

**Diversification in Fund of Funds Investment:
How Many Hedge Fund Managers Are Enough to Represent a Strategy?**

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Abstract

Within the past decade, the growth in hedge funds has led to an increasing number of “fund of funds” investment products by which investors can access hedge fund returns. These funds of funds often contain a number of hedge fund strategies or are strategy specific. In this paper, we update previous research on the number of hedge funds required to significantly reduce the diversifiable risk within a strategy specific hedge fund portfolio. Results in this analysis confirm previous research that a portfolio consisting of approximately five equal-weighted hedge funds reduces overall strategy specific portfolio risk to approximately the level of the larger sample from which the funds are drawn. Results also show that such a portfolio is highly correlated with a comparable hedge fund strategy index.

**Fund Diversification in Fund of Funds Investment:
How Many Hedge Fund Managers Are Enough to Represent a Strategy?**

Introduction

Within the past decade, the growth in hedge funds has led to an increasing number of “fund of funds” investment products by which investors can access hedge fund returns. These funds of funds often contain a number of hedge fund strategies or are strategy specific. Academic research has shown that various hedge fund strategy returns are driven largely by market factors such as equity index returns, bond market returns, exposure to credit markets and market volatility (Schneeweis, Kazemi, and Martin, 2003; Schneeweis, Karavas, DuBose and Machayya, 2005). If one wishes to access the common expected return and risk structure of a particular hedge fund strategy, one must ensure that the diversifiable risks associated with investing in a particular fund strategy are reduced through diversification.

In this paper, we update previous research (Henker, 1998; Lhabitant and Learned, 2002; Schneeweis, Kazemi, and Karavas, 2003) on the number of hedge funds required for a hedge fund strategy based portfolio to represent the larger sample of hedge funds from which the funds are drawn. Results in this analysis confirm previous research that a strategy consistent portfolio comprised of approximately five equal-weighted funds reduces the portfolio’s standard deviation to approximately the level of the sample from which the funds are drawn. Consistent with previous research, our results also show that increases in the number of hedge funds beyond approximately five funds have a marginal impact on both further reducing portfolio level

standard deviation and improving correlation to a comparable strategy based composite index.¹ Results show that a strategy consistent portfolio consisting of approximately five funds is highly correlated with a comparable hedge fund strategy composite index. Thus, a portfolio of five funds provides a return pattern that is representative of the underlying strategy.

In this paper, we also review several issues related to the benefits of an equal weighted strategy consistent portfolio. These issues include: 1) optimized versus naïve diversification at the hedge fund strategy level; 2) costs of fund diversification; 3) strategy consistency; 4) portfolio reweighing; and 5) strategy composition at overall fund of funds level.

Data and Methodology

In this paper, we analyze the impact of increasing the number of funds in a strategy consistent portfolio (assuming equal-weighting) on the standard deviation of that portfolio, as well as on its correlation with a representative strategy composite hedge fund index. The methodology is relatively simple. Six hedge fund strategies (Convertible Arbitrage, Equity Long/Short (U.S.), Event-Driven, Distressed Securities, Merger Arbitrage and Equity Market Neutral) were examined. The strategy consistent portfolios were created from a sample of strategy-classified hedge funds derived from a data set created from five principal public hedge fund databases (CISDM, HFR, TASS, Tuna and Altvest). Duplicate funds were removed. From this set, only those funds with complete data over the time period January 2001 through September 2004 were selected. The size of each strategy sample from which the funds are drawn was as follows: Convertible Arbitrage (105), Equity Long/Short (U.S.) (508), Event-Driven (119), Distressed

¹ The strategy composite index is the average of the EACM, HFR and CSFB/Tremont strategy indices.

Securities (67), Merger Arbitrage (69) and Equity Market Neutral (112). Monte Carlo simulations, with 3000 iterations, were performed on equally-weighted portfolios comprised of 1 to 18 randomly selected hedge funds. For each of these strategy samples, two issues were examined: 1) the impact of increasing the number of funds in a strategy specific portfolio on portfolio risk (e.g. standard deviation) and 2) the impact of increasing the number of funds on the correlation of the portfolio with a comparable strategy composite index.

