Comparing tastes

In the second half of her two-part series, **Hilary Till** of Chicago-based Premia Capital Management compares various alternative investment strategies and offers insights on how to optimise the risk allocation of each. With examples from recent market events, including the sharp downturns in September, she explains why some strategies offer more favourable returns than others.

The first article of this series discussed how to apply the initial step of identifying risk exposures, while this one covers the second and third steps: optimising the risk allocation and implementing the investment strategy.

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

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 in the risk allocation framework is to optimise this risk allocation.

But this step is tricky. The exact returns, risks and correlations to use in modelling the universe of investments, including hedge funds, are not obvious. Also, there is healthy debate about how to characterise the appropriate return-to-risk trade-off for investors.

Singer, Staub, and Terhaar (2003) stress that, as with conventional assets, the returns one assumes in coming up with a policy portfolio should be forward looking. Recent work by Argarwal and Naik (2002) shows it may be that the impressive results in the 90s are unique for at least some hedge fund strategies.

Penalty function

Koh, Lee, and Fai (2002) recommend including a penalty function to adjust returns downwards to account for the additional business risks associated with hedge fund investing. The authors recommend the following sources of risk in computing the penalty function: style purity, asset growth, leverage, liquidity and asset concentration.

Volatility

The common risk measure applied by portfolio managers is volatility. An issue with using historical data to determine volatility is that a number of hedge fund strategies include illiquid securities, so there can be a problem with stale pricing, Weisman and Abernathy (2000). The net result is that volatility can be understated if historical data is used.

The solution to this problem is to use a factor model that describes a hedge fund style's returns in terms of assets frequently traded and with market-observable prices. One then calculates the volatility of the investment based on the investment's replicating portfolio of frequently traded instruments. Four of the factor models, which described in the first part of this series of articles, satisfy this criterion. But what if volatility does not represent the risk that risk-averse investors would prefer to avoid?

Conditional Value-at-Risk

If risk is defined as avoiding large negative returns, then another measure besides volatility may be appropriate. Agarwal and Naik (2002) suggest using Conditional Value-at-Risk (CVaR) as the measure of risk to use in an optimisation. Whereas Value-at-Risk (VaR) measures the maximum loss for a given confidence level over a given period of time, CVaR corresponds to the expected loss conditional on the losses being greater than or equal to VaR.

The advantage of using a constraint, such as CvaR, is that it results in optimal strategies for which the magnitude of extreme losses is kept under control. When using CVaR rather than VaR as the risk measure, optimal allocations to arbitrage strategies decline because of the "tail" risk of these strategies. (Tail risk refers to the possibility of infrequent, large losses.) Those authors use the empirical distribution of the hedge fund returns in calculating CVaR.

Measures incorporating skews

By using variance (or standard deviation) around the mean as an investment's risk measure, one is assuming that investors are indifferent between upside risk and downside risk. In this case, investors are said to not have a so-called "skewness" preference. They are most certainly to have a preference for upside risk and an aversion to downside risk though!

Signer and Favre (2002) recognise the problem with using

a symmetric risk measure for investments that may have asymmetric outcomes. Their research focuses on taking into consideration the third and fourth moments of a portfolio's return distribution.

(The mean and variance are the first and second moments of a distribution; skewness is the third moment, which describes how asymmetric a distribution is; and kurtosis is the fourth moment, which describes how fat the tails of the distribution are. Negative skewness refers to an investment having a higher probability of a very large loss and a lower probability of a high positive return than one with equally balanced probabilities of gains and losses.)

The authors note that "negative skewness and positive excess kurtosis are unwelcome distribution features for the investor, but these are not taken into account in a mean-variance world."

While empirical studies from the 1970s showed that broadly diversified portfolios of equities have returns that appear to be distributed in a symmetric fashion, one cannot make a similar claim about hedge funds. In many cases, this class of investments may have asymmetric payoffs because these investments explicitly use derivatives or because their dynamic trading strategies result in option-like return profiles.

