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Finding the Sweet Spot of Hedge Fund Diversification

April, 2004

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Abstract:

Hedge funds are often thought of as being high-risk investments and many investors in the past have shied away from them for fear of making large losses. However, over the recent years, hedge funds have generally substantially outperformed equities, with much lower volatility. As a consequence, they are now in strong demand, particularly when one remembers that any risk associated with hedge fund investing diminishes in importance when the funds are repackaged into fund of funds products.

Once one admits that portfolio diversification reduces manager risk, there is a fundamental question that needs to be addressed, namely, the optimal number of hedge funds to effectively benefit from diversification. In this paper, using a large database of more than 6000 hedge funds, we provide evidence that from a pure market risk perspective, a small number of funds is sufficient to reap most of the diversification benefits, whatever the considered strategy. In addition, for some strategies, too much diversification results in undesirable side effects in the higher moments of the return distribution. Thus, while a fund of hedge funds may mitigate the negative effects of a hedge fund failure through diversification, too much diversification is also likely to result in diworsification.

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Introduction

What if you had invested all your liquid net-worth in Long Term Capital Management LP in 1995? What if you had looked at Meriwether's track record, admired his partners, understood the strategy, and verified the credit lines? It is easy to imagine that in 1996, you would have congratulated yourself for having made such an outstanding investment. And when the summer of 1997 rolled around, you may even have considered leveraging your winner. But by the autumn of 1998, you would have undoubtedly been asking yourself if you had any cash safely stashed away in a forgotten bank account. And you would also have remembered the old adage: "Don't put all your eggs in one basket".

Albeit intuitive for us all, Harry Markowitz (1952, 1959) wrote the first paper on the benefits of diversification for an investor. Under the assumption that investors are primarily concerned with two elements in their portfolios – risk and return – Markowitz suggested a quadratic programming algorithm to optimize the combination of assets based on their mean rates of return and standard deviations. The objective was the aggregation of risky assets in a portfolio to minimize the overall risk, according to the correlation between them. The key to this process is the fact that a portfolio's risk is less than the sum of the risks of its individual assets.

Today, almost everyone in asset management has been touched by Markowitz's groundbreaking insight that investment returns are tied to risks. Modern portfolio theory has transformed a sleepy industry run by bank trust departments and insurance companies into a dynamically changing business. Diversification is now well practiced by investors, whether in terms of geographical exposure, asset classes, or sectors. But the new key to portfolio diversification seems to lie elsewhere, more precisely in the advent of a new generation of alternative investments known as absolute return strategies and hedge funds. Regardless of whether or not hedge funds are genuinely a separate asset class or just a variety of "risk classes," they are now an acknowledged share of diversified portfolios. Private banks commonly recommend an exposure as high as 30% of alternative investments, and institutional investors admit a 2% to 5% allocation to hedge funds.

Just as choosing a bad manager may easily wipe out all the benefits of a hedge fund allocation, so too investing in only one hedge fund is likely to be sub-optimal. Thus, most of the time, the preferred structure for entering the alternative investment arena is a fund of hedge funds. It frees the investor from the responsibility of monitoring individual managers and provides instant diversification within the hedge fund universe. This is, in simple terms, appealing.

Yet the practice of diversifying a portfolio's hedge fund exposure is not as simple as it is in traditional asset classes. Although the SEC is considering regulation of hedge funds, they are, for the time being, only loosely regulated. This effectively means that finding the information necessary to analyze them in order properly optimize a portfolio of them is complex, and costly. The process of selecting hedge funds for investment requires access to information that is not publicly available, an analytical process that includes a clear conception of the investment strategies employed and the ensuing risks, and high minimum investments. Getting exposure to the hedge fund market so as to choose the best, making visits to analyze the business risk, as well as the labor-intensive process of due diligence requires expertise and knowledge of the crowded industry. Thereafter, monitoring performance and risk is an ongoing activity. Thus, the fund of funds business is flourishing.

Funds of funds have expanded from private bank advisory services for their high-net-worth clients, to multi-billion dollar, institution-serving international entities, with just about every combination in between. The products range from off-the-shelf, multi-strategy fund of funds to concentrated, single-strategy tailored mandates. Given the assumptions that (i) diversifying a portfolio's asset allocation to include hedge funds is beneficial, and (ii) diversifying the allocation to hedge funds is beneficial, the question of how many funds are needed to optimize the diversification benefits is the focus of our attention in this article. Funds of funds provide access to a diversified hedge fund allocation, but what is the optimal number of hedge funds in a single fund of funds?

