he ‘hedged’ the risk of his fund by purchasing undervalued stocks and shorting overvalued stocks.^{1,2} Jones created a market-neutral fund; by gearing his position, he was able to outperform the average US equity mutual fund.^{3,4} With the speculative attack by George Soros on the British pound in 1992 and the collapse of long-term capital management (LTCM) in 1998, hedge funds have received a great deal of coverage in professional and in academic journals.

Considered as absolute return and alternative investment vehicles, hedge funds have certain characteristics that mutual funds do not have at their disposal. The general approach traditionally

used by hedge fund managers is to find and invest in funds that have low or negative correlation with traditional stock, bond and currency markets. By offsetting market movements, hedge funds can improve a portfolio’s risk-return relationship and decrease kurtosis,^{5,6} especially during periods of negative equity returns.^{7,8} Traditional asset classes such as stocks and bonds offer lower diversification advantages and tend to be highly correlated with US equity markets.⁹

Participation in hedge funds is restricted to high net-worth individuals and to institutional investors such as foundations, life insurance companies, endowments and investment banks. Unlike other traditional investments such as mutual funds, hedge funds are not currently regulated by the Securities Act of 1933 and are not required to disclose their positions. The US Court of Appeals has also recently invalidated the Securities and Exchange Commission’s (SEC) attempt to regulate hedge funds under the Investment Advisers Act of 1940. Onshore funds are limited to accredited or sophisticated investors with a net worth exceeding \$1m, but a fund of

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hedge funds (a basket of hedge funds) is not as restrictive. Hedge fund managers are paid an incentive fee based on performance, whereas mutual fund managers are compensated for the amount of assets they gather from investors.

Hedge funds are perhaps viewed as illiquid, absolute private investment vehicles that take advantage of price inefficiencies and market trends in financial markets. According to the Investment Advisers Act of 1940 and the Securities Exchange Act of 1934, private investment pools such as hedge funds are restricted to a maximum of 499 investors and are not able to issue public securities. Many hedge funds, however, form offshore funds as a mirror image of their onshore funds to attract additional investors.

Rather than comparing themselves to a benchmark, hedge funds typically focus on absolute returns in all market conditions.^{10,11} If the hedge fund's strategy is to uncover assets possessing low correlation to stock markets, the fund is labelled 'non-directional' (ie market-neutral and event-driven), while a strategy having high correlation to stock markets is 'directional' (ie global macro, long only and short sellers).¹² Brunel¹³, however, prefers to describe them as 'absolute return' or 'semi-directional' strategies.

Size of industry

How large is the hedge fund industry? The number of hedge funds and the total amount of capital under management is considered problematic. Hedge funds are unregulated, and no official government sources of data exist, thereby forcing investors to rely on private database vendors. Hedge funds typically display a higher attrition rate than mutual funds, as reported by Malkiel and Saha¹⁴, Brown *et al.*¹⁵ and by Liang,¹⁶ while some hedge funds have no communication with any database vendors. Chadha and Jansen⁴ observe that over 50 per cent of hedge funds refrain from submitting monthly performance figures to database vendors. Data in the hedge fund industry is collected on a monthly basis by database vendors such as ZCM/CISDM, HFR and TASS. All returns provided to the vendor are net of all management and performance fees.

Estimates of the number of hedge funds differ: Goldman Sachs and FRM¹⁷ estimates that there are more than 3,500 hedge funds in 1999, while Van Hedge¹⁸ finds approximately 5,800 in existence with nearly \$300bn under management. The President's Working Group on Financial Markets¹⁹ provides a range of 2,500–3,500 hedge funds existing in July 1998, and managing capital of \$250bn. It is very difficult to come to an exact conclusion, but when taking into account overlap, survivorship bias and non-reporting bias, there may be upwards of about 5,500 hedge funds in existence at June 2006 with \$1.3 tn of capital under management.²⁰

What is certain is that both the number of hedge funds and industry assets have increased dramatically over the last ten years, starting from about 140 funds in 1968.⁴ Stadlmann²¹ estimates total asset positions in the industry of around \$4 tn dollars at the end of 2001.

