Managers take your seats

Hilary Till, co-founder of Chicago-based Premia Capital Management, discusses innovative ways to include hedge funds in risk allocation frameworks. In the first of her two-part series in *GARP Risk Review*, she pinpoints unique problems that occur in various investment styles and goes into great detail about how to solve them.

Standard asset allocation practice

A typical investment programme's asset allocation process consists of maximising the return of a portfolio of assets subject to minimising some risk criterion.

As behavioural finance academics have noted, this quantitative process was developed to overcome certain limitations of human decision-making. When faced with large problems, the brain breaks big ones into little ones and then solves each of the little ones sequentially. The difficulty with this method of problem solving is that it ignores the inter-relationships between each boxed-off, little problem.

But a quantitative asset allocation process, which takes into consideration the correlations amongst individual investments, will not suffer from this limitation. Such process should give an optimal solution across all possible combinations of investments, something that conventional human decision-making would be incapable of achieving.

Risk allocation framework

The type of process noted above is typically used in deciding how to allocate assets, but one cannot immediately use such a framework with hedge funds because they are not an asset class. That is because hedge funds consist of a variety of strategies, risks and exposures.

As a result, Wander and Bein (2002) recommend using a "risk allocation framework," which focuses on risk exposures instead of asset classes. Hedge funds can then be readily included in this framework by modelling their underlying risk exposures.

The risk allocation framework consists of the following three steps. For the universe of potential investments:

- Identify risk exposures
- Optimise risk allocation
- Implement investment strategy

Although this process sounds clear enough, one can realise how complicated it is once they dig into the necessary assumptions involved in each step. As Weisman and Birney (2002) noted, such instructions are like explaining how to play a flute by saying: "Blow in this end and adjust the pitch by pressing on these buttons".

Part 1 of this series will discuss the first step in the risk allocation framework, identifying the risk exposures, while Part 2 covers the second and third steps, which are optimising the risk allocation and implementing the investment strategy.

Identify risk (or factor) exposures: linear multi-factor model

As discussed in Till (July 2002), to reverse engineer hedge fund exposures, a good starting point is to use a classic linear, multi-factor model. These models were originally created to understand the fundamental drivers of mutual fund returns. Edwards and Caglayan (2001) use the following multi-factor model to characterise the fundamental risk exposures of hedge funds:

R(i) – Rf = alpha + b*(S&P500 – Rf) + h*HML + s*SMB + w*WML + g*TERM + k*DEF + e(i), where

R(i) is the monthly return of hedge fund i;

R(f) is the 30-day T-bill rate;

HML is the monthly return on a portfolio of high book-to-market stocks minus the monthly return on a portfolio of low book-to-value stocks;

SMB is the monthly return on a portfolio of small stocks minus the monthly return on a portfolio of large stocks;

WML is the monthly return on a portfolio of past year's winners minus the monthly return on a stock portfolio of past year's losers;

TERM is the monthly return on a long-term government bond portfolio minus the one-month-lagged 30-day Treasury bill return;

DEF is the monthly return on a portfolio of long-term corporate bonds minus the monthly return on a portfolio of long-term government bonds; and e(i) is the remaining residual return.

The advantage of such a model is that if its explanatory power is high enough, then one can decide whether the underlying exposures of a hedge fund (or a hedge fund style) are appropriate additions to an investor's overall portfolio.

Difficulties

There are several problems with the approach noted above.

As pointed out by Brealey and Kaplanis (2001), hedge funds generally do not have stable exposures to market factors.

■ Unstable factor exposures

Fung and Hsieh (1997) provide a dramatic example of the difficulty in identifying stable factor exposures for hedge funds. They cite the example of George Soros' Quantum Fund. The Quantum Fund made 25.5% in September 1992 by shorting the British pound sterling. Using monthly returns, the relationship between the Quantum Fund and the British pound sterling only has a R-squared of 23%. Using daily returns in September 1992, the R-squared is only 10%. (Quantum's bet on the British pound sterling appears to have been implemented over a brief, eleven-day timeframe in September 1992).

Given that simple statistical procedures would not have been able to pick up the relationship between Soros' returns and the British pound sterling, the number of market proxies needed to model dynamic trading strategies may be "virtually infinite," note the authors.

■ The big event has not occurred yet

One problem with using empirical data to understand hedge fund strategies is that the key reason for a strategy's returns may be due to the assumption of a potentially catastrophic risk. An empirical measure will not show this if the big event has not occurred yet.

For example, as noted by Ineichen (2000), the "short volatility" aspect of fixed-income arbitrage only became apparent during the autumn of 1998. An empirical regression of fixed-income arbitrage returns versus market factors would only show a relationship to being short volatility after the autumn of 1998. Figure 1 illustrates how the fixed-income arbitrage return distribution changed with the unprecedented losses of this period.