Empirical Results

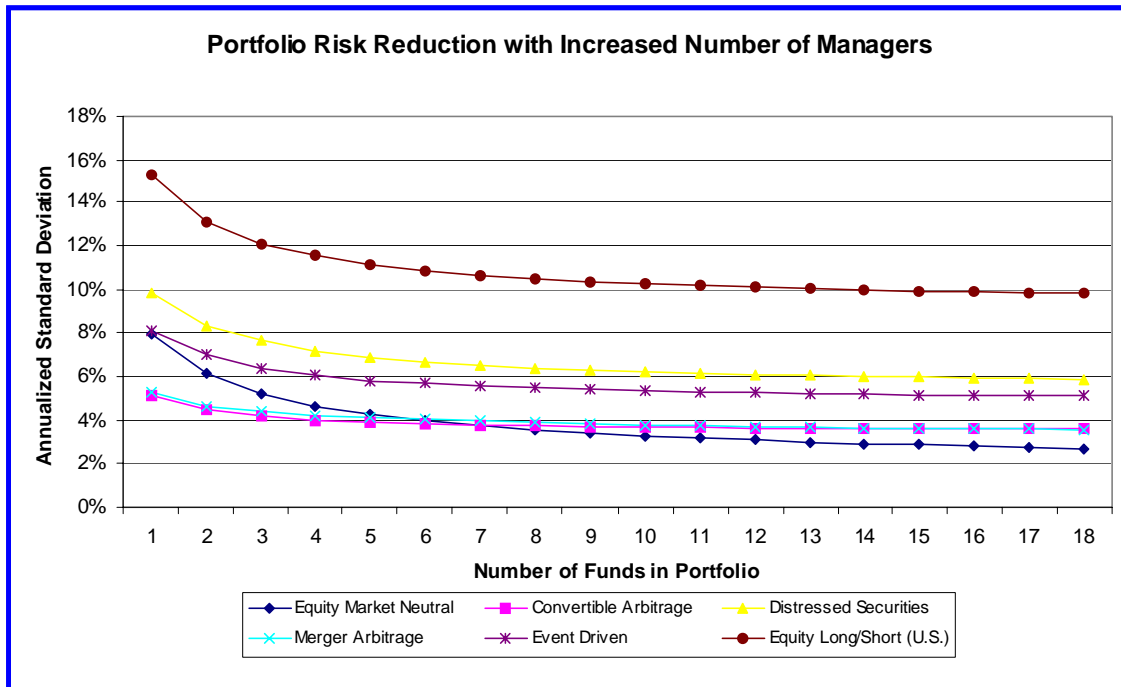
For each of the six hedge fund strategies (Convertible Arbitrage, Equity Long/Short (U.S.), Event Driven, Distressed Securities, Merger Arbitrage, and Equity Market Neutral), the impact of increasing the number of randomly selected funds on portfolio performance characteristics was analyzed. Consistent with past research (Henker, 1998; Lhabitant and Learned, 2002; and Schneeweis, Kazemi, and Karavas, 2003), our results show that increasing the number of hedge funds within a strategy consistent portfolio results not only in a portfolio with standard deviation similar to that of the overall sample from which it is drawn, but also results in a portfolio that has a stronger correlation with the respective comparable strategy composite index.

Portfolio Standard Deviation

Increasing the number of hedge funds within a strategy consistent portfolio results in a portfolio reflecting risk characteristics (i.e., standard deviation or variance) similar to those of a portfolio comprised of the larger sample from which they are drawn. In Exhibits 1a, we provide graphical representation on the impact of increasing the number of hedge funds on the standard deviation of a strategy consistent portfolio. As shown in Exhibit 1a, for all hedge fund strategies examined,

