

Hilary Till, Principal
Premia Risk Consultancy, Inc.

Phone: 312-583-1137
Fax: 312-873-3914
E-mail: till@premiacap.com

Author's Note: This article originally appeared in the Spring 2004 Journal of Alternative Investments.

ON THE ROLE OF HEDGE FUNDS IN INSTITUTIONAL PORTFOLIOS

Abstract

Hedge funds do not easily fit into the current way institutions go about investing. Based on a survey of recent academic and practitioner research, this article reviews six competing frameworks for how to incorporate hedge funds in institutional portfolios. Each framework has very different implications for institutional asset allocation, manager selection, and benchmarking.

In this article, we will review both academic and practitioner research from the standpoint of a hypothetical institutional investor who is looking into whether hedge funds make sense for their portfolio.

Surveying the extensive hedge fund literature, it appears that there are six competing conceptual frameworks for how hedge funds should be incorporated into institutional portfolios. We will review each of these frameworks along with the research that supports their use.

EQUITY PROXIES

One possible role for hedge funds is for them to become substitutes for an institution's equity allocation. The goal would be to benefit from the risk premium of the equity markets but with truncated downside risk.

Ineichen [2003a] notes that long-short equity sector hedge funds have opportunity sets that are correlated to their respective sectors, resulting in the active sector funds having returns that are correlated to their sector indices. Even so, these hedge funds control their downside risk so that their returns compound at a higher rate than their sector indices.

Fung and Hsieh [1999] examine a global macro fund versus five equity-market environments. They find that this fund is positively correlated with stocks.

However, it underperforms equities in up markets and outperforms equities in down markets, behaving as if it owned collars (short calls and long puts) on U.S. equities.

One may consider such an investment strategy as attractive for loss-averse, equity investors.

Before an institution decides to allocate its equity risk to hedge funds, one might consider examining the relative performance of equity hedge funds compared to equity mutual funds. Ackermann *et al* [1999] examine the performance of hedge funds and mutual funds in the eight-year period up to December 31, 1995. They find when comparing mean and median Sharpe ratios, "the hedge fund advantage is fairly pervasive across categories"

Ineichen [2003b] compares the returns of hedge fund indices to equity indices and to average mutual fund performance. He emphasizes the downside risk protection provided by hedge funds in Exhibit 1.

UNCONVENTIONAL BETAS

In the academic literature, there is discomfort with relying on manager self-descriptions to characterize their investment styles. One would prefer classification techniques that are derived from objective, statistical methods.

As a result of this discomfort with current practice, there have been a number of creative articles attempting to extend the Sharpe-style returns-based analysis to hedge funds. In Sharpe [1992], the author discusses how to model mutual fund portfolios as a mix of a limited set of investment styles, and this methodology is widely used by mutual funds and their investors. In a Sharpe style analysis, for example, an equity “growth fund” could be 70% large growth, 25% large value, and 5% small growth. Fung and Hsieh [1997] note that:

The elegance of Sharpe’s intuition was demonstrated empirically by showing that only a limited number of major asset classes were required to successfully replicate the performance of an extensive universe of U.S. mutual funds.

There is not yet a consensus on how to apply the style factor approach to hedge funds. Three possible approaches to consider in coming up with a limited number of factors to explain hedge fund performance are as follows:

1. Create multi-factor models, which include such terms as changes in credit premia and changes in equity option implied volatility as well as asset-based style factors;
2. Use only asset-based style (ABS) factors; and
3. Use the returns on existing hedge fund style indices themselves as the factors.

Schneeweis *et al* [2001] describe using nine financial and macroeconomic factors to explain hedge fund performance. They write that:

... exposures to these factors can explain close to 60% of cross-sectional differences in average rates of return on different strategies.

The authors’ nine explanatory factors are as follows:

- Slope of the yield curve;
- Long-term yield;
- T-Bill rate;
- Credit risk premium;
- Intra-month standard deviation of S&P 500 index;
- S&P 500 total return;
- Small capitalization equity return;
- Equity implied volatility; and
- Intra-month volatility of bond returns.

If an institution were confident in its forecasting ability of these factors, then they could be included in their asset allocation model. At that point one would aim to hire hedge fund managers whose strategies provided exposures to these factors. One might even insist upon “style purity,” as advocated by Schneeweis [2003]. In other words, the goal would be to find managers whose performance was persistent, given the market

conditions represented by the nine market variables. Interestingly under such conditions, hedge fund manager selection becomes a “search for beta” rather than a “search for alpha,” as phrased by Fung [2003].

One can also consider another approach, which is related to multi-factor modeling. In the asset-based style factor approach, one only uses tradable assets as factors. Specifically in this approach, researchers include various asset classes, rule-based investment styles, and options as explanatory factors of a hedge fund strategy’s returns.

Exhibit 2 summarizes the hedge fund styles for which the asset-based style factor approach has been successful so far in explaining returns.

Similar to the multi-factor approach, Fung [2003] describes how the asset-based style factor approach could be used in portfolio construction:

- Determine the relevant ABS factors suitable to overall asset allocation; and
- Construct portfolios of hedge funds such that the aggregate ABS factor betas are consistent with overall asset allocation.

The ABS factor approach helps in understanding the role of hedge funds in a traditional asset allocation framework. Again quoting from Fung [2003]:

... hedge funds deliver “alternative risk premia” for bearing risk in factors different from traditional assets.

Specifically one gets paid for bearing certain types of equity and fixed-income spread risk as well as liquidity risk.

Lhabitant [2001] suggests that one should use existing hedge fund style index returns as the appropriate underlying factors in a returns-based analysis of hedge funds. Lhabitant uses hedge fund style index returns from the database vendor, CSFB/Tremont, but he notes that his analysis could be repeated with other families of hedge fund indices.

Since a hedge fund manager or fund-of-funds will sometimes be diversified across hedge fund styles, he suggests creating “hedge fund style radars,” which graphically illustrate a fund’s beta to each hedge fund style. Examples of hedge fund style radars are shown in Exhibit 3.