When one cannot assume that an investment's returns are distributed normally (or symmetrically), Signer and Favre (2002) propose a risk measure that also takes into consideration the third and fourth moments of an investment's distribution. They describe a statistical method for adjusting VaR to incorporate both skewness and kurtosis. They refer to this new measure as "modified VaR."

Figure 1 illustrates how the efficient frontier is affected when using modified VaR rather than VaR as the risk constraint. This figure shows that the benefits of hedge funds are represented too positively when not taking into consideration the extra moments of an investment's return distributions. Specifically, it illustrates a sample portfolio with a maximum allocation to hedge funds of 10%.

One should add that not all hedge fund strategies can be characterised as exhibiting negative skewness. For example, the equity market neutral strategy has typically been found to have advantageous skewness and kurtosis properties. Instead, it is mainly the event-driven and fixed income arbitrage strategies that have been characterised as having disadvantageous ones.

Figure 2 illustrates the skewness and kurtosis properties for different hedge fund strategies. Signer (2002) calculates these statistics using time series collected from the following three hedge fund databases: TASS, Hedge Fund Research (HFR), and Zurich Capital Markets during the time period, January 1994 through December 2000.

One should also add that the issue of negative skewness applies to other investments besides hedge funds. For example, as noted by Goetzmann, Ingersoll, Spiegel, and Welch (2002): ".... some assets in the US market, primarily small cap stocks, behave as if they are short a (out-of-the-money) put (on the overall stock market.)"

Figure 1
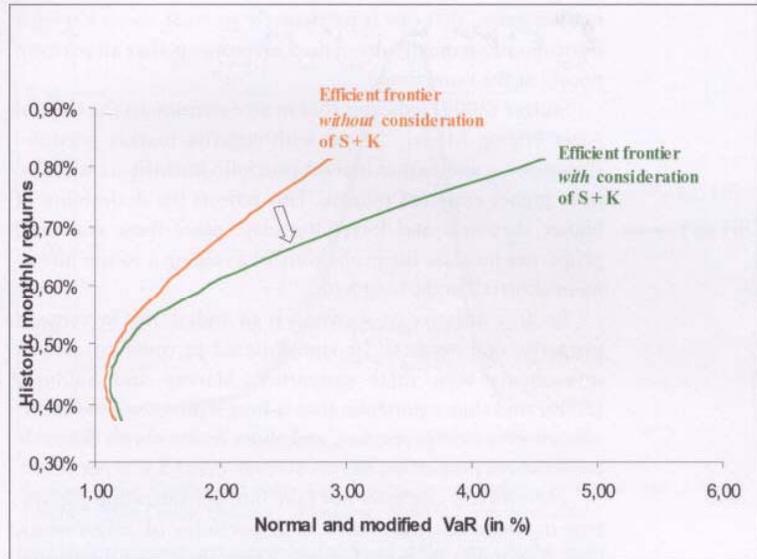
Source: Signer, Andreas and Laurent Favre, "The Difficulties of Measuring the Benefits of Hedge Funds," The Journal of Alternative Investments, Summer 2002, p. 37.

Figure 2
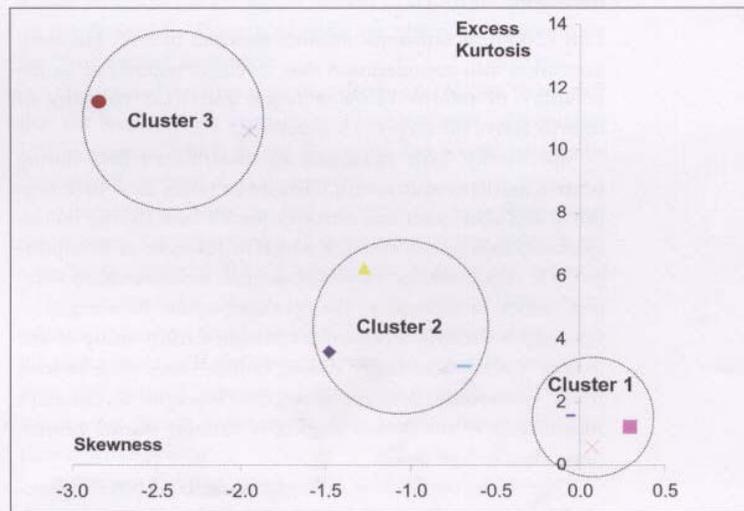
Source: Signer, Andreas, "Generieren Hedge Funds einen Mehrwert? Schwierigkeiten bei der Messung, Relativierung und neuer Erklärungsansatz," Haupt Verlag, Bern/Stuttgart/Wien 2002.