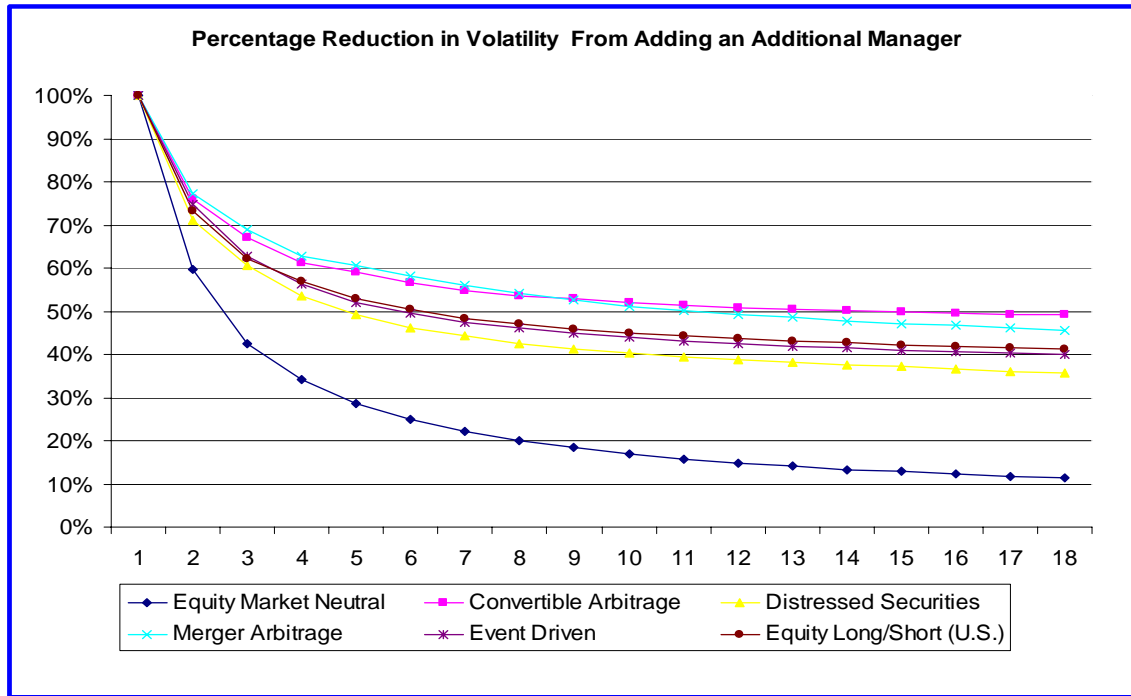
a five-fund portfolio has a standard deviation similar to an 18-fund portfolio. As reflected in Exhibit 1b, when going from 1 to 18 funds, a significant percentage of the reduction of the variance is accomplished during the increment from one to approximately five hedge funds. While further reduction can be achieved beyond five funds, the marginal reduction in variance is relatively small compared to the risk reduction achieved by increasing funds from one to approximately five.

Exhibit 1a



Source: Ursa Capital LLC. Analysis conducted for the period Jan 01 - Sep 04.

Exhibit 1b



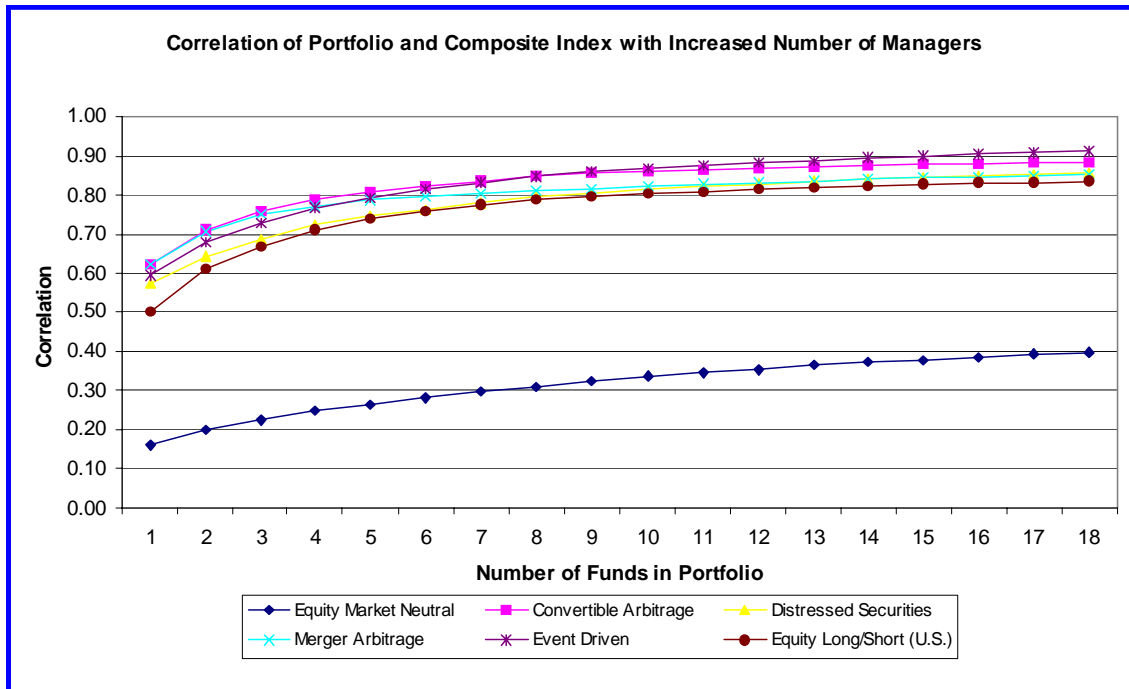
Source: Ursa Capital LLC. Analysis conducted for the period Jan 01 - Sep 04.

