The Nature of Risk Management For Hedge Funds
By Sara Statman, June 2005

Entire books are written on the subject of risk management and it is assumed that the reader has a basic understanding of the main risk factors: market, credit, operational risk and enterprise-wide risk management. This article examines some tools for risk management and highlights some common pitfalls.

In order to manage the risks associated with hedge fund investing, it is necessary to examine their return distributions. For traditional investments, mean-variance analysis is appropriate and the normal or bell-shaped distribution can be described by the asset's mean, variance and standard deviation. Traditional portfolio theory is based on the Capital Asset Pricing Model (CAPM), which states that:

- Investors are risk averse. They employ a mean variance framework and returns are normally distributed. Reward is measured by mean returns while risk is analysed in terms of standard deviations of returns.
- All investors forecast identical mean variance returns and correlations and hold the same risky market portfolio, with varying weights according to their risk profiles; investors are rewarded by market risk alone.
- There are no transaction costs or restrictions: trading, taxes, etc.

With respect to hedge funds, the first assumption is problematic as the standard deviation only explains part of the risk/return profile for hedge funds and returns are often non-symmetric. Furthermore, many hedge fund strategies have non-linear payoffs and are subject to significant event risk - neither of which can be explained adequately by a Sharpe Ratio analysis.[1] The second assumption suggests that market risk is the only risk facing hedge funds and implies that additional returns can be attributed entirely to manager skill. Hedge funds face various risks, dependent on their trading strategy. Risks may include: credit, liquidity, equity, foreign exchange, event, political, regulatory, operational…etc. The third assumption also fails to hold as managers do incur transaction costs and funds or investors may be limited by trading restrictions.

Multi-factor models, such as the Arbitrage Pricing Theory (APT) capture additional risk factors through additional risk premiums. Aside from "luck" hedge fund returns are based on risk premiums and manager skill and the combination thereof. The risks and premiums vary according to the trading strategy employed.

[1] The Sharpe ratio is a measure of the trade-off between return and the risk the investor is exposed to in order to earn that return. The excess return earned over the risk-free rate is divided by the standard deviation of return.

Risk Management Tools

Value at Risk (VaR)

Risk emanates from exposure and uncertainty. Exposures may be categorized by risk factors, while uncertainty is often described by volatility - statistical estimates of future price variability. The advent of Value at Risk (VaR) analysis transformed the field of risk management. VaR describes the maximum portfolio loss for a given confidence level over a specified trading horizon. It can be applied to numerous types of systematic risks and provides a method for comparing portfolio risks across securities and asset classes. Nevertheless, VaR should not be relied upon as the only risk management tool as it is subject to certain limitations:

- VaR relies on a framework in which returns are normally distributed and does not address extreme market moves; measures such as skewness and kurtosis should also be used.
- VaR results depend on the pricing model employed. Many derivatives are not traded actively and are marked-to-model, rather than marked-to-market; this subjects the results to model risk.
- VaR relies on estimated correlations and volatilities based on historical data. It assumes this data is stationary but correlations and volatilities change constantly and are unstable, especially in times of crisis (conditional correlations/volatilities).
- VaR fails to capture non-systematic risks such as corporate event, political, credit spread or model risk.
- VaR is not additive with respect to sub-portfolios.

To overcome this limitation, two additional distribution statistics are useful for analysing hedge fund distributions: kurtosis and skewness. Kurtosis describes when the tails of a distribution, or outliers, are different from that of a normal distribution. Leptokurtosis refers to large tails (a greater exposure to outlier events) while platykurtosis refers to tails smaller than those expected from a normal distribution (less exposure to extreme events). Volatility in and of itself is not a problem: in other words managers hope to gain from volatility when it benefits their trading strategy. Strategies that exhibit positive kurtosis benefit from fat tails and will achieve superior returns in volatile markets. Distributions with a negative skew indicate downside exposure. A positive skew indicates upward bias and a larger proportion of positive returns; this may be attributed to manager skill.

Another useful measure is the Sortino ratio, which divides the excess return over the risk-free rate by the downside deviation. It modifies the Sharpe ratio and replaces the standard deviation with the downside deviation or “bad risk”. Downside deviation is also referred to as “bad risk” to distinguish volatility caused by negative or positive returns.

Jensen’s Alpha measures the degree by which performance exceeds the expected returns for a given level of risk, but it is only relevant when there is a benchmark to track. Standard benchmarks, such as NASDAQ, are not appropriate for hedge funds that aim to generate absolute returns. Instead the market portfolio of funds following a similar style may be used.

Drawdown describes the characteristics of returns. It measures the maximum percentage loss from any starting point and any subsequent Net Asset Value (NAV). Another useful statistic examines the

percentage of winning months, while the largest monthly gain or loss can determine the degree of kurtosis.