The Art and Science of Diversification

Numerous papers have been written on the subject of how many assets are needed to reach an optimally diversified portfolio.¹ A few have also focused on how many hedge funds are needed to achieve an optimally diversified portfolio. The least we can say is that no conclusion has yet been reached. On the academic side, the literature suggests that approximately eight to ten managers should be sufficient to significantly reduce the overall risk of the portfolio – see Billingsley and Chance [1996] for managed futures, Henker and Martin [1998] for CTAs and Henker [1998] for hedge funds. However, Amin and Kat [2002] show that one needs at least 20 funds to fully realize the hedge fund diversification potential. From the practitioner's perspective, the consensus seems to be that at least 30-40 managers are necessary to diversify effectively, as shown by the information released by funds of hedge funds. The short note by Ruddick [2002] shows that the maximum benefits of diversification are reached with around 20 funds, and that it is still possible to have them with 40 funds. But before going any further, it is worth discussing two approaches to diversification: the naïve and the optimized.

Naïve diversification refers to the “1/N heuristics” method, which essentially entails evenly dividing the total allocation among the available assets. Naïve diversification attributes no importance to the relationship between assets. That is to say the correlation between the assets is not utilized in the allocation decision. This method of diversification does, indeed, reduce volatility, and it is simple to use when there is a lack of knowledge about the assets and interrelationships.

By contrast, optimized diversification follows the work Markowitz set out in his dissertation in 1952. His mathematical approach takes into account the correlation between assets in order to maximize the benefits and minimize the overlap. Hence, assets with high volatilities but negative correlation are good combinations in a portfolio, whereas assets that have high volatilities and high correlation are less optimally diversified.

In practice, most hedge fund investors adopt the naïve approach to diversification, rather than the Markowitz optimization. There are several reasons for this. Firstly, most optimizers are unable to effectively incorporate the operational constraints demanded by hedge fund investments such as: minimum investments, lock-up periods, redemption notifications, etc. Secondly, in terms of quantity and quality, the lack of hedge fund information limits the

¹ See Elton and Gruber [1977], Evans and Archer [1968], Latane and Young [1969], Fischer and Lorie [1970], Mokkelbost [1971], Wagner and Lau [1971], Johnson and Shannon [1974], Lorie [1975], Upson, Jessup and Matsumoto [1975], Lloyd, Hand and Modani, [1981], Tole [1982], Statman [1987], Newbould and Poon [1993] or O'Neal [1997], among others.

capacity of econometric modeling; optimizers require precise forecasts of risks, returns and correlations, while hedge fund returns and strategies are not necessarily stable over time, let alone the omnipresent difficulties of predicting future economic environment. Finally, hedge fund return distributions are not always normal, meaning, they tend to exhibit skewness and fat tails; mean-variance optimizers work on the assumption of a normal distribution.

Our Analysis

In this study, one of our aims was to assess the real benefits of diversification in hedge fund portfolios. To provide the most comprehensive representation possible of the hedge fund universe, we aggregated and cleaned up quarterly data from Managed Account Reports, Hedge Fund Research, TASS+, Altvest and Evaluation Associates Capital Management, as well as that received directly from several hedge fund administrators. Thus, our database totaled 6,985 distinct hedge funds, with no restriction on their assets under management, or their lifespan. It also includes a large number of now defunct funds, which should diminish the survivorship bias, albeit not entirely.

With our data, we created series of equally weighted portfolios of increasing size ($N = 1, 2, \dots, 50$ funds) of underlying hedge funds randomly selected. For each portfolio, we built a time series of returns and used it to generate various statistics (average return, volatility, etc.). For each portfolio size, this process is repeated 1,000 times to obtain 1,000 observations of each statistic. This is necessary to estimate the “typical” behavior of a portfolio of size N . When a fund in one of our sample portfolios stops reporting to the database provider (whether from a liquidation or simply self-removal), we have liquidated it at the latest available net asset value and reallocated the assets equally among the remaining funds in the sample portfolio.

We tested both within-style and across-style diversification. In the within-style approach, investors create portfolios by randomly selecting managers of a particular investment style. The result is a single-strategy diversified portfolio. In the across-style approach, investors create portfolios by randomly selecting managers regardless of their investment style. The result is generally a multi-strategy diversified portfolio.