Correlations with Strategy Composite Indices

Increasing the number of hedge funds within a strategy consistent portfolio not only results in a portfolio with a standard deviation similar to that of the sample from which it is drawn, but also in a portfolio that has an increased correlation with a comparable strategy composite index. This result is displayed in Exhibit 2a which shows the impact of adding funds to a strategy consistent portfolio on the correlation between the portfolio and the respective composite of strategy-based indices. The results in Exhibit 2a indicate that as the number of hedge funds increases, the correlation between the hedge fund strategy based portfolio and the strategy composite index strengthens.

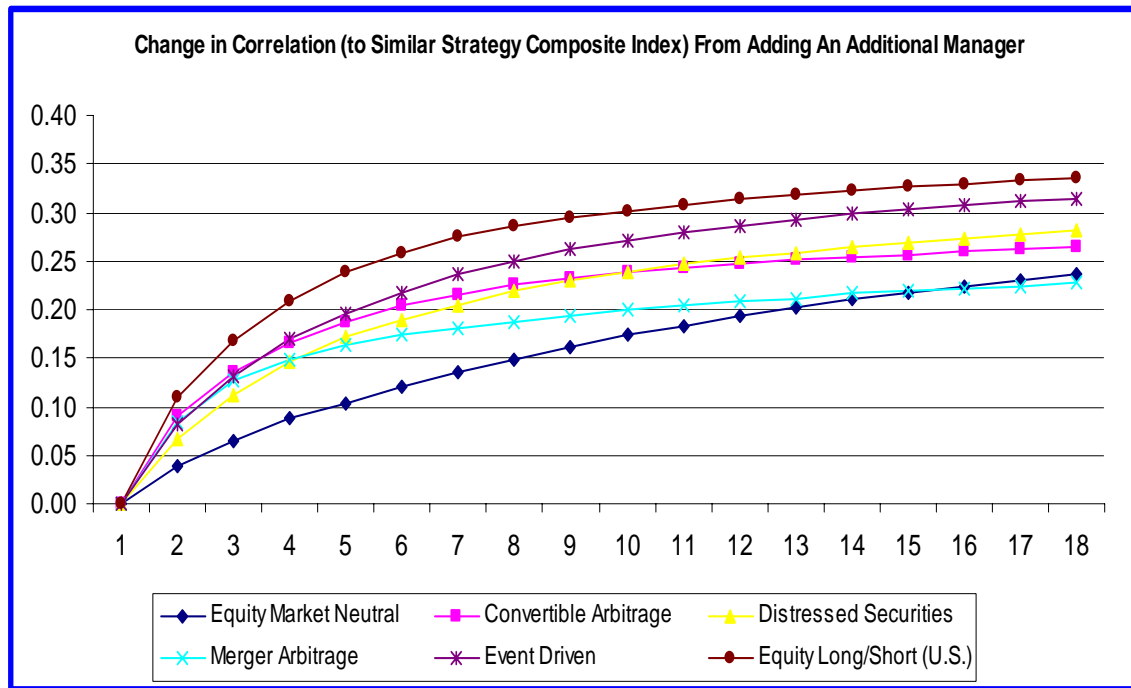
More importantly, as reflected in Exhibit 2b, a significant portion of the increase in correlation takes place when the number of funds is increased from one to approximately five. While further increases in correlation can be achieved by increasing the number of funds beyond five, the marginal increase is lower than when the number of funds is increased from one to five.

Exhibit 2a



Source: Ursa Capital LLC, CSFB/Tremont, EACM & HFR. Analysis conducted for the period Jan 01 - Sep 04.

Exhibit 2b



Source: Ursa Capital LLC, CSFB/Tremont, EACM & HFR. Analysis conducted for the period Jan 01 - Sep 04.

Additional Issues in the Number of Funds in Hedge Fund Diversification

As shown in the previous sections, the benefit of an equally weighted strategy consistent portfolio comprised of approximately five managers is that the portfolio's standard deviation and correlation characteristics are similar to those of a portfolio comprised of a larger sample of funds from which individual funds are drawn. It is also important to point out that when a sample of funds is drawn from a larger population of similar funds, the expected mean return of that sample is always equal to the mean of the population of funds from which the sample is drawn (Schneeweis, Kazemi, and Karavas, 2003). That is, increasing the number of equally weighted funds randomly selected to comprise a strategy consistent portfolio may reduce the portfolio's volatility to approximately that of the population of funds from which they are drawn, but it will not affect the portfolio's expected rate of return. In some ways, random equal weighted

diversification is an “ultimate free lunch”; that is, a reduction in risk with no reduction in expected return.

