MEASURING RISK-ADJUSTED RETURNS IN ALTERNATIVE INVESTMENTS

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PRESENTATION OUTLINE

I. Traditional Performance Evaluation
   • Sharpe Ratio
   • Alpha

II. Alternative Performance Evaluation
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   • 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.”
• 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.”
TRADITIONAL PERFORMANCE EVALUATION  
(Continued)

• 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.*

TRADITIONAL PERFORMANCE EVALUATION

(Continued)

• 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.

TRADITIONAL PERFORMANCE EVALUATION (Continued)

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.
• 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*.
• 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.
TRADITIONAL PERFORMANCE EVALUATION
(Continued)

• 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

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• 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

• 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.

• It is the ratio of the expectation of the positive part of the returns divided by the expectation of the negative part.
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.

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

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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

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

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.

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
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