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Diversification in Hedge Fund Portfolios

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BNP Paribas Hedge Fund Centre Hedge Fund Insights

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Mission of the BNP Paribas Hedge Fund Centre

The mission of the BNP Paribas Hedge Fund Centre is to facilitate, encourage, and sponsor high-level academic research on hedge funds. The Centre also provides outstanding education to students, executives, and investors, and publishes objective and independent information on hedge funds, while promoting understanding and awareness of alternative investment strategies. Through excellence in research on alternative investments, the Centre is recognized for its capacity to foster stimulating exchange of opinions, and to develop a knowledgeable and objective information base regarding hedge funds.

Specifically, the primary objectives of the BNP Paribas Hedge Fund Centre at the Singapore Management University are to

1. conduct and disseminate high quality academic hedge fund research
2. educate finance practitioners and the investor public on hedge funds, and
3. raise the profile of the hedge fund industry in Asia and Singapore

To achieve these goals, the Centre will collaborate closely with academics at the London Business School. Moreover at all times, the Centre is absolutely committed to the highest ethical conduct and will actively avoid any conflicts of interest with outside parties.

Diversification in Hedge Fund Portfolios

Melvyn Teo[1]

Executive summary

We explore the diversification benefits of increasing the number of hedge funds in an investment portfolio. Conventional wisdom suggests that investors should construct a portfolio of 20 to 30 hedge funds in order to achieve a reasonably low portfolio variance. We show using Monte Carlo simulations that the marginal benefit of including an additional hedge fund in a fund portfolio diminishes significantly once the number of hedge funds increases beyond ten. Specifically, the annualized standard deviation of a fund portfolio diminishes from 16.55 percent to 7.40 percent as we increase the number of funds from one to ten. However, the standard deviation only drops by an additional 0.55 percent when we increase the number of funds to 15. Investors can crimp portfolio variance further by spreading their capital judiciously across multiple hedge fund strategies. These findings are especially relevant for investors who are transiting from indirect investments via funds of hedge funds to direct investments in single-manager hedge funds.

How many hedge funds does one require in an investment portfolio in order to drive portfolio variance down to desirable levels? This is a question that pension funds, endowment funds, and family offices grapple with as they move away from investing indirectly in hedge funds via funds of funds to investing directly in the underlying single-manager funds themselves. Conversations with chief investment officers suggest that the optimal number ranges from 20 to 30 funds. From a cost standpoint, a lower number is desirable as due diligence teams are typically small and therefore may find it difficult to source for and monitor a large diverse group of fund managers. From a career concerns standpoint, a lower number limits the reputation risk to the investor, since the probability of experiencing a fund blow-up is a function of the number of funds in one's stable. However, investors are mindful of the conventional view that a portfolio with a select group of managers also comes with insufficient diversification. In this issue of the Hedge Fund Insights, we put conventional wisdom to the test and investigate using simulation techniques how the return variance of a hedge fund portfolio evolves when we vary the number of funds.

Our analysis centers on data obtained from the TASS, HFR and BarclayHedge databases and on the 1994-2011 period. We merge these databases by hand using fund name. The sample includes 36,346 funds of which 22,725 stop reporting by the end of the sample period in December 2011, leaving us with 13,621 live funds at the end of the sample period. Of the funds in our combined sample, 8,857 funds are unique to TASS, 7,487 are funds unique to HFR, and 8,207 are funds unique to BarclayHedge.

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To understand the relationship between the number of funds in a hedge fund portfolio and the variability of returns, we employ Monte Carlo simulation. Specifically, we allow the number of funds n to vary from 1 to 50. For each n, we run 1000 iterations. For each iteration and for every year in the sample starting from 1995, n funds are randomly picked from the universe of hedge funds and held for one year. The 12-month returns from each draw are linked across years to from a single return series for each iteration. When a fund drops out of the sample within the year it is replaced with another randomly chosen fund so that the portfolio is always invested in n funds. The standard deviation of the portfolio is recorded and Figure 1 plots the average standard deviations of the 1000 simulations over the range of n values considered. It indicates that the marginal benefit to diversification from adding another fund to the portfolio diminishes rapidly once the number of funds increases beyond ten.