Another approach followed by researchers is to explicitly model the distributional characteristics of each hedge style, including their skewness and kurtosis properties. Chen *et al* [2002] advocate this approach.

The issue for hedge fund investors, as noted by Feldman [2002], is that:

Most hedge fund “styles” achieve high Sharpe ratios at the expense of high levels of kurtosis and negative skew.

In Chen *et al*, the researchers take into consideration the non-normal return distributions of hedge fund styles. After modeling the performance characteristics of hedge fund styles, the researchers determine the optimal combination of traditional and alternative investments, given different levels of investor risk and loss aversion. For certain levels of risk and loss aversion, the researchers find that the most attractive hedge fund styles to add to a traditional portfolio are the equity market-neutral and global macro styles.

Once one is open to the idea of viewing hedge fund investments in terms of a handful of style bets, one might consider using a tactical allocation strategy. CrossBorder Capital [1999, 2003] proposes linking hedge fund style returns to the global liquidity cycle. One would then tactically switch among hedge fund styles according to one’s predictions about future liquidity conditions.

One stumbling block with this approach is that lock-ups and illiquidity are a fundamental aspect of hedge fund investment. An additional practical problem is that some hedge fund managers restrict the amount of redemptions that can occur at any one time.

As a result, the CrossBorder researchers suggest using investable style tracker funds to implement the strategy. This idea pushes the idea of the “search for beta” to its logical conclusion.

Another way of thinking about style exposures of hedge funds has been proposed by Goodman *et al* [2002], who note that equity hedge funds have a structural value/small-capitalization bias. They warn that:

The relative performances of both [equity] value and small-cap styles have historically been highly cyclical ...

Therefore in constructing “risk-efficient portfolios,” an investor may want to attempt to neutralize this exposure if one does not want to have a small-cap value bias during a particular point in the investment cycle.

The idea that one might be able to successfully carry out equity style timing is provided by Asness *et al* [2000], who describe a methodology for deciding upon the relative prospects of value versus growth. In November 1999, for example, their model correctly forecasted:

... near-historic highs for the expected return of value versus growth.

There is another logical conclusion, which emerges from the “search for beta.” Jensen and Rotenberg [2003] recommend that:

A savvy investor should be unwilling to pay significant fees to an asset manager who is essentially taking in risk premiums for them.

Jensen and Rotenberg discuss examples of hedge fund style returns that could be replicated by passive investment techniques. Exhibit 4 provides one of their examples. Based on an analysis of hedge fund style returns, the researchers advocate that one try to understand whether a hedge fund manager’s returns are due to superior skill or are due to taking in risk premiums.

Before leaving the discussion on beta-versus-alpha, one should add the following cautionary note from Fung and Hsieh [2002] about relying too much on hedge fund style index data for conclusions on individual managers:

... broad-based indexes of hedge funds are more likely to reflect the risk characteristics in the recent “popular bets” among hedge fund managers ... Because of this concentration, the hedge-fund indexes understate the diversity of trading styles in general and overstate the risk of style convergence.

The appropriate benchmarks for hedge fund investments will depend on which factor approach the investor embraces. This section provided three approaches to consider. In the first two approaches, the relevant factor returns would be the benchmark’s. In the third approach, the return on the style-appropriate peer group would be the investment’s benchmark.

As noted at the beginning of this section, there is not yet consensus on which factor approach to use. The larger point to make, though, is that there is not even consensus on whether the factor approach is appropriate for hedge fund investments. The next section of this article will adopt the point-of-view of emphasizing the pure alpha aspects of hedge fund investing.

ALPHA GENERATORS

Anjilvel *et al* [2001] emphasizes the “alpha advantage” of hedge fund managers. They write that:

Our research has shown that a significant proportion of the total return to hedge funds in the past has been alpha, in contrast with a small negative total alpha for mutual funds ...

This view of hedge fund management has a direct impact on the potential capacity of the hedge fund industry. To figure out the capacity of the hedge fund industry, we start by quoting from Cochrane [1999]:

... the average investor must hold the market so portfolio decisions must be driven by differences between an investor and the average investor.

If hedge funds are exploiting market inefficiencies, this means that other investors are supplying those inefficiencies. This means that, unfortunately, we can't all profit from exploiting inefficiencies. Therefore, there is a natural cap on the potential size of the hedge fund industry (assuming that hedge funds are indeed exploiting inefficiencies rather than taking in risk premiums.)

Under this framework we can estimate how large the hedge fund industry could become based on the following three factors:

1. The maximum tolerance of the average investor for supplying inefficiencies;
2. The required return targets of hedge fund investors; and
3. The size of the global capital markets.

According to Anjilvel *et al* [2001], the size of the global equity and bond markets is \$55 trillion. Using this size of the global capital markets, Exhibit 5 shows the potential size of the hedge fund industry based on a give-and-take analysis between the suppliers and exploiters of market inefficiencies.

According to Putnam Lovell NBF and NewRiver [2002], the current size of the hedge fund industry is \$500 billion while the size of the global high net worth (HNW) and institutional marketplace is \$44 trillion. (As of January 2004, the size of the global hedge fund industry had grown to \$700 billion, according to Butcher [2004].) One might think that one could calculate how large institutional investment in hedge funds could become using Exhibit 5's figures. As an example, say the average investor can tolerate up to -0.50% of inefficiencies in their traditional investments before competitive (or regulatory) forces would step in to keep this number from getting larger. Simultaneously, let's say hedge fund investors demand at least 10% in excess returns before committing their money to hedge funds. One might expect that hedge fund investors would require premium returns because these investment vehicles tend to be quite opaque and illiquid. Using these two assumptions, one could plausibly arrive at the size of the hedge fund industry becoming \$2.75 trillion ($= \$55 \text{ trillion} * 0.50\% / 10\%$.) This would mean that institutional and HNW investments in hedge funds could become 6% ($= \$2.75 \text{ trillion} / \44 trillion .)