Fund characteristics, performance and allocation percentage

What has been the track record of hedge fund performance? Can they add value consistently? This is a crucial issue since some hedge funds have lock-up periods of up to two years and redemptions typically require a 30-, 60- or 90-day notice. Bares *et al.*²² find that persistence evaporates rapidly as the time-frame under investigation increases and further observe that absolute returns are sometimes unstable certain time periods. Amin and Kat⁵ observe that hedge funds do not offer a superior risk-return trade-off when non-normality is considered, while Fung *et al.*¹¹ determine that survivorship bias all but eliminates absolute returns. Brown *et al.*¹⁵ examine US offshore hedge funds for the period 1989–1995 and find no persistence; however, they attribute it to style differences among classifications and conclude that there is a lack of managerial skill in the industry. On the other hand, Brorsen and Harri,²³ use overlapping observations and find some support of performance persistence. Their study incorporates a longer time period and a larger dataset than the BGI and Agarwal and Naik²⁴ studies. Conversely, Agarwal and Naik¹² discover a reasonable amount

of persistence when examining quarterly hedge fund returns, but persistence decreases as the time interval increases.

Schneeweis²⁵ concludes that, on average, the volatility levels are more predictable than performance when investigating each hedge fund strategy and stresses that future performance is more dependable when using historical volatility than historical returns. He assumes that this may be due to (1) the long lock-up periods that somewhat prevents rebalancing, and (2) the majority of investors in hedge funds are institutions, pension funds and endowments, which have tendencies to be long-term investors. Schneeweis²⁵ concludes that, on average, the volatility levels are more predictable than performance when investigating each hedge fund strategy and stresses that future performance is more dependable when using historical volatility than historical returns. Several studies use factor analysis to group hedge funds by style, to investigate the performance within each classification.^{26–28}

Ackermann *et al.*²⁹ report that hedge funds do not always do better than stock market indices; however on a risk-adjusted return basis they outperform mutual funds. Their results suggest that hedge funds offer slight benefits as opposed to using index funds when risk-adjusted returns are considered, however, the low betas make hedge funds ideal for investor portfolios. AMR further determine that performance fees explain hedge fund performance. AMR further determine that performance fees explain hedge fund performance, but they do not find a significant relationship between performance and age, size. On the other hand Liang³⁰ observes a positive correlation with performance fees, fund assets, and lock-up periods, but a negative impact for age. Fung *et al.*¹¹ further observe that four factors explain hedge fund returns: management fees, fund size, fund age, and leverage.

Correlation

Fung and Hsieh³¹ find that hedge funds typically have low and in some cases negative correlation with traditional asset classes due to their dynamic strategies, and gearing as well as the constant

change in asset allocation. Diz³² demonstrates that a well-balanced portfolio consisting of alternative investment strategies can yield a lower level of volatility by using a combination of equities, commodities, futures and hedge funds than just equities. Agarwal and Naik³³ and Amin and Kat³⁴ further demonstrate that combining various alternative investments and passive indexing can result in a better risk-return trade-off than only investing in passive different asset classes.

Schneeweis and Kazemi^{35,36} and Schneeweis *et al.*³⁷ create optimised passive indices to investigate certain hedge fund strategies, but argue that non-normal returns create problems if mean-variance optimisation is used. Certain problems still persist when indices attempt to track or mimic a hedge fund universe, however equally-weighted indices can offer enhanced diversification.³⁸ Hedge fund strategies have low correlation with downturns in stock markets thereby minimizing downside risk, but in extreme negative market events their correlations increase significantly.^{7,31,39–43}

While there are isolated cases of high correlation among some hedge fund strategies, it is well-known that a majority of hedge fund strategies traditionally have low correlation among themselves. This has led Schneeweis and Kazemi³⁶ to praise the success of hedge funds to manager skill (alpha) and style selection. Within each hedge fund style, returns are determined by changes in the market environment and economic conditions, such as the adjustment of default spreads or the inherent volatility of a particular form of strategy.^{37,44}

Style analysis, manager skill and performance

Does the superior performance of hedge funds have a relation to investment activity, or to managerial skill? Fung and Hsieh⁴² find no persistence in hedge fund returns, suggesting that returns have no relation with managerial skill. Goldman Sachs and FRM¹⁷ also report that managerial skill has no relationship with performance, and that newly created funds outperformed well-known hedge funds. What about size? The results are mixed, with Van Hedge¹⁸ arguing that size is positively related to

performance, while Gregoriou and Rouah⁴⁵ find that performance of hedge funds and funds of hedge funds is not related to size. Agarwal *et al.*⁴⁶ determine that hedge fund size is influenced by past performance, but that larger size ultimately leads to inferior performance.

The heterogeneity of hedge funds has caused Brunel¹³ who finds it unwarranted to group hedge funds together, while Lo⁴⁷ labels hedge funds not as a separate and distinct asset class, but to a certain extent as a “mongrel category”. Fung and Hsieh^{31,42} use a multi-factor approach and Schneeweis and Spurgin⁷ use an extended Sharpe style analysis of eight classifications and five styles. The authors find that the five styles explain 45 per cent of hedge fund returns.