A last qualifying remark is that to be more precise, the important statistical characteristics are co-skewness and co-kurtosis rather than skewing and kurtosis, per se. Co-skewnesss (co-kurtosis) refers to the component of an asset's skewing (kurtosis) related to the market portfolio's skewness (kurtosis.)

Co-skewness and co-kurtosis provide an investor with information on how an investment will perform during times of overall market stress. Negative skewness, as with a hurricane bond (which results from factors unrelated to market stress) is not as undesirable an investment as one that does very poorly during times of equity market stress, and so it has negative co-skewness. (This is because it is during times of

market stress, that one is particularly worried about having a portfolio of seemingly diversified investments that all perform poorly at the same time.)

Stutzer (2000) indicates that in an extension to the Capital Asset Pricing Model, "assets with negative market portfolio skewness ... and higher market portfolio kurtosis ... will also have higher expected returns. This reflects the desirability of higher skewness and lower kurtosis" since these statistical properties increase the probability of avoiding a future investment shortfall in the long haul.

Because negative co-skewness is an undesirable investment property, one needs to be compensated in order to assume investments with these properties. Harvey and Siddique (2000) find that a portfolio that is long equities with undesirable co-skewness properties, and short equities with desirable co-skewness properties, has on average made 3.6% per year.

Therefore, if one does not take into consideration the systematic skewness properties of a portfolio of investments, then they might be misled into thinking they have discovered a "free lunch" by incorporating certain types of negatively skewed investments in their optimisation, as noted by Amin and Kat (2002).

Beta-gap

Low (2000) recommends another measure of risk. His measure takes into consideration that investors regard risk as the volatility of returns below a target and treat volatility of returns above the target as a sweetener.

Specifically, Low calculates an investment's Beta during bearish market conditions, a measure he refers to as Beta-negative, and also calculates an investment's Beta during bullish market conditions, a measure which he refers to as Beta-positive. He then constructs a composite risk measure called Beta-gap, which is defined as Beta-positive minus Beta-negative. Beta-gap is positive when an investment's relationship to the overall market is stronger during bullish times than bearish times. Conversely, Beta-gap is negative when an investment's relationship to the overall market is stronger during bearish times than bullish times.

One might expect low Beta-gap portfolios to be undesirable by investors, and that they therefore would require a return premium in order to hold such a portfolio. And in fact, Low finds that a low Beta-gap portfolio outperforms a high Beta-gap portfolio by 6.1% per year. Low also finds that Beta-gap captures the relevant information about returns asymmetry better than systematic co-skewness.

A concluding remark on Beta-gap is similar to the concluding remark on skewness as a risk measure. Unless one takes into consideration the asymmetric response of an investment to bullish and bearish market conditions. One may again believe that they have found a "free lunch" by investing in assets or strategies that have undesirable conditional responses to market conditions.

Volatility regimes

Even if an investor is confident about using volatility as a risk measure, there is another complicating issue. As noted in Till

(August 2002), an investor frequently uses the normal distribution to represent the returns of a diversified portfolio since one assumes that it is acceptable to use the Central Limit Theorem. Under this theorem, as the number of randomly distributed independent variables becomes large, the distribution of the collection's mean approaches normality.

This would be fine for a portfolio's return if its individual strategies would never be influenced by a dominant event. But in practice, this does not happen as seen during the October 1987 stock-market crash, the autumn of 1998 bond debacle and during the aftermath of the September 11 terrorist attacks last year.

Johnson, Macleod, and Thomas (2002) suggest addressing this problem by representing an investment's distribution as a combination of two distributions: one for peaceful times and one for eventful times.