On the other end of the spectrum, if the average investor can tolerate -1.0% in inefficiencies in how their money is invested, and if hedge fund investors only require 5% in excess returns before giving their money to hedge funds, one could envision the hedge fund industry being able to grow to \$11 trillion. The trouble with this conclusion is that one would expect competitive forces to step in at some point: there should be an

interaction effect between the size and success of the hedge fund industry and the willingness of the average investor to tolerate mediocre investment management.

Therefore in viewing the predictions of Exhibit 5, one must caution that at some point the size and success of alpha-generating strategies can only attract so much capital before this would jeopardize their continuing success.

Analyzing the potential size of the hedge fund industry from a “demand point-of-view,” Putnam Lovell NBF and NewRiver [2002] predict that by 2010, global HNW and institutional investment in hedge funds could become 3% of this sector’s assets. Using Exhibit 5’s framework, it is plausible that such a size could be achieved from a “supply point-of-view.” Using Putnam Lovell NBF and NewRiver’s assumed growth in the size of the capital markets, their estimate would be consistent with the average investor tolerating -0.25% in inefficiencies and the hedge fund investor requiring 10% excess returns on their investments.

There are a number of historical examples to point to in showing that superior investment strategies have historically been fleeting, which is why this section of the article is sounding a cautionary note on predicting the potential size of the (alpha-generating portion of the) hedge fund industry. To provide a broad historical perspective, Siegel [2003] writes that:

High-beta stocks beat low-beta stocks until William Sharpe discovered beta in 1964; small stocks beat large ones until Banz and Reinganum discovered the size effect in 1979 ...

Gatev *et al* [1999] provide a more recent example. They simulate the performance of the equity pairs trading strategy. Over the period 1962 to 1997, they:

... find average annualized excess returns of up to 12 percent for a number of self-financing portfolios of top pairs.

But they also find that:

Pairs trading has declined in profitability dramatically from the 1970’s and 1980’s to a low point at the end of our sample when the returns were sometimes negative.

They hypothesize that after the strategy’s discovery in the early 1980’s, “competition has decreased opportunity.”

Agarwal, Daniel, and Naik [2002] provide further evidence of the capacity-constrained nature of the hedge fund industry. Using data from January 1994 through December 2000, they note that:

... large funds with large inflows display poor future performance and a lower probability of exhibiting persistence. This finding is consistent with decreasing returns to scale in the hedge fund industry.

Given that some hedge fund styles can potentially be passively replicated, have there been any studies so far on how to select hedge fund managers whose performance cannot be linked to known risk factors? The answer is yes; Chen and Passow [2003] and Herzberg and Mozes [2003] have provided two studies on this topic so far, and both have provided evidence that such screens are successful in selecting superior managers in out-of-sample tests. What these studies cannot answer, though, is at what point would the popularity of such tests lead to the selected managers quickly reaching or exceeding their capacity constraints? As with the pairs-trading study, one worries that the identification of superior investment strategies will lead to their profits disappearing.

Confirming Fung and Hsieh's warning about using hedge fund style index data to represent the heterogeneous hedge fund industry, Ross and Oberhofer [2002] find that:

The variability of individual fund characteristics suggests that investors' selection of hedge funds should be strictly a bottom-up exercise.

The Russell researchers illustrate the variability of exposures across individual managers within a given style in Exhibit 6.

For investment strategies that exploit inefficiencies, Ineichen and Johansen [2002] suggest one possible way of approaching the benchmark question:

One possible solution could be to combine objective quantitative assessment with qualitative judgment. The classical market benchmark could for example be replaced through a set of absolute investment objectives. The objectives are enforced through consent between manager and investor. The active manager will then be measured and held accountable against these objectives.

TRADITIONAL FACTOR EXPOSURES WITH ADDITIONAL RETURNS FROM MARKET SEGMENTATION AND LIQUIDITY PREMIA

Another framework to consider in deciding how alternative investments should fit into an institutional portfolio has been suggested by Terhaar *et al* [2003]. They emphasize the natural consequences of diversification as it applies to both traditional *and* alternative investments:

Any individual alternative investment may have low correlation with other assets in the portfolio. But when investors build well-diversified alternative investment

programs, the systematic influences – underlying economic fundamental drivers – become more significant and the residual noise diminishes. Hence, the more diversified the private equity, real estate, natural resource or hedge fund portfolio, the more correlated it is likely to be with public markets.

Their recommended solution is to use a factor approach to build a consistent set of forward-looking return and risk characteristics for conventional *and* alternative asset classes alike.

Their chosen factors attempt to reflect the underlying economic exposures of the assets and strategies. They choose twelve primary factors to capture the systematic risk characteristics of both alternative and conventional assets. Each investment, including hedge funds, is represented by some combination of these systematic risk factors plus a risk premium, reflecting the investment's level of market segmentation, and illiquidity.

Their study recommends that an “appropriate” policy mix for a mid-risk institutional investor should include a 20% allocation to alternative investments with 3% allocated to hedge funds.

As a final note on the capacity issue, one should note that the previous section discussed the size of the hedge fund market if it were assumed that the industry's returns were due to capitalizing on inefficiencies or generating alpha, so to speak. In this section, we are assuming that the hedge fund strategies are earning risk premia. One would still note that even under this framework, the strategies would still become capacity constrained at some level since if everyone took advantage of a market segmentation effect, there would no longer be a market segmentation effect. Also, to earn a return from providing liquidity, “an investor must have a longer horizon than the average market participant,” quoting Scholes [2000]. And again, unfortunately, we can't all have a longer horizon than the average participant.

In the “Unconventional Betas” section of this article, we noted that the appropriate benchmark for hedge fund investments would depend on which factor approach the investor embraces. Similarly under the framework described in this section, the collection of an institution's hedge fund managers should be benchmarked against the returns of the traditional factor exposures plus the assumed premia arising from market segmentation effects and illiquidity.