Another example concerns investing in emerging market currencies. The Sharpe ratio for investing in Thai baht deposits that were funded by US dollar denominated loans was 2.55 over the period 1980 to 1996, according to data in Shimko and Reider's (1997) article. Given the unexpected, dramatic devaluation of the baht in July 1997, it appears that an investor was earning a well-deserved risk premium for taking on this investment.

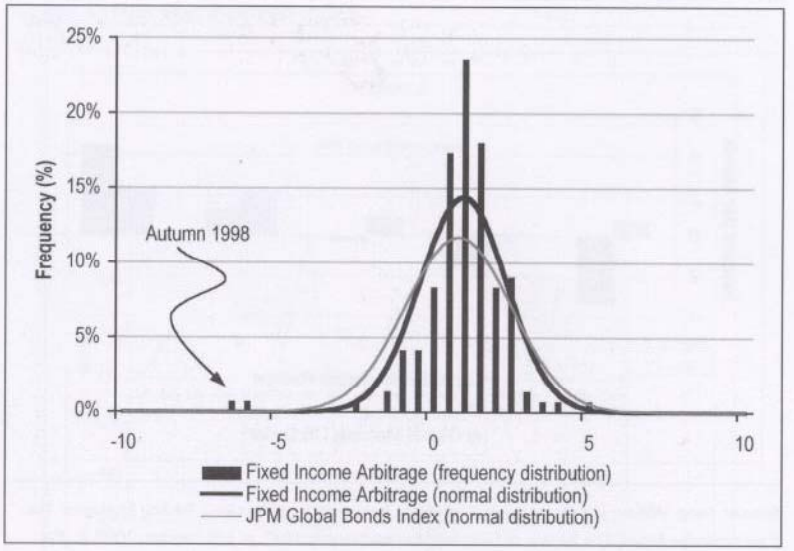
The suggested solutions to the above problems are two-fold. One is to use non-linear models to try to capture dynamically changing risk exposures. The other solution is to attempt to understand the economic drivers of returns so that one is prepared for the type of losses that could result from the strategy, even if those losses have not yet occurred.

Non-linear models

It appears that a number of hedge fund styles produce returns that have non-linear relationships to fundamental risk factors. This could be because these investments explicitly use derivatives or because their dynamic trading strategies result in option-like return profiles.

The following section will cover six innovative approaches that researchers have applied recently in attempting to best model hedge fund returns.

Figure 1



Source: Ineichen, Alexander, *The Risk of Hedge Funds*, Managing Hedge Fund Risk, Risk Books, London, 2000, p. 394.

1. Non-linear regression

Example: Equity non-hedge strategy

Favre and Galeano (2002) recommend using non-linear regressions to estimate the relationship between a hedge fund strategy and a portfolio of traditional assets. They find that the equity non-hedge strategy appears to be equivalent to a long position in a traditional portfolio combined with long out-of-the-money calls and short out-of-the-money puts. For their purposes, the portfolio of traditional assets is represented by an equity-and-bond benchmark of interest to Swiss institutions, the LPP Pictet Index.

2. Performance during different market environments

Example: Global macro

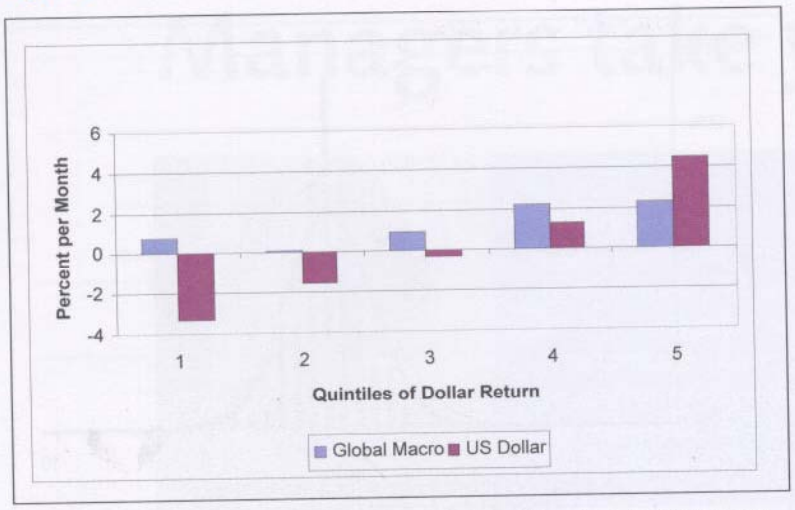
Fung and Hsieh (1997) suggest focusing on extreme events to detect non-linear correlations between hedge fund strategies and risk factors. Figure 2 illustrates how the global macro style behaves like a straddle on the US dollar. (A straddle is the combination of being long a call option and long a put option.)