We tested both naïve and smart diversification during three distinct periods: 1990-1993, 1994-1997, and 1998-2001. As described in the previous section, naïve diversification is the practice of randomly choosing a specified number of funds, and allocating assets evenly to them. The second approach, smart diversification, is only applicable to across-style diversification. It also assumes that investors will randomly choose a specified number of funds and allocate assets evenly among them. However, the choice is made such that no single investment style is more represented than another. This is to say that the addition of each new fund to the portfolio is a rotational process through the universe of investment styles². For example, if we classify all hedge funds under ten investment styles, then the smart diversification of a ten-fund portfolio would randomly select one hedge fund from each of the ten styles.

²

We used the ten generally accepted hedge fund investment styles as Global Macro, Commodity Trading Advisors, Long/Short Equity, Dedicated Short Bias, Emerging Markets, Equity Market Neutral, Event-driven, Fixed Income Arbitrage, Convertible Arbitrage and Multi-strategy funds. It should be noted that in this study, we rely on the style classification as given by the hedge fund manager, because this is the most likely approach a typical investor will take. However, a more accurate classification could be made by style analysis, which tracks past performance and exposures to map the manager's trades. See Lhabitant (2001, 2002)

Diversification within styles³

In general, naïve diversification of hedge funds provides benefits for the investor. However, our study finds that a minimum number of funds are needed to maximize the potential benefits.

Figure 1 shows the effect on the fund of hedge funds portfolio's return as the number of hedge funds in the portfolio changes. Not surprisingly, the return on the portfolio is not greatly affected by the number of funds. This result is due to the linearity of the average operator⁴. It is evident that the mean return varies widely across strategies and over time.

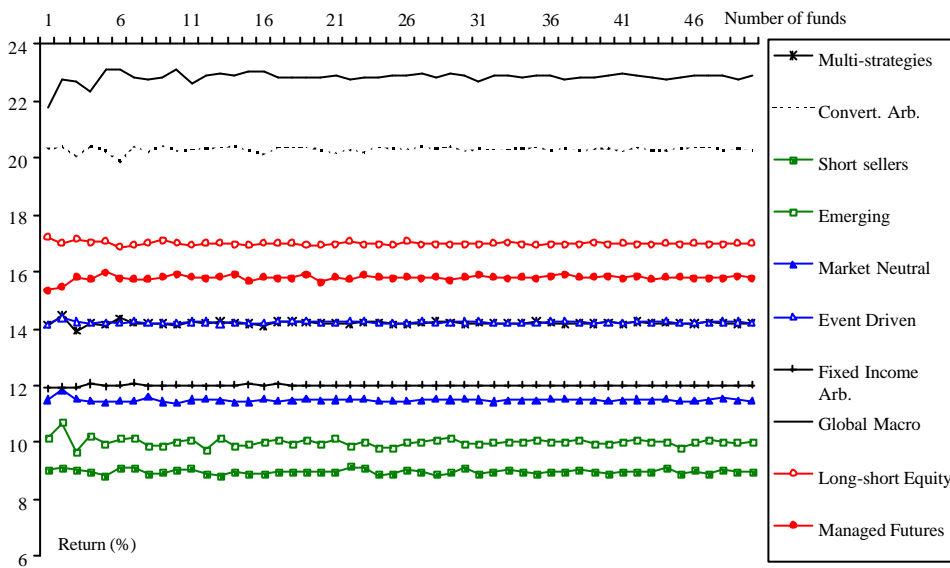


Figure 1: Evolution of the mean return of a fund of funds portfolio as a function of the number of underlying hedge funds.

Figure 2 shows the effect of the number of funds on the volatility of the portfolio. The number of funds required to reduce the volatility is quite small. We find that approximately ten hedge funds are enough to reduce most of the volatility. Adding more funds thereafter produces only marginal gains. This result stands whatever the period and the investment style

³ For the sake of clarity, we only report the results we obtained for the 1998-2001 period. The results for other periods are available from the authors.

⁴ The average operator is linear. In a sense, the figure we obtain for a one-fund portfolio is the average of 1,000 hedge funds returns, while the figure for a two-fund portfolio will simply be the average of 2,000 hedge funds. The number will, therefore, rapidly converge to the sample average.