TOTAL RETURN THROUGH A FUND-OF-FUNDS

A defining feature of hedge funds is their boutique nature. A hedge fund may only have one or two key decision-makers, for example. This does not give a lot of comfort to institutional investors who require a deep team of investors carrying out a disciplined and repeatable investment process that does not rely on any one individual for its continued success.

Fund-of-funds provide the type of structure that gives comfort to institutional investors. One possible organizational model is for institutions to use fund-of-funds to diversify away idiosyncratic, operational risk of an individual hedge fund. In this framework, one should not compare individual hedge funds to mutual funds but instead should see fund-of-funds as the analog to mutual funds.

However, Schneeweis *et al* [2001] warn that fund of funds:

... may be market timing and are less useful in asset allocation strategies since ... [both their] factor sensitivity and [investment] composition change in contrast to more style-pure hedge fund indices or strategies.

Exhibit 7 illustrates the changing strategy emphasis in fund of funds.

Drawing from Schneeweis *et al*'s work, if one needs control over the factor exposures of their investments, then fund of funds may not be the appropriate vehicle for an institutional investor. But instead if one were treating their hedge fund investment as a separate asset class with a total-return “bogey” or benchmark, then a fund-of-funds investment would be appropriate.

From a modeling standpoint, a quantitative researcher welcomes using fund-of-fund data rather than individual hedge fund manager data. Fung and Hsieh [2002] reason that:

... the most direct way to measure hedge-fund performance is to observe the investment experience of hedge-fund investors themselves – the fund of funds.

Despite anecdotal evidence that fund-of-funds tend not to use quantitative techniques in portfolio construction, this section will forge ahead and briefly discuss three proposals on optimal fund-of-funds construction using quantitative methods.

Amenc and Martellini [2002] discuss how to create a portfolio of equity and hedge fund investments in which the goal is to minimize return variance. Their dataset covers the period, 1994 to 2000. They find that the following strategies are never included in the minimum variance portfolio: emerging markets, global macro, and equity long/short. On the other hand:

... the largest fraction of the portfolio is consistently invested in equity market neutral.

Lhabitant and Learned [2002] examine how many hedge funds are needed to create a diversified portfolio. Using data from 1990 through 2001, their key findings are as follows:

- Per hedge fund style, between 5 and 10 hedge funds are usually sufficient to eliminate 75% of the specific risk in the portfolio;

- Diversification within some hedge fund strategies may appear highly attractive in mean-variance terms, but this is much less so when skewness and kurtosis are taken into account;
- There are limited benefits in diversifying amongst arbitrage hedge funds; and
- An investor can significantly reduce risk in his or her portfolio with fewer hedge funds if the funds are chosen across investment styles.

Bacmann and Pache [2003] investigate the impact of creating optimal portfolios with metrics that take into consideration skewness and kurtosis. They find that:

... the portfolios optimized with [such] ... measures provide better out-of-sample returns than the ones constructed in the mean-variance framework.

For their study, the researchers examine an out-of-sample period from 1996 through 2002.

One could argue that a fund-of-funds effectively becomes a “surrogate plan sponsor” since they control the factor exposures of their slice of an institution’s investment. In that case, the proper benchmark for a fund of funds might be a diversified portfolio of stocks and bonds as represented by a 60% equities/40% bonds balanced portfolio.

Perhaps surprisingly this has been a tough benchmark to beat. Ackermann *et al* [1999] show that over several timeframes, the average and median hedge fund has a Sharpe ratio that is less than a balanced portfolio of 60% in the S&P 500 index and 40% in the Lehman Aggregate Bond index. Those timeframes are as follows: January 1994 through December 1995, January 1992 through December 1995, and January 1988 through December 1995.

To provide a more up-to-date comparison, Exhibit 8 compares an index of fund-of-funds versus a balanced equity-and-bond benchmark. The balanced benchmark has outperformed on an absolute *and* risk-adjusted return basis.

Does this invalidate the case for investing in fund of funds when a diversified portfolio of indexed stocks and bonds has historically beaten an index of actively managed funds of hedge funds?

The short answer is no. Amongst the objections to the story portrayed by Exhibit 8 is that we are showing results starting in 1994 when the hedge fund industry did poorly. If one had started this comparison at other points in time, one would have come up with different conclusions. For example, Edwards and Gaon [2003] present fund of fund, equity, and bond data from January 1990 to November 2002. Exhibit 9 provides an excerpt from their table of performance results.

Given the large difference in results between Exhibit 8 and 9, one might conclude that we do not have enough data to make robust conclusions in comparing diversified hedge fund investments to a balanced benchmark.

There are a number of trade-offs to consider in analyzing hedge fund results. The reason we had started our comparison using 1994 as the beginning year is that is the year that hedge fund data gathering became the most reliable, according to Fung and Hsieh [2002].

UNSTABLE FACTOR EXPOSURES

An investor may be uncomfortable with an investment having unstable factor exposures. For example, Bennett *et al* [2002] ask:

... is this the way investors expect to make money in hedge funds – through a series of timely factor bets?

If the answer is no, it means that one does not want their fund-of-fund manager to become, in effect, a surrogate plan sponsor. One may then conclude that hedge funds cannot be integrated into an institutional investment framework. As a matter of fact, Bennett *et al* write that:

... our standard advisory position is that we do not advocate hedge funds. We believe most clients with well-designed investment policies are better off without them.

CONCLUSION

This last sentence may be a controversial way to end an article on hedge fund research. But as the economic historian, Peter Bernstein, stated in Chernoff [2003], one should be careful about expecting:

... a degree of neatness about the investment process [because] there is nothing to neat about it. It's very hard.

One can logically argue the merits of each of the six conceptual frameworks presented in this article as long as they are consistently applied.

ENDNOTES

The content of this article is the opinion of the author alone.

This article received research support from the Foundation for Managed Derivatives Research.