The distribution during eventful times would not just include higher volatility, but also the greater correlation among strategies that occurs during crises. It would be down to the investor to explicitly determine the proportion of crisis returns in the combined distribution.

Correlations

In addition to returns and risk measures, another essential input in a portfolio optimisation is the determination of the participating investments' correlations. One important issue has already been alluded to during crises, and that is: the only thing that seems to go up is correlations! In other words, depending on whether one is in peaceful or eventful times, one should make different correlation assumptions.

Asness, Krail, and Liew (2001) have noted another difficulty. These authors argue that the lack of correlation of hedge fund indices to the S&P 500 is actually due to the reporting of stale prices for hedge fund positions. Once one adjusts for stale pricing of illiquid hedge fund positions, the relationship of a respected hedge fund index to the S&P is quite high using data from January 1994 to September 2000. The authors adjust for lagged pricing by regressing hedge fund index returns versus lagged S&P returns.

Return-to-risk trade-off

During the discussion on optimising a portfolio's risk allocation, it has been assumed that investors are risk averse, and therefore that they will make some trade-off between return and risk. Interestingly, just how to mathematically characterise that trade-off is a topic of intense debate.

Mean-variance

The traditional approach in representing the trade-off between return and risk is as straightforward as a trade-off between a portfolio's average returns and its variance. The problem with this technique is that as recommended allocations to hedge funds become large, one can expect lower skewness in the overall portfolio's return distribution, as pointed out by Amin and Kat (2002). In other words, there is a trade-off between improving a portfolio's mean-variance characteristics and taking on more risk of rare, but large losses.

As shown in the return distribution graph of Figure 3, Kat and Amin have illustrated that a diversified portfolio with a large allocation to hedge funds compared to one without hedge funds has a higher probability of a very large loss and a lower probability of a high positive return.

Ad-hoc practitioner solutions

For many practitioners, it does not come as a surprise that improving a portfolio's mean-variance ratio might be because of taking on the possibility of extreme loss. Anecdotally, one fund-of-fund manager has stated that he will not invest in a manager with a Sharpe ratio of over 1.5, figuring that it is ratio is unsustainable in efficient markets. Instead, it may be the result of earning risk premiums for a catastrophic event that has not yet occurred.

One prominent fund-of-hedge-funds manager who did poorly during the liquidity crisis of the autumn of 1998 now recognises that arbitrage strategies are at risk to "tail" events. This is undesirable. As a result, this manager now balances the implicit short put options in their portfolio with a portfolio overlay based on options volatility, which uses a small percentage of capital but pays off exponentially.

Another example is a commodity futures manager profiled by Patel (2002). This manager recognises that their portfolio has a bias to being long commodities and illiquid financial markets. As a result, during sharp shocks to business confidence (as in the aftermath of the September 11 terrorist attacks), the portfolio is at risk to extreme losses. This manager responds to this risk by purchasing out-of-the-money fixed income call options as a kind of macro hedge to these exposures. This hedge can be effective because of the flight to quality in US fixed income instruments during times of market stress.

In the above examples, the managers understand the tail risk of their portfolios, and therefore use enhanced hedging to address this risk.

## Behavioural models that incorporate loss aversion

Hedge fund research is now focusing on coming up with better models of investor preferences in order to determine whether the unique returns and risks of various hedge fund strategies provide a better match for various classes of investors.

Not only are investors risk averse, but a better model of investor preferences shows that they are also loss averse. As discussed by Chen, Feldman, and Goda (2002): "Risk aversion is a measure of a general tendency to avoid risk. Loss aversion is a specific measure of how much more weight an investor accords to a loss of a given magnitude in comparison to an equivalent gain."