Figure 1: The average monthly standard deviation of hedge fund portfolios based on a Monte Carlo simulation with 1000 iterations and a holding period of one year.
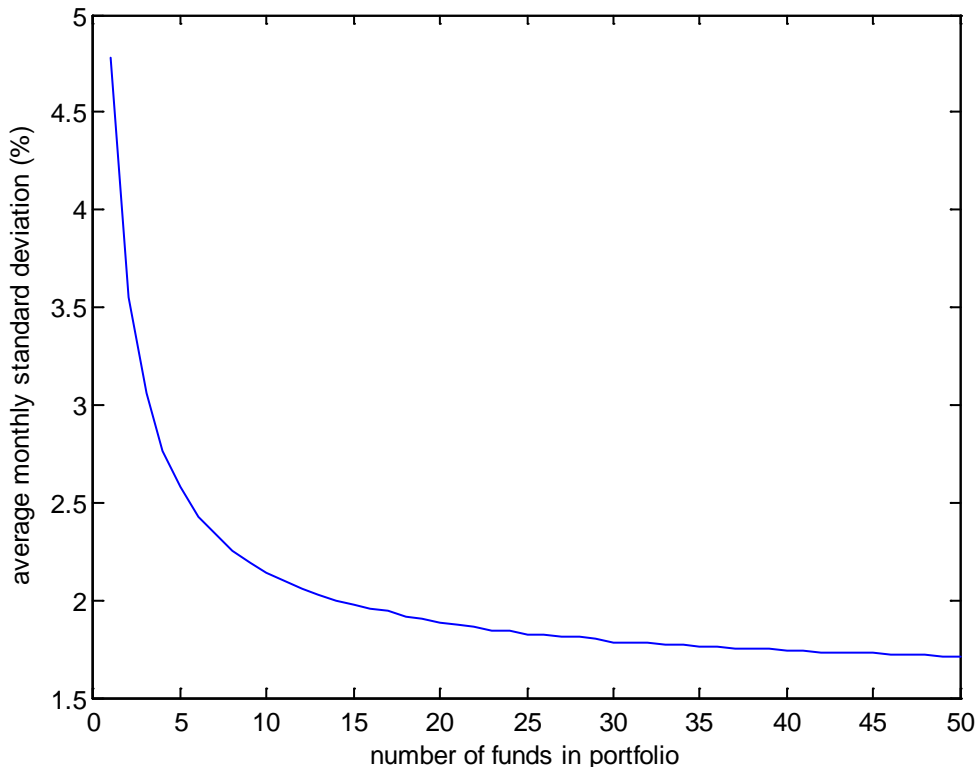

A single fund portfolio is associated with a monthly standard deviation of 4.78 percent or an annualized standard deviation of 16.55 percent. As a testament to the value of diversification, a ten-fund portfolio is only associated with a monthly standard deviation of 2.13 percent or an annualized standard deviation of 7.40 percent. Therefore, portfolio return variability is more than halved as a result of the increase in the number of hedge funds. However, when we increase the number of funds to 15 and 20, the annualized standard deviation of portfolio returns only decreases to 6.85 percent and 6.53 percent, respectively, indicating that the marginal benefit to diversification of increasing the number of hedge funds beyond ten is small. These results resonate with those of Amin and Kat (2002) who show that in order to drive down portfolio standard deviation it is sufficient to invest in 15 hedge funds.

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One concern with our methodology is that investors may not hold a fund for only a year and fully reform the portfolio at year end. Indeed some funds feature long lock-up periods and other share restrictions, limiting investors' ability to rebalance frequently. To address this concern, we also run a Monte Carlo simulation where we hold a fund for three years and fully reform the portfolio every third year. We do not materially change our results by doing so. The incremental reduction in portfolio standard deviation still slows down dramatically once the number of funds in the portfolio increases beyond ten.

Another concern is that our methodology does not consciously minimize return standard deviation by deliberately spreading capital across multiple strategies or investment regions. Clearly, an investor who is conscious of the need to minimize variance will select funds with complementary characteristics in order to achieve the lowest possible return variance. To simulate such an investor, we first confine our sample to funds engaged in the following six investment strategies: equity long/short, fixed income, event driven, macro, multi-strategy, and managed futures. Then we modify the random drawing process in the simulation so that the first six funds selected include one fund from each of the six investment strategies. Similarly the first 12 funds selected include two funds from each of the investment strategies. In Figure 2 we plot the results from the original simulation alongside those for the modified simulation optimized across strategies for comparison.