She would like to thank Mr. Richard Oberuc of Burlington Hall Asset Management, Inc. for sharing his extensive library of hedge fund research; Mr. Sol Waksman of the Barclay

Trading Group for the use of the Barclay MAP database; and Ben Borton and HFR for the use of historical data.

She would also like to thank Jeff Hank of Harris Associates and Gary Knapp for assistance in the analysis of hedge fund and asset class return series. Finally she would like to thank Laurence Siegel of the Ford Foundation, Matthew Smith of Grosvenor Capital, Joseph Eagleeye of Premia Capital, and Gary Knapp for their helpful comments.

REFERENCES

Ackermann, C., R. McEnally, and D. Ravenscraft. "The Performance of Hedge Funds: Risk, Return, and Incentives." *Journal of Finance* (June 1999), pp. 833-874.

Agarwal, V., N. Daniel, and N. Naik. "Flows, Performance, and Managerial Incentives in the Hedge Fund Industry." Working Paper, Georgia State University and London Business School, 2002.

Amenc, N., and L. Martellini. "Portfolio Optimization and Hedge Fund Style Allocation Decisions." *Journal of Alternative Investments* (Fall 2002), pp. 7-20.

Anjilvel, S., B. Boudreau, B. Johmann, M. Peskin, and M. Urias. "Hedge Funds – Strategy and Portfolio Insights." Morgan Stanley Quantitative Strategies Research, 2001.

Asness, C., J. Friedman, R. Krail, and J. Liew. "Style Timing: Value Versus Growth." *Journal of Portfolio Management* (Spring 2000), pp. 50-60.

Bacmann, J-F., and S. Pache. "Optimal Hedge Fund Style Allocation Under Higher Moments." RMF Investment Management Research, 2003.

Bennett, P., R. Ennis, and M. Sebastian. "Hedge Funds: Return Enhancer or False Hope." Ennis Knupp + Associates Research, 2002.

Butcher, J. "Onwards and Upwards." *Hedge Funds Review* (January 2004), pp. 11-12.

Chen, K., and A. Passow. "Quantitative Selection of Long-Short Hedge Funds." Working Paper, FAME and HEC Lausanne, 2003.

Chen, P., B. Feldman, and C. Goda. "Portfolios with Hedge Funds and Other Alternative Investments: Introduction to a Work in Progress." Ibbotson Associates Research, 2002.

Chernoff, J. "Radical Thought: Bernstein Suggests Policy Portfolios No Longer Make Good Sense." *Pensions & Investments*, March 17, 2003.

Cochrane, J. "Portfolio Advice for a Multifactor World," *Economic Perspectives*, Federal Reserve Board of Chicago (Third Quarter 1999), pp. 59-78.

CrossBorder Capital. "TSS – Tactical Style Selection." Hedge Fund Research, November 1999.

CrossBorder Capital. "Dynamic Style Analysis." Hedge Fund Research, April 2003.

Edwards, F., and S. Gaon. "Hedge Funds: What Do We Know?" *Journal of Applied Corporate Finance* (Summer 2003), pp. 8–21.

Feldman, B. "Portfolio Construction with Alternative Investments," Ibbotson Associates Research, Presentation to Chicago QWAFEFW, 8/22/02.

Fung, W. and D. Hsieh. "Empirical Characteristics of Dynamic Trading Strategies: The Case of Hedge Funds." *Review of Financial Studies* (Summer 1997), pp. 275-302.

----- . "A Primer on Hedge Funds." *Journal of Empirical Finance* (September 1999), pp. 309-331.

----- . "Hedge-Fund Benchmarks: Information Content and Biases." *Financial Analysts Journal* (January/February 2002), pp. 22-34.

----- . "The Risk in Hedge Fund Strategies: Alternative Alphas and Alternative Betas." In L. Jaeger, ed., *The New Generation of Risk Management for Hedge Funds and Private Equity Investments*. London: Euromoney Books, 2003, pp. 72-87.

Fung, W. "The Risk in Hedge Fund Strategies: Alternative Alphas and Alternative Betas." Presentation at Infovest21, New York, 4/15/03.

Gatev, E., W. Goetzmann, and K. G. Rouwenhorst. "Pairs Trading: Performance of a Relative Value Arbitrage Rule." Working Paper, Yale School of Management, 1999.

Goodman, M., K. Shewer, and R. Horwitz. "Beware of Systematic Style Biases." *Risk Magazine* (December 2002), pp. S17-S19.

Ineichen, A. and J. Johansen. "Benchmark Conundrum," UBS Warburg Global Equity Research, 2002.

Ineichen, A., "Asymmetric Returns and Sector Specialists." *Journal of Alternative Investments* (Spring 2003), pp. 31-40.

Ineichen, A., *Absolute Returns*. Hoboken, NJ: Wiley Finance, 2003.

Jensen, G. and J. Rotenberg. "Hedge Funds Selling Beta as Alpha." Bridgewater Daily Observations, 6/17/03.

Lhabitant, F-S. "Hedge Fund Investing: A Quantitative Look Inside the Black Box." Union Bancaire Privee Research, 2001.

Lhabitant, F-S., and M. Learned. "Hedge Fund Diversification: How Much is Enough?" *Journal of Alternative Investments* (Winter 2002), pp. 23-49.

Mozes, H., and M. Herzberg. "The Persistence of Hedge Fund Risk: Evidence and Implications for Investors." *Journal of Alternative Investments* (Fall 2003), pp. 22-42.

Putnam Lovell NBF and New River Research. "Institutional or Institutionalized – Are Hedge Funds Crazy." December 2002.

Ross, L., and G. Oberhofer, "What the 'Indexes' Don't Tell You about Hedge Funds," Russell Research Commentary, 2002.

Schneeweis, T., H. Kazemi, and G. Martin. "Understanding Hedge Fund Performance: Research Results and Rules of Thumb for the Institutional Investor." CISDM and Lehman Brothers Research, November 2001.

Schneeweis, T. "Persistence of Hedge Fund Returns." Schneeweis Partners, Presentation at Infovest21, New York, 4/15/03.