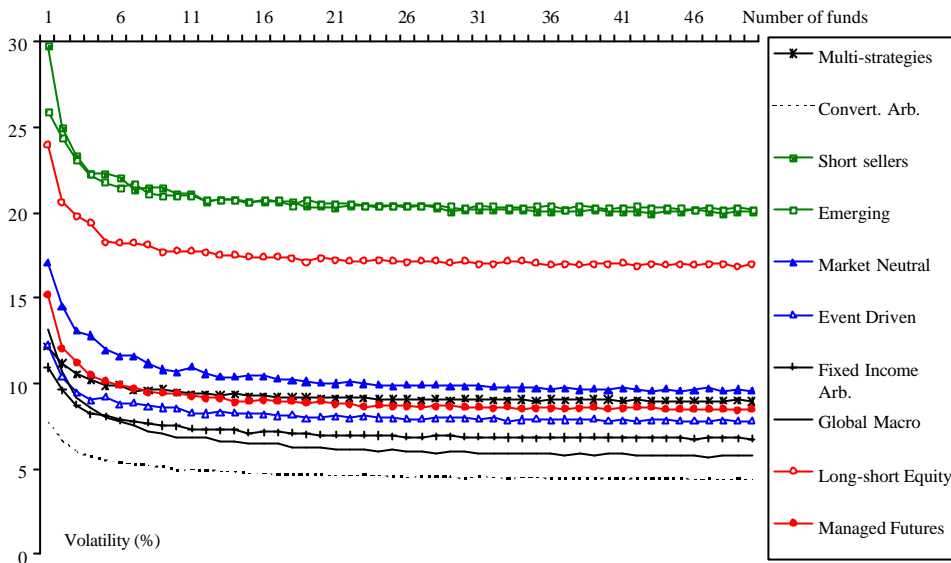


Figure 2: Impact of diversification on the volatility of a fund of funds portfolio

As mentioned above, hedge fund returns are generally not normally published. Asymmetry and fat tails in the return distribution are a result of the complexity of their trading styles. If a fund's returns are positively skewed, the investor is probably quite happy. If the tails are fat, the investor can expect a more thrilling investment ride. The characteristics of a hedge fund's past performance do not determine its future performance, as all disclosure statements continuously remind us. However, a fund that is highly, positively skewed most certainly gives the investor a different gut feeling from one that is negatively skewed. For this reason, we have included the effect of the number of hedge funds in a portfolio on skewness and kurtosis in this study. Skewness is expected to disappear with diversification, as funds with negative skewness are mixed with positively skewed ones so that, at the aggregate level, these individual effects cancel each other out. For the same reason, we expect excess kurtosis to be somehow reduced by diversification.