Figure 2: The average monthly standard deviation of hedge fund portfolios based on a Monte Carlo simulation with 1000 iterations (before and after optimizing across strategies) and a holding period of one year.
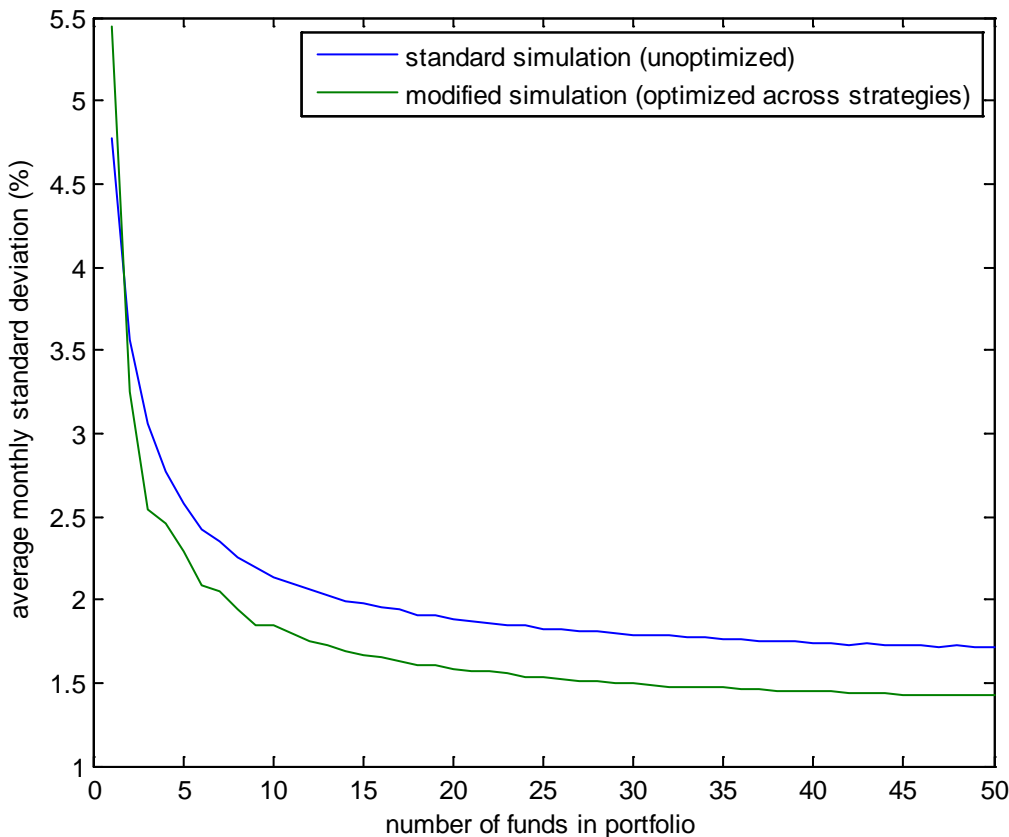

The results suggest that spreading capital judiciously across strategies is an effectively way of keeping portfolio variability down. The standard deviation for the modified simulation portfolio starts off at a higher level

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than the original simulation owing to the smaller number of funds sampled, since we only consider funds belonging to the six aforementioned investment strategies. However the modified simulation yields better results once we increase the number of funds beyond one. In particular, with ten funds, the average annualized standard deviation falls from 7.40 percent to 6.38 percent when we spread capital equally across multiple strategies. Nonetheless, modifying the fund selection process to ensure a wider investment strategy footprint does not fundamentally change the shape of the relationship between the number of funds and portfolio return variability. The marginally benefit of increasing the number of funds beyond ten is still low.[2] These results suggest that perhaps our ability to effectively reduce portfolio variance to reasonable levels with just a ten fund portfolio may be traced to the preponderance of multi-strategy hedge funds in the recent years. Indeed, we find that the proportion of multi-strategy funds in our sample has increased steadily from 0.9 percent in 1994 to 10.09 percent in 2011.