Scholes, M., "The Near Crash of 1998: Crisis and Risk Management." AEA Papers and Proceedings (May 2000), pp. 17-21.

Sharpe, W.. "Asset Allocation: Management Style and Performance Measurement." *Journal of Portfolio Management* (Winter 1992), pp. 7-19.

Siegel, L., *Benchmarks and Investment Management*. Charlottesville, VA: Association for Investment Management and Research, 2003.

Terhaar, K., R. Staub, and B. Singer. "Determining the Appropriate Allocation to Alternative Investments." *Journal of Portfolio Management* (Spring 2003), pp. 101-110.

EXHIBITS

Exhibit 1

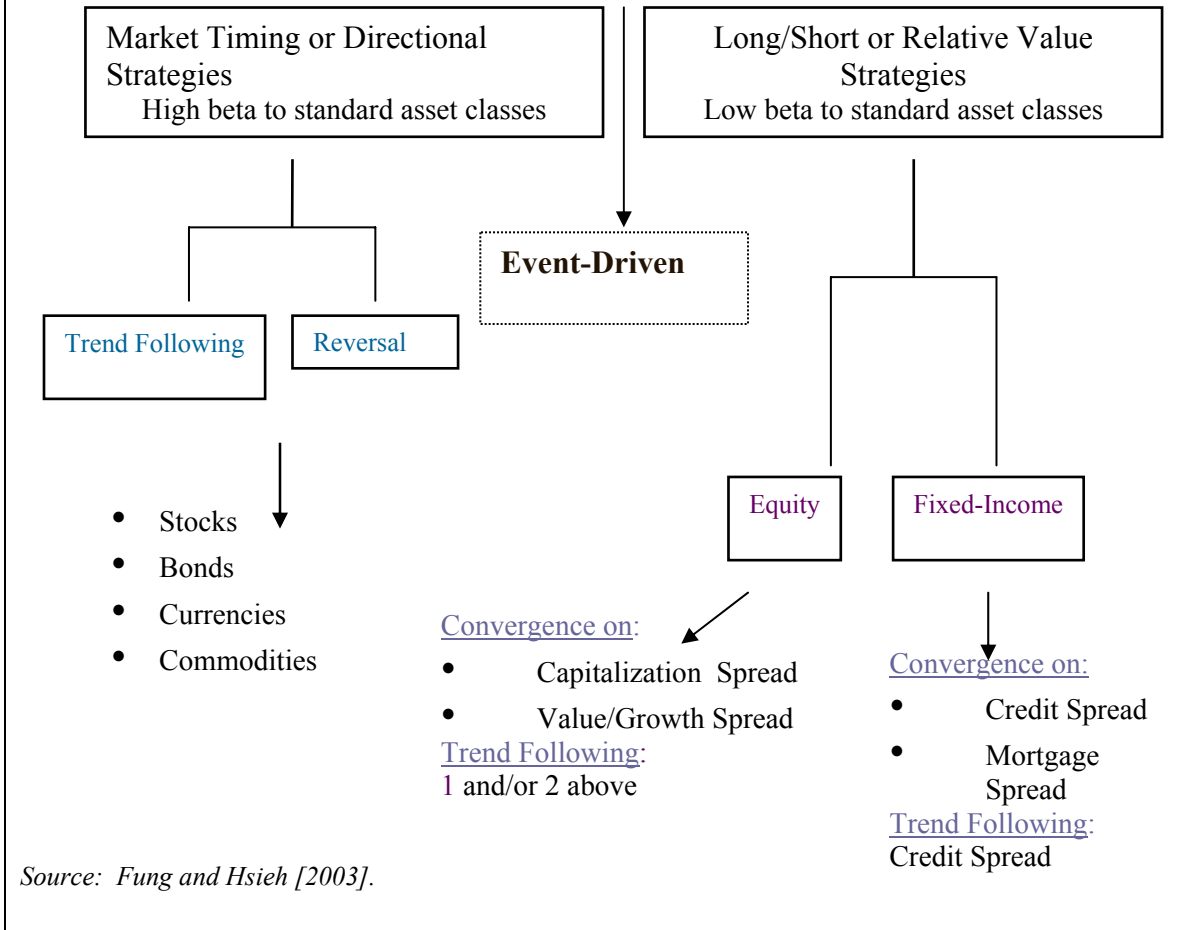
Hedge Fund Returns Compared with Mutual Fund and Index Returns (1988-2001)

	MSCI World Total Return <u>Index</u>	S&P 500 Total Return <u>Index</u>	Morningstar Average Equity <u>Mutual Fund</u>	Van Global Hedge <u>Fund</u>	HFRI Fund Weighted Composite <u>Index</u>	CSFB/ Tremont Hedge Fund <u>Index</u>
Average	10.0	15.5	12.1	17.5	16.4	12.2
Median	16.7	18.8	16.0	17.6	18.9	13.3
High	25.3	37.6	31.9	39.5	32.2	25.9
Low	-16.5	-11.9	-12.5	0.4	2.6	-4.4

Source: Ineichen [2003b].

Exhibit 2

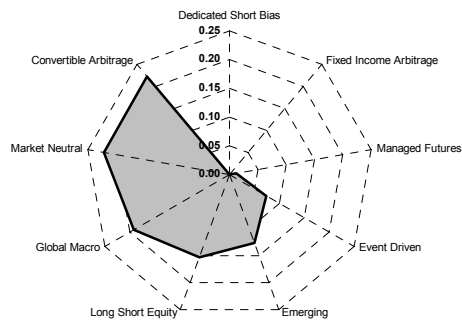
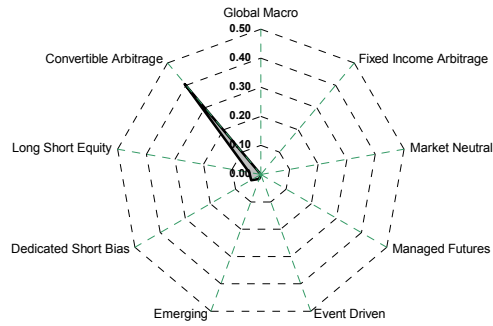
Hedge Fund Styles That Can be Modeled with Asset-Based Style Factors



Source: Fung and Hsieh [2003].