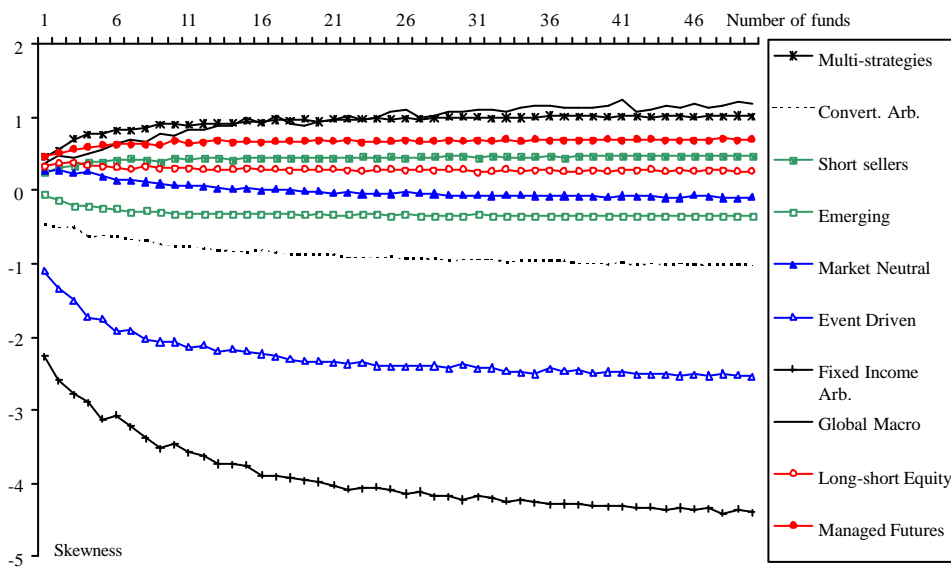


Figure 3: Impact of diversification on the skewness of a fund of funds portfolio

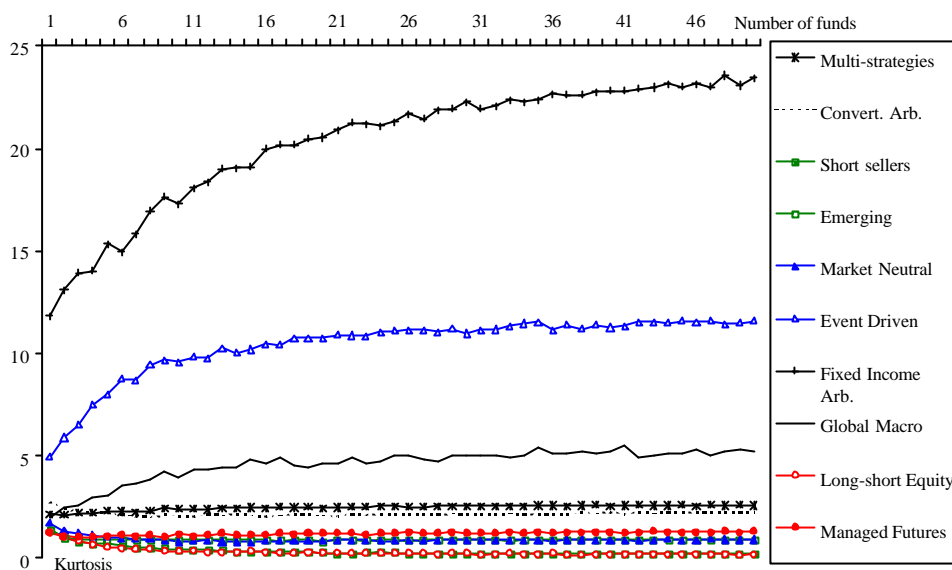


Figure 4: Impact of diversification on the kurtosis of a fund of funds portfolio

As Figure 3 shows, the average skewness tends to fall as the number of funds rises. In Figure 4, we see less of an effect on the portfolio's kurtosis when we increase the number of hedge funds. But it is worth noting that fixed income arbitrage and event-driven diversification may create problems, as skewness decreases and kurtosis increases sharply. We note with interest the same pattern for these two strategies for the other periods considered. It is our assumption that many of these managers have heavily invested in the same underlying assets, and are, therefore, exposed to the same systemic risks (LTCM crisis, the Alcatel-Honeywell merger failure, distressed situations that went bankrupt such as Kmart, Global Crossing, WorldCom, and Qwest Communications, or the planned elimination of the 30-year T-Bond contract etc.). By diversifying among them, we are, in a sense, sure to capture these risks...

We also analyzed the behavior of three generally accepted downside-risk statistics, the worst monthly return, the value at risk and the maximum drawdown. The largest monthly loss is the greatest decline in net asset value for a particular hedge fund for any one-month period during the time span considered. The maximum drawdown is the biggest percentage-losing period ("peak to valley") experienced by a particular fund, regardless of whether or not the drawdown consisted of consecutive months of negative performance. It corresponds to the loss that an investor would experience buying shares at the highest net asset value and selling them at the lowest net asset value over a period. Finally, the value at risk (VaR) is an estimate of the maximum a particular fund could lose over a one-month period in normal market conditions. In our case, we defined "normal market conditions" as being 95% of the time and we calculated VaR by simply taking the 5% percentile of the empirical return distribution over the considered period.

All these risk measures gave the same answer: diversification seems to work well in terms of downside-risk reduction, but most of the diversification benefits are obtained with about 10 funds. Adding more funds still provides benefits, but the gains seem marginal compared to the drawbacks of managing the enlarged portfolio.