In preliminary work by Chen, Feldman, and Goda, the researchers explicitly model the distributional characteristics of each hedge style, including their skewness and kurtosis properties. They then 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

Figure 3
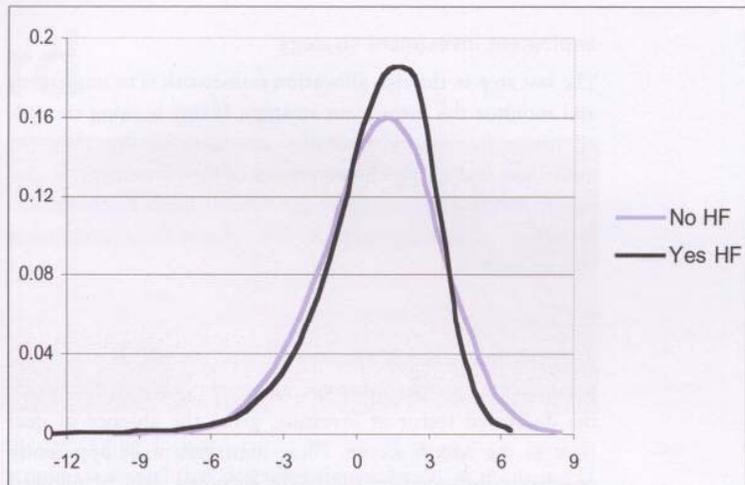
Source: Amin, Gaurav and Harry Kat, "Stocks, Bonds and Hedge Funds: Not a Free Lunch!," ISMA Centre, University of Reading, Working Paper, April 2002.

find that the most attractive hedge fund styles are equity market-neutral and global macro styles. As noted above, the equity market-neutral style has historically sacrificed returns in exchange for dramatically lower volatility. The global macro style has a return pattern, which historically has sacrificed upside return in the US equity market in return for protection on the downside. These trade-offs are obviously appropriate for "loss averse" investors.

The researchers also note that there is no reason to assume that the levels of risk aversion and loss aversion are common to all investors, which means that portfolios would need to be customised for each class of investor.

Alternatively, Siegmann and Lucas (2002) hypothesise that the optimal behaviour of a loss-averse investor depends on whether the investor is in a surplus situation. If one is in the fortunate condition of surplus, then the optimal investment strategies are ones that have long option payoffs with particular strike prices. If the investor is in the opposite situation, then the optimal investment strategies are ones that have income-producing, short option-like payoffs. Again with particular strike prices.

Siegmann further notes that the optimal strategy also depends on the available options (or achievable dynamic strategies.) This will determine whether the long call or the straddle pay-off is optimal in the case of a positive surplus. The same goes for negative surplus and the short put and short straddle pay-off. The author also says that it is up to ongoing research to interpret the properties of dynamic strategies in terms of specific option strategies.

Anecdotally, the very wealthy clients of European fund-of-funds prefer strategies that have a lot of optionality, including CTAs and global macro. These funds have some times gravitated to managers who are in the midst of large draw downs, figuring that with such a large dispersion of results, there is an increased chance of a large upside.

But if Siegmann and Lucas' model is correct, then for everyone else, the appropriate hedge fund strategies are income-producing, arbitrage strategies, which are implicitly short options as discussed by Agarwal and Naik.

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 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.

Style drift

That might be a heroic assumption. Anecdotally, during 2002, a number of merger arbitrage managers gravitated towards the distressed sector of investing, given the absence of deal flow in the M&A sector. These managers were apparently negatively impacted by the credit surprises, which followed from the discovery of WorldCom's accounting fraud.

Diversification implosion

Fung and Hsieh (1997) have noted another problem with implementing a diversified portfolio that includes a number of hedge fund styles. While style exposures of hedge fund strategies may be diverse, market exposures can converge. And they provide an example from 1993 and 1994 about how three different investment strategies ended up with highly concentrated bond portfolios. If one held such a portfolio, then it would have done quite poorly in February 1994 when the Fed raised rates after a long hiatus.

Conclusion

In reviewing the latest research on how to apply a risk allocation framework to hedge funds, one can see that there is still a lot of debate on how to evaluate alternative investment strategies.

The conclusion may be that some hedge fund strategies offer superior returns because of either their illiquidity or because the investor is being compensated for taking on the risk of rare, large losses. In addition, it may be that some hedge fund strategies also create return-to-risk profiles that are a better match for the preferences of certain classes of investors than is the case with traditional assets. ∎

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