In a later article, Fung and Hsieh (1999) also graph the global macro style versus five equity-market environments. They find that the global macro style is positively correlated with stocks:

"However, it under-performs equities in up markets and outperforms equities in down markets, behaving as if it owned collars (short calls and long puts) on US equities."

Anecdotally, one of the largest surviving global macro funds has a consistent, structural view on investing. This fund, if it has a position, will always be long the dollar, long the stock market and long Eurodollars. Plus, the fund has a rigid risk management policy. If any of these positions starts losing money, then the position will be periodically scaled back until they have no position in the losing market. This dynamic trading strategy could produce payoff diagrams of the type that Fung and Hsieh have noted in their research.

Figure 2 Global macro style versus the dollar



Source: Fung, William and David Hsieh, *Empirical Characteristics of Dynamic Trading Strategies: The Case of Hedge Funds*, The Review of Financial Studies, Summer 1997, p. 290.London, 2000, p. 394.

3. Rule-based strategies

Example: Commodity trading advisors

Fung and Hsieh(2001) have proposed an additional way of dealing with the dynamic aspect of some hedge fund strategies when modelling fundamental exposures. They have proposed searching for rule-based strategies that can be implemented systematically and passively, which mirror a dynamic trading strategy's returns.

They used this approach in modelling the returns of trend-following Commodity Trading Advisors (CTAs.) In this case, they found high explanatory power in modelling the return profile of CTAs as equivalent to look-back straddles on currencies, commodities and fixed income. In this way, they were able to capture the non-linear, option-like return of profile of CTAs better than buy-and-hold benchmarks.

4. Non-parametric, non-linear optimisation

Example: Mortgage-backed securities

As discussed in Till (October 2001), Weisman and Abernathy (2000) have published an innovative practitioner approach to reverse engineering hedge fund risk exposures.

Based on a qualitative review of an individual hedge fund, the authors decide which assets and option types that the investment likely has an exposure to. They then use an optimisation technique that fits an individual hedge fund's returns to these exposures. The particular non-parametric, non-linear optimisation technique they choose is based on their experience of which characteristics are most important in evaluating a manager. They try to capture the manager's large winning and losing months, the manager's use of leverage and the inflection points of the manager's returns.

One of their examples emphasises the utility of such an approach. The authors describe a mortgage-backed securities manager who had a historical Sharpe ratio of 4.99 using performance data from July 1995 to August 1998. (A Sharpe ratio of greater than 1.0 is considered quite good.)

A decomposition of the type of exposures in such a portfolio reveals that the pattern of reported returns could also have been achieved with substantial leverage and short option exposure. And indeed, after August 1998, this manager reported a very large loss.

This approach is helpful as a forensic tool in determining the implicit short options risk of a manager, especially if one only has a short track record to analyse.

5. Volatility timing

Example: Equity market neutral

Busse (1999) finds that volatility timing is an important factor in the returns of mutual funds and has led to higher risk-adjusted returns. The idea is that it may be quite difficult to time market returns, but that on the other hand, market volatility is predictable because it persists. The author finds evidence that some mutual funds change their market exposure when market volatility changes.

Anecdotally, some superior equity market neutral funds may be achieving their superior risk-adjusted returns by going into cash or reducing their market exposure during times of market volatility. Such a strategy would likely lead to lower returns on average, but even lower volatility on average than a market index. According to Ineichen (2000), citing Hedge Fund Research (HFR) indices, the equity market neutral strategy had 62% of the returns of the S&P 500, but only 23% of the volatility of the S&P 500.

To say that the fundamental strategy (which underlies the equity market neutral style) is volatility timing, can be highly speculative. But, it is likely that at least some funds in the equity market neutral universe employ this technique.

6. Stepwise regression including options

Example: Arbitrage strategies

A number of arbitrage strategies have been characterised as implicitly including short options.

For example, as discussed in Till (September 2001), in the merger arbitrage strategy, a merger candidate is bought by a hedge fund at a discount to where its intended buyer has announced it will pay for the company. An investor assumes the risk that a merger deal will fail. This strategy tends to earn consistent returns, but sustains very large losses in the event that a deal does not get consummated.

A historical analysis of merger arbitrage deals conducted by Mitchell and Pulvino (2001) shows that this strategy's return is correlated to the overall market during severe market downturns, giving a return profile similar to short index put options.

Agarwal and Naik (2002) take into consideration the option-like features inherent in a number of arbitrage strategies. They do so by performing stepwise regressions on a number of these strategies. Their regressions not only include the kind of linear factor model terms discussed above, but also options on market indices.

The authors find that the following risk factors are significant in explaining the returns of the HFR event arbitrage strategy. A short out-of-the-money put on the S&P 500 along with two of the linear model factors, the size (SMB) factor and the value (HML) factor.