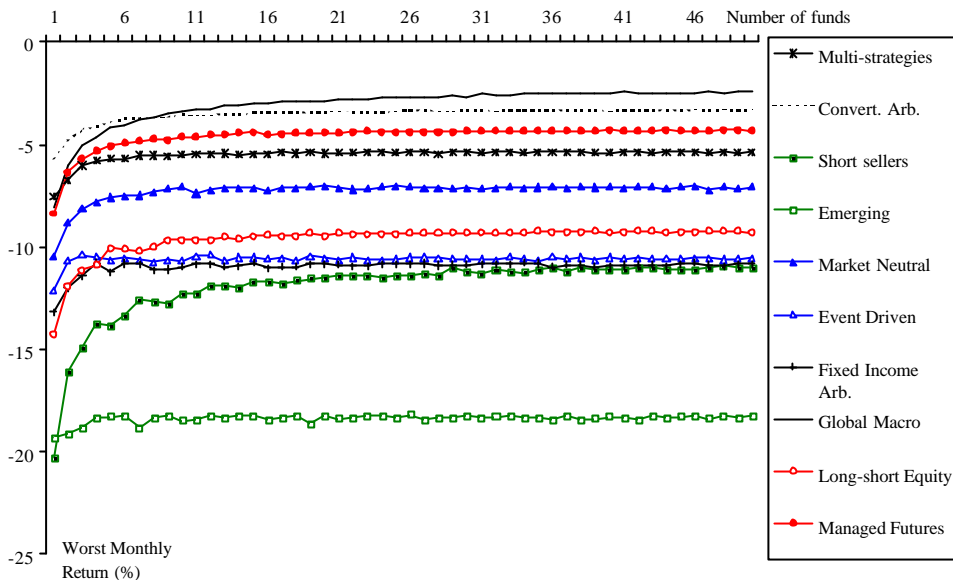


Figure 5: Impact of diversification on the worst monthly return of a fund of funds portfolio

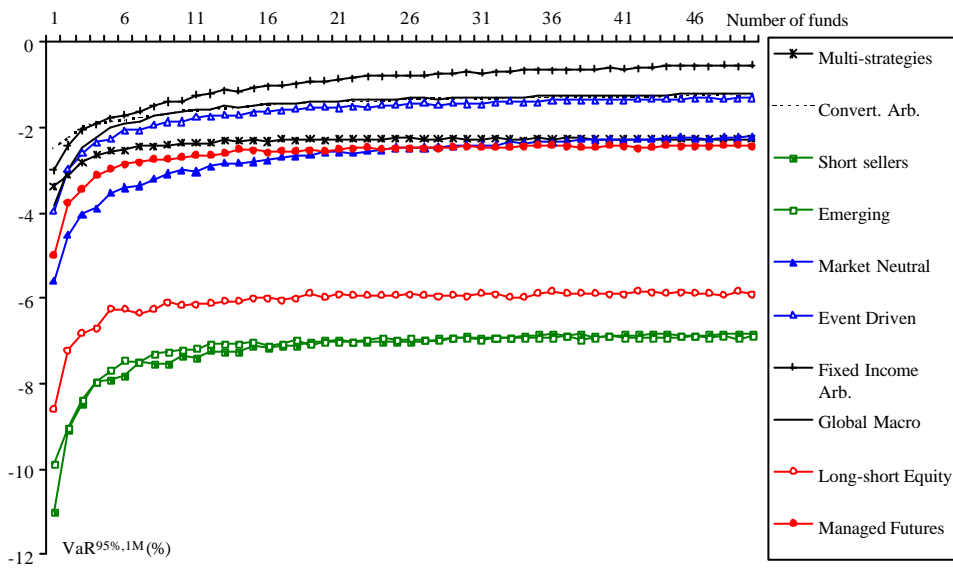


Figure 6: Impact of diversification on the value at risk of a fund of funds portfolio