Figure 3: The average monthly return (raw and abnormal) standard deviation of hedge fund portfolios based on Monte Carlo simulations with 1000 iterations and a holding period of one year.

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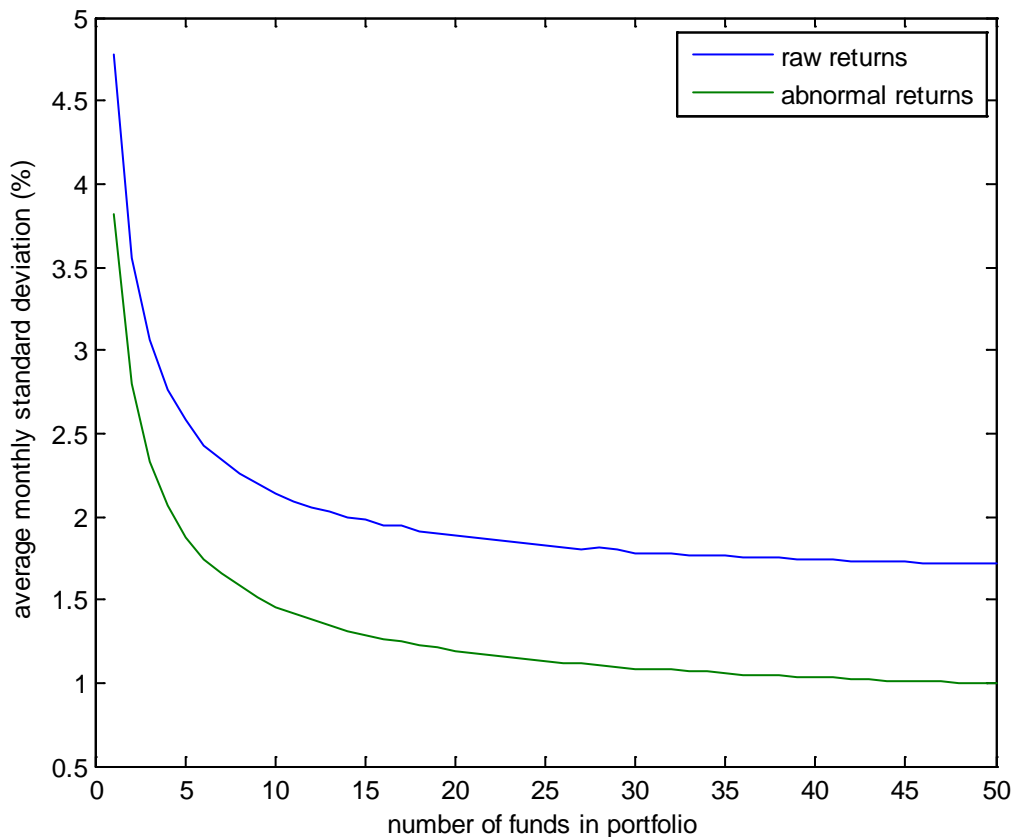
[2] We do not find that diversifying across investment regions engenders lower portfolio return variability. Our modified simulation deploys capital equally across the following six investment regions: Asia, Emerging Markets, Europe, Global, Japan, and the US. However we find that the standard deviation of returns increase marginally with the modified simulation that has been optimized across regions, indicating that the strategy of spreading capital equally across the six regions does not dominate that of deploying capital across regions based on the proportion of funds in each region, at least from a diversification standpoint.

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Fund investors may be concerned not simply with the variability of raw returns but also with the variability of alpha or abnormal returns adjusted for exposure to various risk factors. Therefore, we evaluate the performance of hedge funds relative to an augmented Fung and Hsieh (2004) factor model and re-run the Monte Carlo simulation. The Fung and Hsieh (2004) factors include the S&P 500 factor (SNPMRF), the size factor (SCMLC), the term spread (BD10RET), the default spread (BAAMTSY), and trend following factors for bonds (PTFSBD), foreign exchange (PTFSFX), and commodities (PTFSCOM). For funds with at least 36 months of returns, we compute fund factor loadings using the full sample of fund performance data. Then, for each month, we compute fund monthly abnormal/risk-adjusted returns or alpha as the difference between the monthly excess return of the fund (in excess of the risk free rate) and the factor loadings multiplied by the factor realizations.