It is well-known that most hedge fund styles have negative skewness and high kurtosis. However, Kat⁴⁸ finds that managed futures possess positive skewness and less kurtosis than the majority of other hedge fund classifications. To account for non-linearity Brown and Goetzmann²⁸ use a Generalized Classification algorithm and find that classification differences add approximately 20 per cent of the cross-sectional variation in hedge fund performance. Bares *et al.*⁴⁹ further present evidence on the style uniformity of hedge funds, using hard and fuzzy clustering. Park and Staum⁵⁰ evaluate hedge funds by investigating the ratio of the manager’s alpha (skill) to the information ratio in order to avoid difficulties encountered with the Sharpe and Treynor/Black ratios.

Survival analysis

Kouwenberg⁵¹ lists four reasons funds may drop out of a database: (1) no further requirement to attract new capital, (2) poor performance, (3) assets are returned to investors and 4) bankruptcy. How large of a problem is it? Brown *et al.*⁵² document that 50 per cent of hedge fund managers disappear within 30 months, while only 4 per cent had been in business for ten years. Gregoriou⁵³ finds that the median survival lifetimes of all hedge funds from 1990 to 2001 is 5.51 years using the ZCM database. Liang⁵⁴ finds an average of 8.54 per cent of funds vanish each year (13 per cent in 1998 alone), while

Kouwenberg⁵¹ using ZCM data finds an average of 15 per cent that disappear.

According to BGP⁵², the probability of survival is affected by investment style, size beta, and style consistency. The authors further notice a relationship between historical performance and risk levels of a fund, a result consistent with the Brown *et al.* (BHS)⁵⁵ findings for mutual fund managers. Good performing hedge funds in the first half of the year usually decrease the volatility of their portfolios during the second half of the year, while poor performing funds in the first half of the year increase their volatility in the second half of the year.

Amin and Kat⁵⁶ divide the HFR database into four groups and observe that hedge fund size is related to survival, with the smaller funds dying more rapidly. They also confirm that geared funds have higher attrition rates when compared to non-geared funds. Furthermore, Amin and Kat⁵⁶ find that managers investing in their own fund did not have any impact on survival times. In the BHS study, the authors discover that excess volatility leads to fund closure and the newer the fund the more likely it is to drop out of the database.

Random walks, cointegration, market timing, and size

Gregoriou *et al.*⁵⁷ determine that all hedge fund classes except a market-neutral category followed a random walk, and that most classes display evidence of a significant positive drift. In their follow-up study, Gregoriou and Rouah⁵⁸ investigate the long-term relationships between the ten largest hedge funds in the ZCM/Laporte database and four stock market indices over a ten-year period. They find that three of the largest hedge funds were cointegrated with various market indices, while the remaining seven were not.

Gregoriou *et al.*⁵⁹ then investigate the security selection and market-timing abilities of 1,494 hedge funds during the 1990–2000 period. Using a multi-index model designed to measure market timing and security selection in mutual funds, they discover that nearly all hedge fund styles exhibit poor market-timing skills, but that the

majority possess good security selection abilities, a result consistent with the mutual fund literature. They also, however, find their results to be sensitive to the benchmark and market-timing model used. Within styles, they document evidence of a negative correlation between security selection and market-timing, but no correlation between returns and asset size or age. Gregoriou and Rouah⁶⁰ also examine the returns of funds of hedge funds from 1994 to 1999 and observe that size does not affect performance. On the other hand, Agarwal *et al.*⁴⁶ determine that they are first increasing, then decreasing returns associated with hedge fund size.

Data biases

The SEC restricts advertising by hedge funds; neither are they required to submit their returns to database vendors. This poses a problem for researchers, analysts, and academics who must understand the numerous sources of bias in the data^{29,44} such as: (1) Selection bias is present when returns are not an accurate representation of the hedge fund universe. (2) Instant history bias is present when vendors backfill monthly returns of new funds entering the database. (3) Survivorship bias occurs if poor performing funds are discarded from the database. (4) Termination bias exists when funds shut down or voluntarily cease from reporting their returns. (5) Multi-period sampling bias occurs when a hedge fund must have a sufficient amount of historical data before it can be added to the universe or sample.

