MEASURING RISK-ADJUSTED RETURNS IN ALTERNATIVE INVESTMENTS

Hilary Till
Premia Capital Management, LLC
Chicago, IL

June 20, 2002
PRESENTATION OUTLINE

I. Traditional Performance Evaluation
   • Sharpe Ratio
   • Alpha

II. Alternative Performance Evaluation
   • Asset-Based Style Factors
   • Gain-Loss Ratio
   • Fat Tails
   • Non-Linear Relationships to Asset Markets
   • Scenario-Driven Risk Visualization
TRADITIONAL PERFORMANCE EVALUATION

- Two CAPM performance measures are the *Sharpe ratio* and *alpha*.

- The *Sharpe ratio* measures an investment’s excess return divided by its standard deviation.

- *Alpha* measures an investment’s excess return beyond taking on market risk.
These CAPM metrics are appropriate if:

1. Investors choose portfolios using a mean-variance framework;
   and
2. Market risk is the only source of risk for which investors are rewarded.
1. **Investors Choose Portfolios Using a Mean-Variance Framework**

- The first assumption is not appropriate in investments that have highly asymmetric outcomes as with option strategies.
- Four Yale University professors have derived an optimal strategy for maximizing the Sharpe ratio.
• The optimal strategy has a truncated right tail and fat left tail.

This strategy can be achieved by selling certain ratios of calls and puts against a core equity market holding.

The Yale professors conclude that:

“expected returns being held constant, high Sharpe ratio strategies are, by definition, strategies that generate modest profits punctuated by occasional crashes.”
TRADITIONAL PERFORMANCE EVALUATION
(Continued)

• The experience of the Art Institute of Chicago’s endowment provides evidence for the Yale professors’ concern.

• One of the endowment’s hedge fund managers noted in their marketing material that their fund had “the highest Sharpe ratio in the industry.”
• The hedge fund noted it would combine “cash holdings with stocks and riskier index options” in such a way that they:

“could guarantee profits of 1% to 2% a month in flat or rising markets. The fund … could lose money only if the stocks to which the options were tied dropped more than 30%.”

• This firm’s funds were wiped out late last year.

• An extreme example of how a superior investment can have a low Sharpe ratio is as follows:

  – Take a lottery whose ticket costs one cent today, and where winners pocket fifty billion dollars next year with probability 10%, and nothing otherwise.

  – This lottery has a Sharpe ratio of 0.33.

2. **Market Risk is the Only Source of Risk For Which Investors are Rewarded**

- Under this assumption, any return unrelated to the market would be due to superior judgment or inside information.

- This excess return is *alpha*.

- Financial economists now believe that there are multiple sources of risk besides the market factor.
TRADITIONAL PERFORMANCE EVALUATION  
(Continued)

• There may be large losses from bearing one of these risk factors, resulting in a short-option-like return profile.

• But the returns over time are sufficient to make the activity profitable.

• These returns are called *risk premia*. 
TRADITIONAL PERFORMANCE EVALUATION

(Continued)

• Using the Sharpe ratio to evaluate risk-premia strategies will create the same type of problems as with short-option sellers.

• A number of alternative investment strategies seem to earn risk premia.

• They include: Relative Value Bond Funds, Equity Risk Arbitrage, Equity Option Market-Making, The Value vs. Growth Equity Strategy, and High Yield Currency Investing.
• One problem with evaluating risk-premia strategies is that while one may be earning a return due to being exposed to an unlikely event, an empirical measure will not show this if the Big Event has not occurred yet.
ALTERNATIVE PERFORMANCE EVALUATION: ASSET-BASED STYLE FACTORS

• Being able to model the shape of uncertainty is key to establishing proper risk-adjusted performance measures.

• The current academic thinking is to use “asset-based style factors” to characterize an alternative investment.

• The idea is if an investor can link a hedge fund’s returns to its underlying “style factors,” then one can use the style factor’s longer history of returns to evaluate the risk of a specific hedge fund.
• One application of the asset-based style factor approach was noted in the book, Risk Budgeting.

• The authors use an optimization technique to fit a hedge fund’s returns to certain underlying assets and options.

• One example is a mortgage-backed securities manager. This manager had a reported Sharpe ratio of 4.99 prior to August 1998.
ALTERNATIVE PERFORMANCE EVALUATION: ASSET-BASED STYLE FACTORS
(Continued)

• A decomposition of the fund’s returns showed that a similar pattern of returns was achievable using substantial leverage and short options exposure.