The findings depicted in Figure 3 indicate that a significant portion of the return variability can be traced to variation in factor realizations. For a portfolio with ten funds, the average annualized standard deviation of abnormal returns is only 5.05 percent (versus 7.40 percent for raw returns) suggesting that about a third of the variation in raw returns can be attributed to variation in the underlying risk factors themselves. When the number of funds in the portfolio approaches 50, the proportion of return variability driven by the factors themselves reaches 50 percent. Still, we find that the shape of the abnormal return standard deviation graph mimics that of the raw return standard deviation graph.

Conclusion

Conventional wisdom dictates that one needs to invest in between 20 to 30 hedge funds so as to reap the benefits from portfolio diversification. Our findings challenge this conventional view. We show that one needs only to deploy capital in about ten hedge funds in order to harvest most of the benefits from diversification. The standard deviation of portfolio returns decreases only marginally once the number of hedge funds increases beyond ten. One can exert additional downward pressure on portfolio returns by increasing one's investment strategy footprint and ensuring that the ten funds are chosen such that they represent in a diverse set of investment strategies. Institutional investors who are transiting from investing indirectly via funds of funds to investing directly into the single-manager hedge funds, who have lean due diligence teams, or who are worried about the headline risks associated with hedge fund investments, may take comfort in these findings.

A few caveats are in order as we wrap up our study. One caveat is that our findings are likely to be less relevant to funds of hedge funds and other investors who focus exclusively on hedge funds. For these investors, it may not be appropriate to hold a ten-fund portfolio as the impact to returns of a blow-up in one of the ten funds may be too great to bear. Another related caveat is that given the non-normality of hedge fund returns, standard deviation alone may not be a sufficient statistic for the dispersion in hedge fund returns. It will be interesting to understand how left tail risk varies with the number of hedge funds in a portfolio. We leave this question to future work. Finally, it is important to understand that hedge fund risk is a multi-faceted concept. For example, investors who deploy capital into hedge funds should also seek to understand the liquidity risk profiles of the funds that they subscribe to and ensure that the liquidity risk of their underlying investments matches the liquidity of their liabilities.

References

Fung, W., Hsieh, D., 2004. Hedge fund benchmarks: a risk based approach. Financial Analyst Journal 60, 65–80.

Amin, G., Kat, H., 2002. Portfolios of hedge funds. Unpublished working paper, Cass Business School.

Update on the Centre's Activities

Education

The hedge fund centre organized a seminar on 22 March featuring Indy Nanayakkara, CEO of Piquant Capital. Indy has 19 years of experience in both the buy-side and the sell-side having worked at Henderson Global Investors, Jardine Fleming Securities, Donaldson, Lufkin and Jenrette/Credit Suisse, and Macquarie Funds Management. He holds degrees in Economics from the University of Oxford and University College London, UK, and is also a CFA charter holder. Indy spoke on the topic "How to Slay Dragons using Quant Spells: the Experience of a Start-up". He chronicled Piquant Capital's journey from its launch in October 2011 to opening its strategy to investors recently. Piquant runs a quantitative, systematic, equity market neutral strategy focusing on the Asia Pacific region. Indy expressed hope that his informal talk will motivate start-ups especially quantitatively driven firms to persevere in the face of extremely low odds of success: raising seed capital is difficult, the launch process can be long and stressful, and costs are unusually high, compounded by increasing regulatory requirements. 50 people including 42 practitioners attended the seminar.

Research

The centre director presented his research on "Growing the Asset Management Franchise: Evidence from Hedge Fund Firms" at the NYSE Euronext 5th Annual Hedge Fund Research Conference in Paris on 24 January. The paper is joint with Bill Fung, David Hsieh, and Narayan Naik. The research piece was subsequently profiled by a *Hedge Fund Manager Week* article entitled: "Failure to Launch?"

http://smu.edu.sg/sites/default/files/smu/news_room/smu_in_the_news/2013/sources/HFMW_20130131_1.pdf

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For more information regarding the BNP Paribas Hedge Fund Centre at SMU and our upcoming activities, please contact Ms Karyn Tai, centre coordinator (Tel: +65-6828-0933, E-mail: hfc@smu.edu.sg) or visit our webpage at http://www.smu.edu.sg/centres/hfc/index.asp. We look forward to receiving your suggestions and comments.