Exhibit 3

Hedge Fund Style Radars





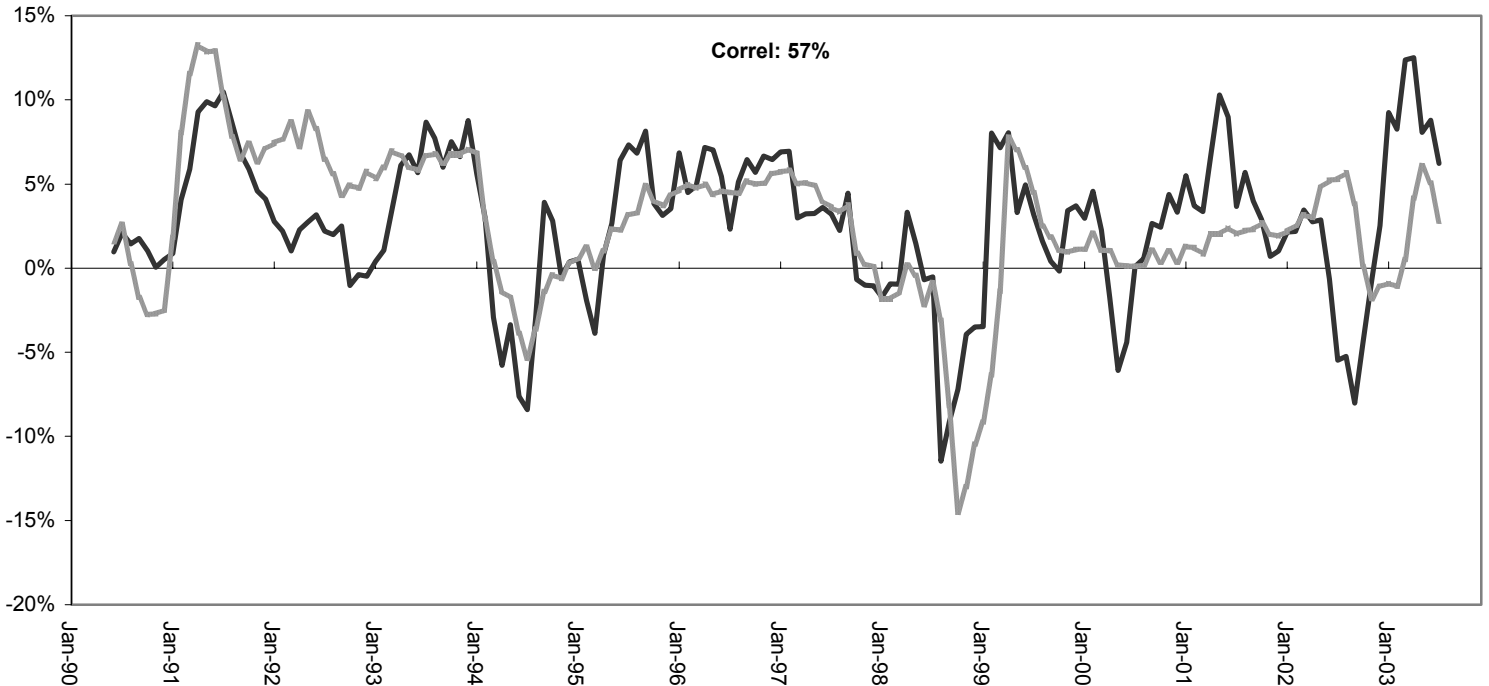
Note: “The figure shows the hedge fund radars obtained for a convertible arbitrage fund (top) and a fund of hedge funds (bottom). The sensitivities (i.e., style-beta coefficients) are estimated using three years of historical data.”

Source: Lhabitant [2001].

Exhibit 4

**Rolling Six-Month Returns of a Naïve Mix of Illiquid Fixed Income Instruments
Versus the Rolling Returns of Fixed Income Arbitrage Hedge Funds**

	Fixed Income Arbitrage Model Using Mortgage Spds, Corp Spds, EMD, Euro\$ 6m Return Above Cash
	CSFB/Tremont Fixed Income Arbitrage Manager Index 6m Return Above Cash



Source: Jensen and Rotenberg [2003].

Exhibit 5

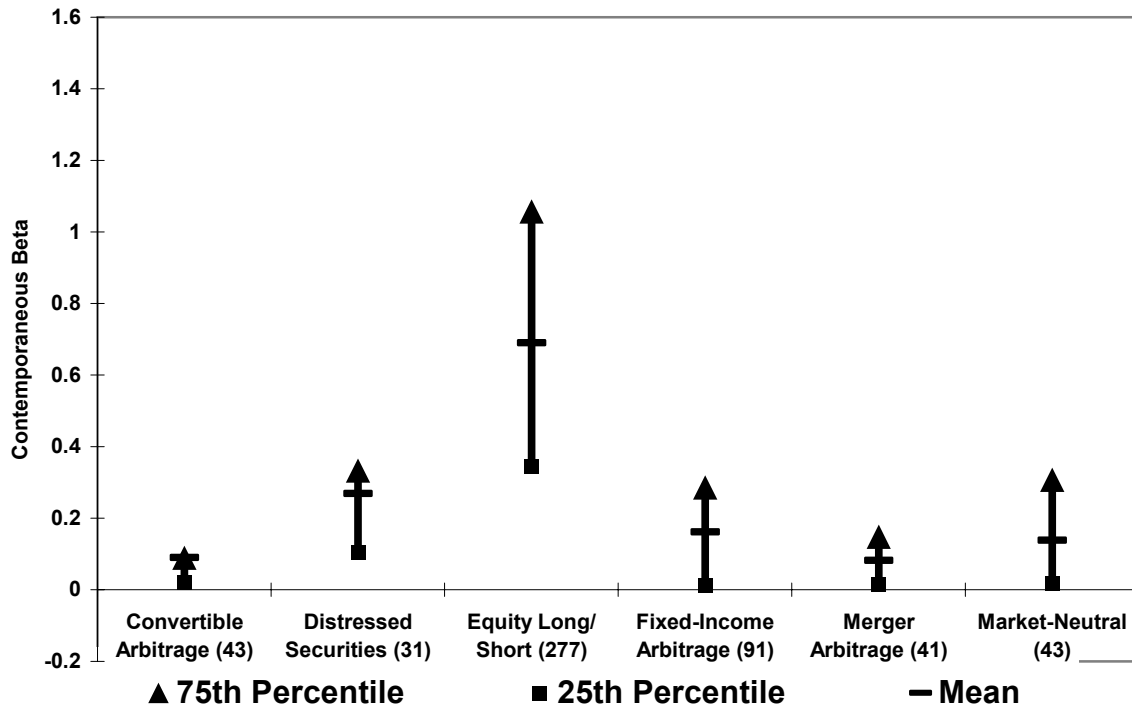
**Capacity of Hedge Fund Industry (With an “Alpha Advantage”)
in Billions of Dollars**