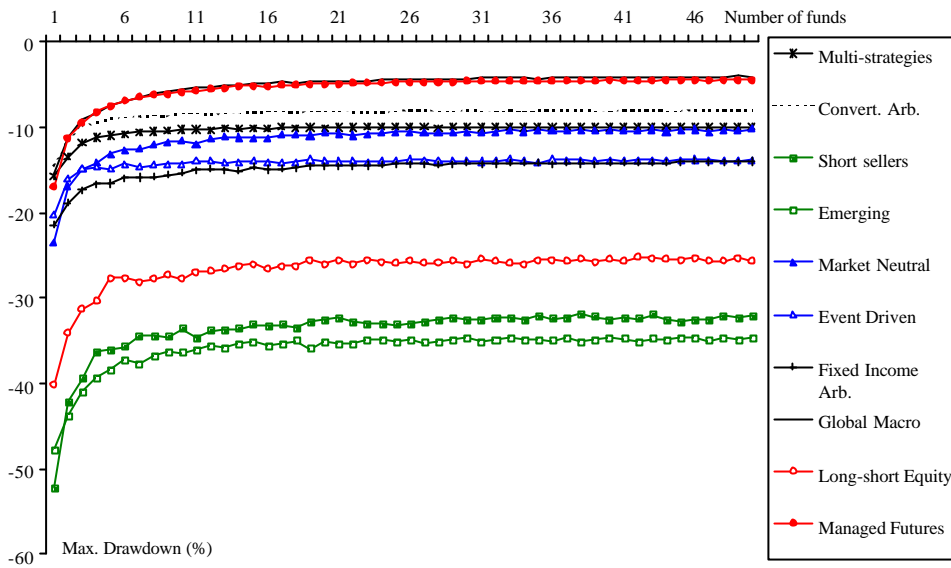


Figure 7: Impact of diversification on the maximum drawdown of a fund of funds portfolio

Finally, the last statistic we examined was correlation. Since investors generally still maintain an equity portfolio alongside their hedge fund allocation, it is essential to examine the impact of the number of funds in a portfolio on the correlation of its attributes with equities (represented hereafter by the S&P 500). As illustrated in Figure 8, it appears that diversification within a style leads to a small increase in the absolute value of the correlation with the S&P 500. That is, positive correlations with the S&P 500 tend to increase, while negative correlations with it tend to decrease as the number of funds increases.

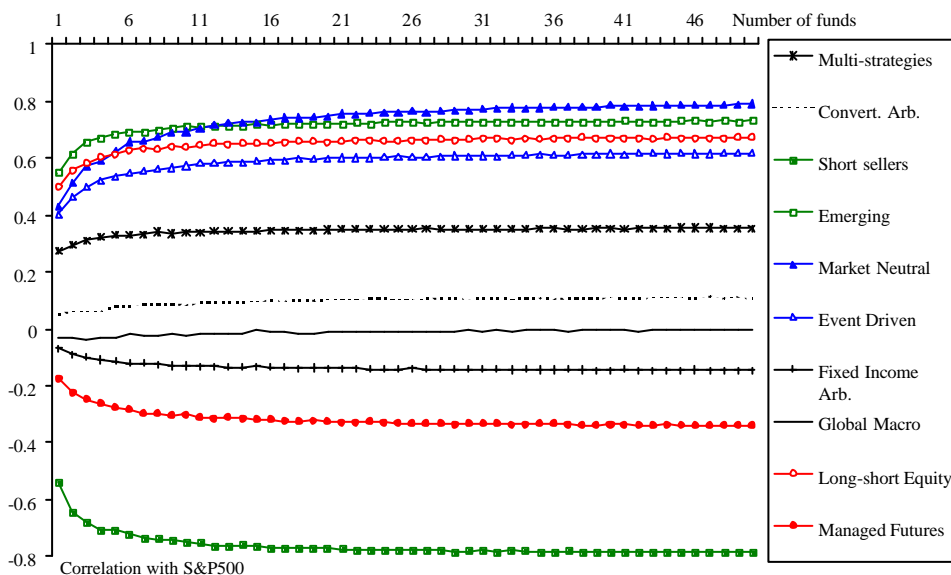


Figure 8: Impact of diversification on the correlation with the S&P 500 of a fund of funds portfolio

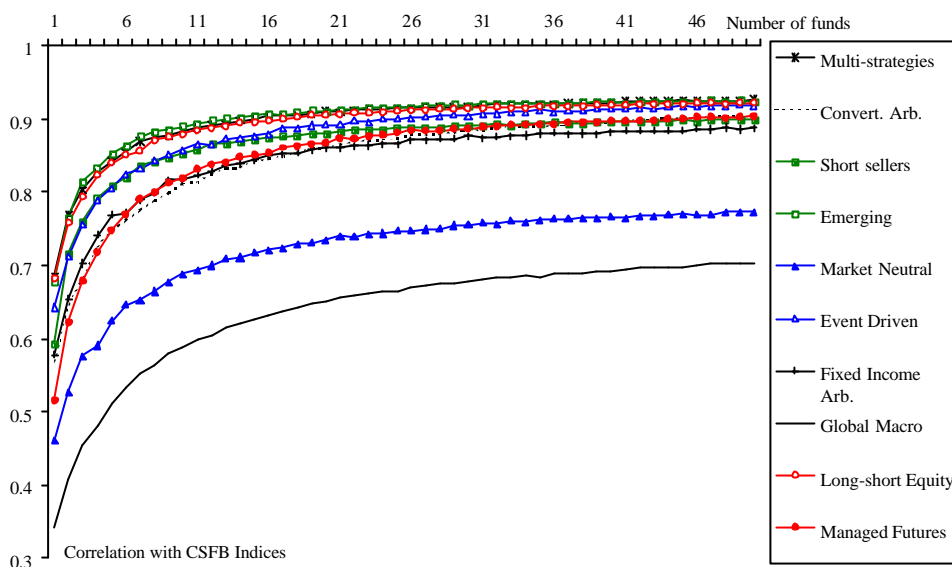


Figure 9: Impact of diversification on the correlation with the CSFB indices of a fund of funds portfolio