Covariance and Correlation

Covariance and correlation are fundamental concepts in statistics. They measure the extent to which two random variables are related. The correlation (coefficient) is a number between –1 and +1 and acts as a standardized form of covariance. High positive correlation implies that both variables have a high tendency to move in the same direction; high negative correlation implies that both variables tend to move in opposite directions; the higher the correlation (coefficient), the closer the value is to +/- 1 and the stronger the relationship. A correlation of zero implies an absence of any relationship between the two variables. Correlation only measures linear relationships; derivative instruments have non-linear payoffs and many hedge fund strategies rely heavily upon the use of derivatives. A scatter plot may be used to look for non-linear relationships.

It is important to note, however, that high correlation may be coincidental and therefore insignificant. In other words, it is necessary to determine whether causation is present. If orange consumption increases when Manchester United win a match one can hardly infer causation. Sometimes variables are correlated as both are affected by a third variable. For example, ice-cream consumption tends to increase during summer. Insect bites also increase during the summer months but it cannot be inferred that people bitten by insects tend to consume more ice-cream nor can it be inferred that individuals consuming more ice-cream are at greater risk of receiving an insect bite. In this instance correlation is visible but causation is absent.

Just as correlation does not imply causality, weak correlation does not imply an absence of causality. Faults in a model, insufficient or inaccurate data could prevent data from showing a strong correlation, even when causality exists. In fact, causality cannot be inferred from data analysis alone. It requires a logical relationship between the two variables.

Similarly sequences do not imply causality. There might be a tendency for it to rain after Manchester United score a goal but one cannot imply causality only because one event occurs after another. Care must be taken to rule out chance events.

Data should also be examined for outliers: extreme data points, as these will affect the sample mean and variance. Although outliers are often removed from the data set, before any arbitrary removal, outliers should be examined carefully as they may include important information about the underlying stochastic process. To reduce the influence of outliers additional correlations can be taken, such as the correlation during positive/negative market returns.

Stress Testing and Scenario Analysis

Stress testing and scenario analysis can be applied to individual instruments and asset classes as well as correlations between securities and asset classes/sectors. It is often used to consider potential outcomes during extreme market events. The results, however, depend very much on the stress test employed and due care should be taken. Careful attention should be paid to:

- The size of the extreme movement to ensure the "shock" is large enough
- The degree of skew: the test should be for skewed distributions
- Stress testing various combinations of asset classes individually and in combination
- The correlation breakdown: extreme events often cause very different correlation structures

Attention should also be paid to scenario selection. This may be:

- *Historical Scenarios*: replicating past events e.g. Black Monday, the Asian Crisis or the collapse of LTCM
- *General Scenarios* e.g. a fall in interest rates; a parallel shift in the yield curve or a rise in the oil price
- *Portfolio-Specific Scenarios*: analyse the effect of changes in asset prices or correlations between securities and may incorporate specific forecasts

Sensitivity Analysis

Sensitivity approaches such as duration analysis and PV basis point testing are useful tools that allow the trader to quantify hedge ratios and perform tests to ensure positions are risk neutral; sensitivity limits may be established to constrain the trading unit from taking large open positions. Nonetheless this approach has its limitations:

- Sensitivity tests do not address the probable level of risk in a portfolio.
- The relationship between incremental price changes and extreme price shifts is uncertain given the non-linear relationships of different price/yield curves and the non-linear risks of derivative instruments.
- Systemic events may cause any co-relationships between markets or instruments to become irrelevant.

Risk Management

The risk management function should be independent and separate from investment decisions, to ensure that risk takers do not manage risk. Risk managers should have authority to act when risk limits are exceeded; when exposures to certain risks should be reduced; or when external events require positions to be cut back. An effective risk management policy requires that risks are measured, monitored and managed, to ensure that risk can be allocated optimally among various strategies and asset classes. Although much emphasis is often placed on quantitative measures, qualitative risk assessments should be incorporated.

Increasingly hedge funds are choosing to outsource their risk management function and in so doing avoid having to:

- Set up an internal risk management system
- Gather all the data required to perform risk analysis
- Hire and manage an entire risk management team with support staff, thereby reducing indirect costs (office space; payroll function; computers; phone lines).

Over time it is likely that managers will also outsource their risk reporting function. Benefits would include:

- Small-medium sized hedge funds accessing capabilities previously afforded to larger investment firms
- Hedge Fund Managers offer investors a credible, unbiased risk management and reporting solution
- Risk Reporting systems will validate pricing, calculate risk positions, identify risks and provide immediate notification of risk-related issues; risk systems alone cannot verify pricing and still require a risk manager to interpret results.
- Reducing barriers-to-entry for new hedge funds

Sara Statman is CEO and founder of Statman Consulting - a financial markets training, risk management consulting and executive search and recruitment firm. Since January 2004, Sara served as a Director of The Hedge Fund Association, chairs its Education and Research department and is currently Vice President.