Risk and Performance Measurement For Alternative Investment

Presented at
Investment Performance Measurement Conference

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Outline

• Difference Between Traditional and Absolute Returns in Investment Management
• Current State of Risk Management and Performance Measurement
• Measure of Association: Implications for Investment Management
• Challenges Involved
The Difference

• The Differences Between Benchmark-Based and Absolute-Return Management Result From:
  – Competing Views on Sources of Investment Returns
• Which Then Result in Differing:
  – Investment Processes;
  – Risk Management Practices; and
  – Expectations for Money Managers.

Different views on sources of returns.
COMPETING VIEWS ON SOURCES OF RETURNS

• Asset Allocation as Dominant Source of Returns
• Absolute Returns Expected from Each Investment
• Hybrid View

There are three different views.
I. Asset Allocation

• The view that *asset allocation* is the dominant source of returns …

• … has resulted in *benchmark-based management*.

Some believe that asset allocation accounts for most returns.
I. Asset Allocation
(Continued)

• Performance Attribution Studies
• CAPM
• Long-Term Structural Returns
• Industry Organization
• Investment Process
• Risk Measurement and Monitoring
• Consequences


A. Performance Attribution Studies

- The decision by an institutional investor on how to allocate among a number of asset classes is the key performance driver.

Asset allocation is the most important driver.
A. Performance Attribution Studies (Continued)

- Asset allocation is more important than security selection.

- *Asset allocation policy on average accounted for 93.6% of total return variation across time amongst the corporate plans studied.*

# A. Performance Attribution Studies (Continued)

<table>
<thead>
<tr>
<th>Category</th>
<th>Minimum</th>
<th>Policy</th>
<th>Maximum</th>
<th>Benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic equities</td>
<td>12%</td>
<td>22%</td>
<td>40%</td>
<td>60% S&amp;P500, 10% S&amp;P 400, 10% Russell 2000</td>
</tr>
<tr>
<td>Foreign equities</td>
<td>10%</td>
<td>15%</td>
<td>20%</td>
<td>83% EAFE, 7% Solomon Extended ex US Mkt</td>
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<tr>
<td>Emerging markets</td>
<td>3%</td>
<td>9%</td>
<td>13%</td>
<td>IFC Global and EMER+</td>
</tr>
<tr>
<td>Private equities</td>
<td>10%</td>
<td>15%</td>
<td>20%</td>
<td>Cambridge Associates Weighted Composite</td>
</tr>
<tr>
<td>Total Equities</td>
<td>40%</td>
<td>61%</td>
<td>75%</td>
<td></td>
</tr>
<tr>
<td>Absolute return portfolio</td>
<td>0%</td>
<td>5%</td>
<td>10%</td>
<td>60% Sal Global Eq, 20% Morgan Global Bonds, 20% LIBOR + 5%</td>
</tr>
<tr>
<td>High-yield bonds</td>
<td>0%</td>
<td>3%</td>
<td>5%</td>
<td>Salomon High-Yield and Bankrupt</td>
</tr>
<tr>
<td>Commodity-related a</td>
<td>3%</td>
<td>6%</td>
<td>9%</td>
<td>GS3 and NCREIF Timber leverage adjusted</td>
</tr>
<tr>
<td>Real estate</td>
<td>4%</td>
<td>7%</td>
<td>10%</td>
<td>NCREIF Property Index, 50% leverage</td>
</tr>
<tr>
<td>Total</td>
<td>12%</td>
<td>21%</td>
<td>32%</td>
<td></td>
</tr>
<tr>
<td>Domestic bonds</td>
<td>5%</td>
<td>10%</td>
<td>20%</td>
<td>Lehman 5+ year Treasury index</td>
</tr>
<tr>
<td>Foreign bonds</td>
<td>0%</td>
<td>4%</td>
<td>10%</td>
<td>J.P. Morgan Non U.S.</td>
</tr>
<tr>
<td>Inflation-indexed bonds</td>
<td>2%</td>
<td>7%</td>
<td>12%</td>
<td>Salomon 5+ year TIPS</td>
</tr>
<tr>
<td>Cash</td>
<td>8%</td>
<td>18%</td>
<td>30%</td>
<td>One month LIBOR</td>
</tr>
<tr>
<td>Total Fixed Income</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Harvard Management Company (2001)
B. CAPM

- Under the Capital Asset Pricing Model (CAPM), in equilibrium all assets and portfolios have the same return after adjusting for risk.

- Empirical studies had justified the use of the CAPM for a quarter of a century.

- In the main, the only way to earn more returns is to take on more market risk or “beta.”

They believe that the market is efficient, and that there is no free lunch.
C. Long-Term Structural Returns

US Equities
Arithmetic Average Rates of Return
Annual Data: 1927-2001

But higher risk does not mean higher returns.