Looking across styles

Diversifying across styles produces similar results. As one might expect, we observed that smart diversification gives better and quicker results in terms of risk reduction than the naive approach, so that fewer funds are necessary to reach the same level of diversification. Whatever the risk measure, it seems that around ten hedge funds are sufficient to eliminate most of the specific risk in a portfolio.

This contradicts what styles provided similar results. As one might expect, we observed that smart diversification gives better and we can see in fund of hedge funds portfolios in the current market, that is, portfolios of 30 to 50 hedge funds. From the pure risk reduction perspective, the diversification gains appear marginal compared to the drawbacks of managing the corresponding portfolio (large minimum investment requirements for each fund, multiple lock-up periods, etc.). The explanation is likely to be other risks, for example, reduction of operational risks or lack of strong conviction about individual managers.

Conclusions

The proliferation of hedge funds, the increasing participation of investors in alternative investments, the growing collection of articles analyzing hedge funds, and the ever-present uncertainty of future market conditions all give rise to a greater need to choose the right funds. Although naïve diversification proves better than no diversification at all, smart diversification proves even better. Using the smart approach can enhance the use of diversification to hedge against a bad decision. That is to say that if an investor wants hedge fund exposure diversifying by choosing multiple hedge fund styles is more effective than randomly choosing regardless of style. However, over ten funds, diversification is likely to become diworsification and open the door to mediocrity.

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Description of investment styles

Global Macro fund managers analyze the global macro-economic landscape in search of opportunities to profit from trends or geopolitical events. They typically invest in interest rates, currency markets, and equity markets, and their trades are often leveraged. Famous managers include: Soros and Buffet.

Commodity Trading Advisors (CTAs), or Managed Futures, trade financial, commodity and/or currency futures globally. The trades are determined either via a systematic programme or discretionary analysis. Typical approaches include: trend-following, pattern breakout.

Long/Short Equity managers are the most numerous in the universe. They attempt to isolate *alpha* by investing long equities they believe will increase in price value, and short equities they believe will decrease in price value. They can use pair strategies in an attempt to neutralize their exposure to the market.

Dedicated Short Bias managers are stock-pickers who are net, and potentially, gross short the market.

Emerging Market managers invest in the equity and fixed income markets of emerging economies. Due to restrictions in short-selling and lack of index derivative products, they are most often either long or in a cash position.

Equity Market Neutral managers are akin to Long/Short managers in their stock-picking approach; however, they execute trades only on stocks that will result in a net beta neutral position. A variation is the market neutral manager who is net zero in a sector, and consequently, may have a long sector exposure. This approach may be either systematic or discretionary.

Event-driven managers trade company-specific events, which give rise to pricing inefficiencies between and among securities. Typical approaches include distressed debt, capital structure arbitrage, and merger arbitrage. Most managers employ multiple strategies, depending upon the opportunities in the market.

Fixed Income Arbitrage aims to profit from pricing inefficiencies among interest rates, cash and derivative instruments. Approaches include yield curve arbitrage and curve spread trading. Some managers may execute directional trades based on their bet on the market evolution.

Convertible Arbitrage managers attempt to profit from the miss-pricing of convertible bonds, which are a hybrid of fixed-income and equity holdings. They hedge credit and interest rate risk, take profits on the difference between the cash inflows of the bond coupons and the short interest rebates, and the cash dividend payout to the lending equity holder. The convergence of prices between the long convertible position and short equity position adds profits. Approaches include volatility trades (gamma trading), premium capture (inexpensive put), and credit plays (inexpensive call).

Multi-strategy funds attempt to capture the benefits of multiple hedge fund strategies in one fund. Typically, multiple managers invest a “book” (or allocation), which is aggregated into

the fund. The portfolio manager may actively change the allocations to the strategies, or to each book, depending on market conditions.