A number of funds of funds, however, are constructed without having multiple managers within a particular strategy or, are invested in such a way that the asset weights of individual funds may differ dramatically across the fund of funds. In short, the actual number of funds within a particular strategy, asset allocation to these funds, or asset allocation across various hedge fund strategies may be affected by additional issues in fund construction. In this section, we briefly review several additional issues in hedge fund diversification.

Optimized Versus Naïve Diversification at the Hedge Fund Strategy Level

The benefit of diversification using equal weights across randomly selected funds is a function of the difference between the average variance of the individual funds in the sample universe from which a portfolio of equal-weighted funds is drawn and the average covariance of the funds within the same sample universe. In brief, the more homogeneous the sample, the fewer the number of funds required to reduce the volatility of the portfolio to that of the sample from which the funds are drawn. This implies that a relatively small number of managers is required for a hedge fund strategy consistent portfolio to represent the larger sample of funds from which they are drawn.

Of course, when individual fund correlations are known, individual funds may be strategically combined such that the risk of a “Markowitz”-based strategy consistent portfolio (e.g., funds individually weighted to minimize risk while maximizing return to a predefined level) can be

managed. It is important to note, however, that an optimized strategy specific portfolio may include a limited number of funds or, may over or underweight certain selected funds. As a result, diversifiable risk will not be minimized and out-of-sample results may significantly differ from in-sample results.

Costs of Fund Diversification

If there were no costs associated with adding funds to a portfolio, then holding the entire portfolio of sample hedge funds would result in the optimum reduction in diversifiable risk. However, fund selection and fund review costs do exist. For instance, database management costs exist in determining the sample of funds to comprise a strategy consistent portfolio. Even after candidate funds are identified, costs associated with initial and ongoing due diligence, compliance and other operational aspects increase with each incremental manager. Thus, despite the potential reduction in standard deviation, one should consider the marginal cost of adding an additional manager to a portfolio.

Strategy Consistency

Previous sections of this paper show that increasing the number of funds within a strategy consistent portfolio to approximately five often results in a decrease in risk to approximately that of a portfolio comprised of the larger set of potential managers, while reflecting a stronger correlation with a comparable strategy composite index.

Previous research (Lhabitant and Learned, 2002; Schneeweis, Kazemi, and Karavas, 2003) indicates that the number of funds required to mirror the standard deviation of the larger sample

universe from which funds are drawn is affected by the degree of homogeneity among the funds used in the analysis. In other words, when funds are selected from a style or strategy consistent set of managers, a lower number of funds is required to create a strategy specific portfolio that reflects the standard deviation of the sample of funds from which they are drawn.

It is also important to note that the more similar the level of fund standard deviations are, the lower the probability that a particular fund will have a standard deviation considerably greater or less than other funds in the sample and a significantly greater impact on portfolio standard deviation.

Portfolio Reweighting

The exhibits in the paper have shown that adding additional managers to an equally weighted strategy specific portfolio results in a reduction in risk and an increase in correlation to a comparable strategy composite index. For portfolios in which the asset weighting differs substantially from equal weights, the addition of subsequent managers may not have the same portfolio risk reduction impact as indicated in this review. To obtain the risk reduction benefits described in this paper, a strategy specific hedge fund portfolio should rebalance to equal fund weightings at predefined intervals.

Strategy Composition at Overall Fund of Funds Level

In this paper we have concentrated on the impact of fund diversification at the hedge fund strategy level. Fund of funds are often constructed across strategies. Academic research has shown that, in general, the asset class decision dominates the security selection decision. In short,

one should diversify across asset classes (e.g., hedge fund strategies) rather than simply across funds regardless of strategy. The actual allocation to those strategies is dependent, of course, on the particular return to risk tradeoff desired at the overall portfolio level.

Summary

The question as to the proper number of funds needed to create a portfolio with a return pattern that best reflects the expected performance of a particular strategy is empirical. In this paper, we update previous research on the number of hedge funds required for a strategy consistent portfolio of hedge funds to represent the larger sample strategy universe. Results of this analysis confirm previous research that a strategy consistent portfolio of approximately five equally weighted hedge funds reduces portfolio risk to approximately the level of a portfolio comprised of the larger sample of funds from which they are drawn. Results also show that a strategy consistent portfolio comprised of approximately five equally weighted funds is highly correlated with a comparable strategy composite index.

In addition, the impact of optimized diversification (e.g. Markowitz) versus random manager diversification, strategy consistency, the cost of manager selection and maintenance, as well as portfolio reweighting at the strategy level should be considered in assessing the actual financial impact of portfolio construction. Lastly, the benefit of diversifying across strategy consistent hedge fund portfolios rather than simply across generic hedge funds at the overall fund of fund level should be considered.

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