The existence of such biases can considerably affect performance evaluation. Fung and Hsieh⁴² and Brown *et al.*¹⁵ have estimated that survivorship bias can explain the returns difference of 1.5–3 per cent per year. Fung *et al.*¹¹ also assert that survivorship bias is of sufficient scale to negate any absolute returns. Conversely, Ackermann *et al.*²⁹ maintain that survivorship bias and self-selection bias nullify each other. Self-selection bias frequently occurs when good performing hedge funds stop reporting their returns to database vendors in order not to attract additional capital that may actually hamper performance. For example, Tiger Management and the Soros Group of Funds experienced poor

performance and fund size may have been the culprit. They were analogous to supertankers that could never port due to their enormous size. Tiger, with \$18bn under management closed its doors in March of 2000, while Soros underwent restructuring and eliminated many of its funds and merged others. The once aggressive Soros approach to investing became more conservative.

Liang¹⁶ investigates survivorship bias and observes that the overlap of databases is approximately 65 per cent, and that the difference in returns of the live funds and the returns of all the funds surpassed 2 per cent per year.

Portfolio allocation of hedge funds

Numerous large pension funds are beginning to accept hedge fund allocations of 5–20 per cent within their portfolios.⁶¹ CalPers (USA), one of the world's largest pension funds has allocated nearly \$12bn of its \$160bn fund to hedge funds.⁶² According to Watson, Wyatt and Indocam,⁶³ European pension funds have increased their allocations to hedge funds by more than three-fold between 2000 and 2003. Endowment funds and institutional investors have also welcomed alternative investments with more eagerness than pension funds. This can be a result of the longer time frame of investing on the part of pension funds as well the liability of cash flow they require. The lock-up periods in the industry last one to three years thereby allowing a greater amount of management flexibility so the hedge fund manager's strategy can be executed without frequent interruptions and redemptions.

Sharpe⁶⁴ asserts that an allocation of 10–20 per cent of alternative investments is ideal for pension funds. Amin and Kat³⁴, find that optimum Sharpe ratios can be attained with a 10–20 per cent allocation to hedge funds within a traditional (S&P 500) portfolio. In a traditional stock and bond portfolio an optimal allocation of 20 per cent to hedge funds is consistent with Liew⁶⁵ and can augment the Sharpe ratio from 22.7 to 45.4 per cent.

Fees and hurdle rates

The fee structure and performance-based or incentive system of hedge funds are important

drivers for superior performance. Hedge funds typically charge a management fee of 2 per cent and a performance fee of 20 per cent on capital appreciation,⁴⁸ whereas funds of hedge funds usually charge a management fee of 1–2 per cent and a performance fee of 10 per cent. Most funds specify a ‘high water mark’ on their performance fees, assuring that in the event of poor performance, the fee will not be charged until prior losses are recuperated. Hurdle rates are intended to transmit a message of assurance to investors that their fund will experience high returns. Liang⁵⁴ suggests that hedge funds in the ZCM database with hurdle rates have outperformed those without.

Agarwal *et al.*⁴⁶ determine that money flows “chase” after good performance irrespective of high performance fees, but larger inflows are related with substandard future performance. They attribute this to a certain extent to a liquidity risk premium, since better performance is related with greater hindrance to capital withdrawals. Many managers habitually have money invested in their own funds, ensuring that their interests and those of their clients are better aligned (agency theory). The best performing funds set high standards that benefit investors, whereas underperforming funds are willing to lower their fees to attract more investors and increase their asset base. Numerous multi-manager hedge funds also charge front-load fees in addition to their management and performance fees.

Funds of hedge funds

Investors find that the selection of individual hedge funds is a risky, arduous and a burdensome task. However, investors can simply purchase into a ‘fund of hedge funds’ and obtain sufficient and instant portfolio diversification with less capital than directly investing into hedge funds. Funds of hedge funds combine hedge fund managers having various strategies so as to provide more consistent performance.^{45,61,66} But choosing ‘star’ hedge fund managers with great track records may also be too simplistic since past performance is not indicative of future performance.⁶⁷ An additional consideration is that although a multi-manager fund with 25–100 underlying hedge

fund managers would provide sufficient diversification, statistical theory suggests there is an asymptotic boundary as to the reduction of standard deviation.^{50,68,69} Any more than 25 managers does not provide additional benefits in terms of diversification. One study suggests that 15–25 hedge fund managers may provide sufficient diversification,⁷⁰ while another purports that 5–10 managers may be sufficient.⁷¹ Larger numbers of hedge fund managers in a fund of hedge funds may eventually reduce diversification to the extent that styles may start overlapping.⁴⁹

Institutional investors and pension funds stress the importance of on-site visits to examine back offices of hedge fund managers on a bi-monthly basis, to ensure they are adhering to their investment strategies. But if a fund of funds contains a high number of managers (>50), it can be very difficult to regularly monitor the managers’ investment strategies.⁷⁰ Moreover, the aptitude to rapidly change market exposure and get in and out of positions quickly is easier with small funds of hedge funds, and difficult when there are 50–100 fund of hedge fund managers.