• After August 1998, the manager reported a very large loss.
ALTERNATIVE PERFORMANCE EVALUATION: THE GAIN-LOSS RATIO

• Under normality, the Sharpe ratio summarizes the attractiveness of an investment opportunity.

• But if normality cannot be assumed, one would like a measure that accounts for an investor’s preference for positively skewed outcomes and their avoidance of negatively skewed outcomes.

• The Bernardo-Ledoit gain-loss ratio is one such measure.
• The gain-loss is the ratio of the expected return given a gain divided by the expected return given a loss.

ALTERNATIVE PERFORMANCE EVALUATION: FAT TAILS

- If an investment’s returns are not normally distributed, one may want to try to come up with more accurate return distributions in order to understand an investment’s return-to-risk trade-off.
ALTERNATIVE PERFORMANCE EVALUATION: FAT TAILS (Continued)

• For example, the returns of relative value hedge fund strategies exhibit negative skewness.

ALTERNATIVE PERFORMANCE EVALUATION: FAT TAILS
(Continued)

• The returns of Commodity Trading Advisors, on the other hand, have positive skewness.

ALTERNATIVE PERFORMANCE EVALUATION: NON-LINEAR RELATIONSHIPS TO STOCK AND BOND PORTFOLIOS

• Alternative investments are frequently marketed based on their lack of correlation to stock and bond portfolios.

• Performance measures that accurately capture this correlation are therefore needed.
ALTERNATIVE PERFORMANCE EVALUATION: NON-LINEAR RELATIONSHIPS TO STOCK AND BOND PORTFOLIOS
(Continued)

• One extreme example would be a fund that had convex payoffs with respect to the market (through long calls and puts.)

• Say its payoff is $Y = X^2$, where $X$ is the market return.

• The correlation of the strategy to the market is zero, even though it is entirely determined by the market’s return.
Let's take an example where the constant correlation is equal to zero and there is a deterministic relationship between X and Y:

\[ y = x^2 \]

The constant correlation is equal to

\[
\rho(x, x^2) = \frac{E(xx^2) - E(x)E(x^2)}{\sqrt{[E(x^2) - E(x)^2][E(x^4) - E(x^2)^2]}} \overset{x \sim N(0,1)}{=} \frac{0 - 0 \times 1}{\sqrt{(1 - 0)(3 - 1)}} = 0
\]

The constant correlation shows no relation between both distribution even though the Y asset is depending on the X asset. This is due to the fact that the constant correlation "tries" to find linear relation between X and Y. In this case, there is absolutely no linear relation between X and Y, but only a positive quadratic relation.

ALTERNATIVE PERFORMANCE EVALUATION: NON-LINEAR RELATIONSHIPS TO STOCK AND BOND PORTFOLIOS (Continued)

• One can use non-linear regressions to estimate the relationship between a hedge fund strategy and a portfolio of traditional assets.

Equity Non-Hedge Strategy

Equivalent to long position in traditional portfolio with some long out-of-the-money calls and some short out-of-the-money puts.

ALTERNATIVE PERFORMANCE EVALUATION: NON-LINEAR RELATIONSHIPS TO STOCK AND BOND PORTFOLIOS

(Continued)

Event-Driven Strategy

Managed Futures

The Favre-Galeano article shows that most hedge fund categories have concave payoffs on the downside.

Diversification benefits disappear at extreme levels of traditional asset returns with several exceptions.
**ALTERNATIVE PERFORMANCE EVALUATION: SCENARIO-DRIVEN RISK VISUALIZATION**

- An investor frequently uses the normal distribution to represent returns of a diversified portfolio since one assumes it is OK 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 OK for a portfolio’s return if its strategies would never be influenced by a dominant event.
One idea is to represent an investment’s distribution as a combination of two distributions: one for peaceful times and a second for eventful times.

The distribution during eventful times would not just include higher volatility, but also the greater correlation among strategies that tends to occur during crises.

A risk manager would explicitly determine the proportion of crisis returns in the combined distribution.
ALTERNATIVE PERFORMANCE EVALUATION: SCENARIO-DRIVEN RISK VISUALIZATION

(Continued)

CONTACT US

Ms. Hilary Till
Principal
Premia Capital Management, LLC
505 N. Lake Shore Drive
Suite 402
Chicago, IL  60611  USA

Phone:  312-583-1137
E-Fax:  240-414-8933

E-mail:  till@premiacap.com