		Allowable Inefficiency in Private, Mutual Fund and Institutional Fund Management		
		-0.5%	-0.75%	-1.0%
Required Excess	10.0%	2,750	4,125	5,500
Return for	7.5%	3,667	5,500	7,333
Hedge Funds	5.0%	5,500	8,250	11,000

Source: Premia Risk Consultancy, Inc.

Exhibit 6

Range of Beta Estimates by Style

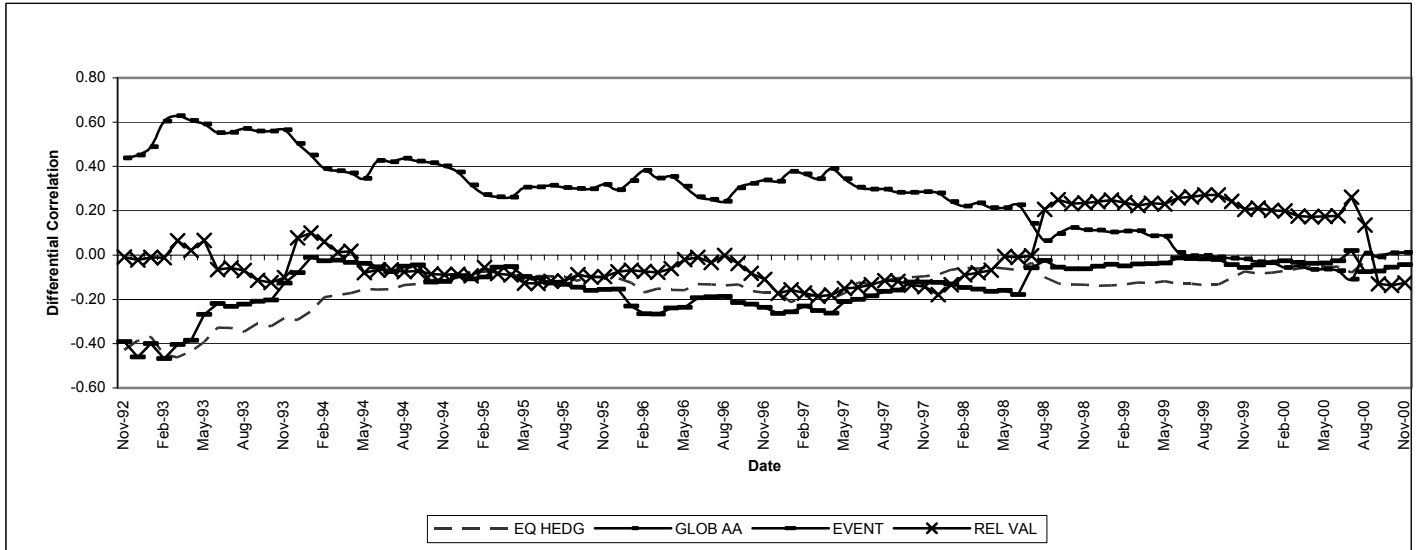


Note: This figure “demonstrates the range of betas [with respect to the Russell 3000 equity index] attributable to managers within the styles they follow.”

Source: Ross and Oberhofer [2002].

Exhibit 7

Differential 24 Month Correlations (Fund of Funds – Average Fund Weighted Index) 1992-2000



Notes: EQ HEDG: Hedge Equity; GLOB AA: Global Asset Allocation (or Global Macro); EVENT: Event Driven; REL VAL: Relative Value.

“Note that over time the correlations of Hedge Equity rise and Global Macro fall, indicating an increase in Fund of Funds’ use of Hedge Equity and a decrease in the use of Global Macro.”

Source: Schneeweis et al [2001].

Exhibit 8

Performance Results

January 1994 to June 2003

	<u>Annual Return</u>	<u>Annual Volatility</u>	<u>Sharpe Ratio</u>
HFR Fund of Funds Index	7.24%	6.29%	0.47
Traditional 60/40 Portfolio	9.50%	9.76%	0.53

Note: The Traditional Portfolio of Equities and Bonds is represented by a blended index of 60% in the S&P 500 Total Return Index and 40% in the Lehman Government/Credit Bond Index. Allocations are rebalanced yearly.

Data Sources: HFR and Bloomberg.

Exhibit 9

Performance Results

January 1990 to November 2002

	<u>Annual Return</u>	<u>Annual Volatility</u>	<u>Sharpe Ratio</u>
HFR Fund-of-Funds Index	10.56%	5.95%	1.0
S&P 500 Index	9.08%	15.16%	0.30
JP Morgan Global Bond Index	8.08%	4.27%	0.81

Source: Edwards and Gaon [2003].