The authors find that in addition to event arbitrage, the payoffs of the restructuring, event driven, relative value arbitrage and convertible arbitrage strategies resemble that from writing a put option on the market index.

The authors create replicating portfolios for each hedge fund strategy based on their respective significant risk factors. They do so using out-of-sample data. They want to make sure that their results are not mere statistical artefacts of the data. If the replicating portfolios resemble their hedge fund index's results using out-of-sample data, this is highly suggestive evidence that the risk factors represent the true economic risks of the particular hedge fund strategy.

With only one exception, the replicating portfolios and their respective indices are statistically indistinguishable. Figure 3 illustrates the out-of-sample results for the event driven index. (EDRP is the event driven replicating portfolio, and ED is the actual event driven index results.)

But the authors go one step further – they look into whether the superior performance of arbitrage strategies is unique to the decade of the 1990's. There has not been an obvious way to determine this since the return history of hedge funds only goes back to 1990.

If the authors' replicating portfolios, which are constructed using buy-and-hold and option-based risk factors, are accurate for describing the returns of arbitrage strategies, then one can use the replicating portfolios as proxies for the strategies and therefore look into the past to see how these strategies would have performed.

The authors examine the period from 1927 to 1989 to find the long-run returns and volatility of the hedge funds' replicating portfolios. They find that the long-run returns of the replicating portfolios are smaller, and the long-run volatilities are higher compared to their performance in the 1990's. Their conclusion is that the performance of the arbitrage strategies "during the recent period appears significantly better compared with their long-run performance."

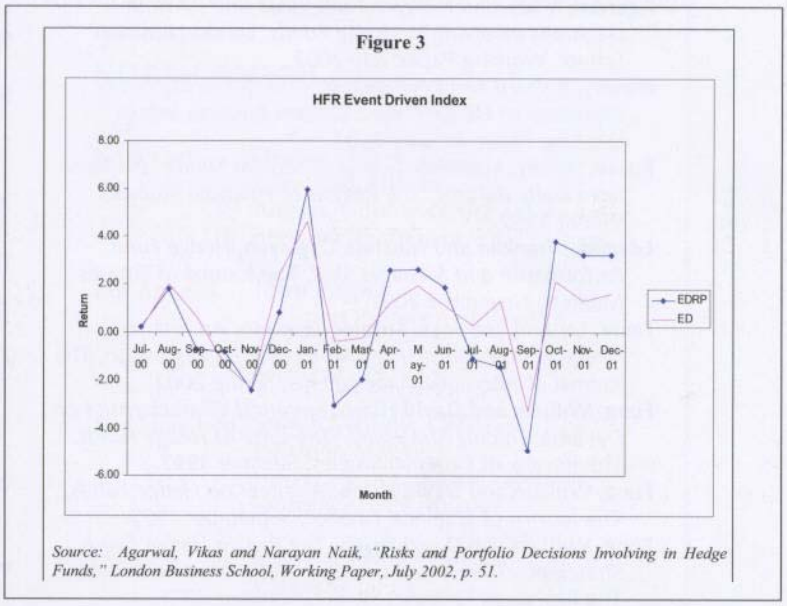
Underlying economic drivers

Another innovative way of identifying risk exposures is discussed by Singer, Staub, and Terhaar (2003). They discuss how alternative investment return data are problematic at best. The data "suffer from illiquidity and infrequent pricing biases, ... and also are fraught with membership and survivorship biases."

The authors attempt to reconcile quantitative and qualitative techniques, given the problems with using historical data. And their recommended solution is to use a factor approach to build a consistent set of 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.

Figure 3 HFR event-driven index



Source: Agarwal, Vikas and Narayan Naik, "Risks and Portfolio Decisions Involving in Hedge Funds," London Business School, Working Paper, July 2002, p. 51.

Optimise risk allocation

If one is satisfied with having identified the risk exposures for hedge funds, perhaps by using either an empirical, non-linear model or a theoretical, economic-driver approach, then the next step is to optimise this risk allocation. The issues involved in this step will be covered in part two of this series, which will appear in the November/December issue of *GARP Risk Review*.

Implement investment strategy

The last step in the risk allocation framework is to implement and monitor the investment strategy. If one is using the risk allocation framework, then that means they are assuming that they can model the underlying characteristics of the investment. It also means that one expects the hedge fund manager to consistently follow an investment style that reflects those underlying characteristics. The difficult issues involved in this last step will also be covered in part two, so stay tuned. ■

Hilary Till is a co-founder and portfolio manager of Premia Capital Management, LLC. Based in Chicago, Premia Capital specialises in detecting pockets of predictability in derivatives markets using statistical techniques. Prior to Premia Capital, Till was Chief of Derivatives Strategies at Boston-based Putnam Investments.

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