Funds of hedge funds have become a strong force in the hedge fund industry, accounting for more than 22 per cent of all funds in the hedge fund universe. They provide greater stability of returns, lower volatility and higher survival times than most hedge fund classifications. (The failure of LTCM in 1998 reminded investors of the importance of diversifying among different hedge fund managers, even at the expense of paying an extra layer of management and performance fees typically charged by fund of hedge funds.

Diversified funds of hedge funds with a global stance are the favorite among investors.⁷² with “Diversified funds of hedge funds with a global perspective are preferred by investors.⁷² Factor analysis and cointegration (especially for long/short equity hedge funds) can be used to avoid including two or more managers with similar investment styles in a portfolio of hedge fund.⁷³

The selection process generally requires that both qualitative and quantitative characteristics must be assessed. Picerno⁷⁴ finds that 25 per cent of hedge fund managers had unethical and suspicious trading practices. In addition, funds of

hedge funds are often non-transparent and do not disclose their positions or trading strategies to their investors. Lo⁴⁷, however, stresses that the existence of transparency risk is the price to be paid for proprietary information (or manager skill) possessed by hedge fund and fund of hedge fund managers, which is the base of their performance-fee-reward structure. Howell⁷⁵ suggests that hedge funds attain their best performance during their first two years of existence; however, the mortality rate of hedge funds peaks at 28 months.

Statistical methodologies

Common evaluation tools used in portfolio theory include the Sharpe ratio, the modified Sharpe ratio, Jensen's alpha, beta, covariance and the Sortino ratio.⁴⁰ None of these measures in isolation can provide effective portfolio construction, performance evaluation or risk management. Tomlinson⁷⁷ and Nawrocki⁷⁸ have their reservations about using the standard deviation since gearing can artificially alter returns, some authors have advocated using the information ratio to account for gearing (alpha divided by the standard deviation).

Mean-variance analysis is also used extensively, often by using optimisers with built-in excel spreadsheet software that produce optimal portfolio allocations. Mean-variance optimisation assumes that returns are normally distributed, although hedge funds frequently employ options, leverage and market-timing results in fat tails due to their non-normal characteristics. Agarwal and Naik⁷⁸ use a modified approach by applying a passive option-based strategy to account for the difference in hedge fund returns, while Amenc *et al.*⁹ suggest that conditional betas should be used to explain the dynamic and non-normality characteristics of hedge fund risk.

Other measures of selecting hedge funds or fund managers are stress testing and back testing to find funds with low volatility and minimum drawdowns. Brunel¹³ proposes a simple objective function in evaluating hedge fund returns: Return - Volatility + Skewness - Kurtosis. Since hedge funds are often classified according to style, L'Habitant⁷⁹ suggests using index returns for

separate hedge fund styles as appropriate benchmarks. In an effort to construct a more widespread explanation of hedge fund returns, Fung and Hsieh²⁷ apply an asset-based style factor model, a la Fama and French's⁸⁰ APT model.

Conclusions

The inclusion of hedge funds in portfolios represents a unique opportunity for institutional investors to protect their investments in bear markets. Rao and Szilagyi⁸¹ estimate that by 2006, \$1.7 tn of capital will be invested in hedge funds. By the year 2000, hedge funds amassed as much as \$1 tn in assets; however, they still only control only 4 per cent of the \$25 tn pensions, mutual funds, endowments funds and insurance industry assets.⁸² Kouwenberg⁵¹ finds that a majority of hedge funds have positive alphas, and Capocci and Hubner⁸³ conclude that over 25 per cent of funds delivered positive and significant excess returns, while Amin and Kat³⁴ observe that 72 of 77 hedge funds were not efficient as stand-alone investments when third and fourth moments were examined. Recently, Gregoriou *et al.*⁸⁴ use data envelopment analysis as an alternative performance measure to investigate the efficiency and performance of hedge fund classifications. This technique should be used by FOF managers to help in hedge fund manager selection.

Still, most studies agree with the conclusion that a well-balanced portfolio containing hedge funds can provide superior long-term returns with lower volatility than one without hedge funds. If properly managed, hedge funds can provide effective safeguards during bear markets and periods of increased volatility. Finally, since hedge funds are considered illiquid investments, institutions wishing to invest in this alternative asset class must have a long-term outlook.

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