Risk cannot be measured by standard deviation alone.

• Value and growth data courtesy of Fama/French.
• CRSP data courtesy of the Center for Research in Security Prices, University of Chicago.
D. Industry Organization

• Pension fund consultants and financial planners advise on the long-term asset allocation mix.

• Each asset class within the mix is assigned a benchmark.

• The investment managers are responsible for providing investment results that are relative to the benchmark.

• The investor owns the risk of the benchmark.

Investors are exposed to market risk (which until recently was considered acceptable).
E. Investment Process

• The investment process is centered around ensuring that any deviation from the benchmark is an active investment decision.

• The scaling of each active bet should correspond to the degree of confidence in that bet.

So, deviation from benchmark must be justified.
F. Risk Measurement and Monitoring

- The risks that are monitored are as follows:
  - Style Drift
  - Tracking Error
  - Maverick Risk.

Main risks are style drift, deviation from benchmark, and manager risk.
F. Risk Measurement and Monitoring: Style Drift

- In the event of style drift, the overall asset allocation plan could be invalidated.

- The structural returns of the benchmark are sufficient, so it does not make sense to give a manager too much discretion.

The structural returns are sufficient.
F. Risk Measurement and Monitoring: Tracking Error

• The total risk of the portfolio is not important.

• The manager’s risk is always viewed in relative terms.

We need only to worry about relative risk.
G. Consequences

• *A mutual fund can lose over 50% of its market value.*

• This is acceptable as long as the losses are consistent with its benchmark or product category.

• In 2001, this was the case for the aggressive growth equity style.

One needs to be able to tolerate -50% losses.
G. Consequences (Continued)

• The manager can note that the performance is consistent with its product design.

• The manager can also note that they will continue offering the product.

• Articles on the topic are broadly sympathetic to the manager.

Performance is consistent with its product design despite sharp fall in NAV.
II. Absolute Returns Expected from Each Investment

• The Post-2000 view is starting to depart from some of the preceding assumptions …

• … Which has consequences for:
  – The investment management industry’s organization;
  – Investment processes;
  – Risk management and monitoring; and
  – Expectations for managers.

There is a change in view since year 2000.
A. Absolute Returns Expected from Each Investment (Continued)

- Long-Term View on Structural Returns is Shaken
- Valuation Matters
- Performance Attributions Studies Questioned
- Throw Out Equity Benchmarks
- Downside Risk Protection is Crucial
- Consequences
- Risk Management
  - Event Risk
  - Extreme Risk

Expectations have changed and absolute returns are expected.
A. Long-Term View on Structural Returns is Shaken

• Equities may have returned 12.7% annually since 1927.

• But there are long stretches where one had to be very patient.

Some believe that the market will take a long time to bounce back.
A. Long-Term View on Structural Returns is Shaken (Continued)

- DOW JONES INDUSTRIAL AVERAGE
  December 31, 1964: 874.12
  December 31, 1985: 875.00

- “Now I’m known as a long-term investor and a patient guy, but that is not my idea of big move.”

There may be extended periods of low returns.
B. Valuation Matters: Bill Gross

- The returns on equities depends on their beginning valuation and right now valuation remains poor.

- “Earnings have been phonied up for years ....”

- “Companies have been diluting ... equity via stock options ....”

There are good reasons for the equity market to stay low.
B. Valuation Matters: Warren Buffett

- **Key value-determining factors:**
  - Interest rates must remain low; and
  - Corporate profitability in relation to GDP must rise.

Some believe that in the long run, performance is mostly about valuation.
C. Performance Attribution Studies Questioned

- Institutional investors have chosen asset allocation as the key area to exercise investment discretion ...

- ... But it may be that the “natural opportunity set presented by the capital markets” is far greater than what’s offered through discretion in asset allocation.

There may be better investment opportunities than strictly relying on asset allocation.

D. Throw Out Equity Benchmarks

• Equity benchmarks produce a high tracking error against underlying liabilities of pension plans.
  - Alan Brown, group Chief Investment Officer of State Street Global Advisors

• Instead, pension plans may start considering:
  - Bigger allocations to bonds;
  - Increased use of risk budgeting; and
  - Allocations to absolute-return products.

This leads to a change in the mindset of some pension funds.

E. Downside Risk Protection is Crucial

• Once one no longer has faith in equity benchmarks providing target returns, ...

• … Downside risk management becomes crucial.

They conclude that it is important to manage downside risk.
E. Downside Risk Protection is Crucial (Continued)

• “Investors are not indifferent whether an active manager simply captures the premium of the asset class ....”

• “.... Or whether he or she tilts the return distribution of the portfolio to the right.”


It is absolute returns that the second group of investors are after.
E. Downside Risk Protection is Crucial

(Continued)

- Ineichen notes that long/short equity sector funds have an opportunity set correlated to their sector.

- Even so, long-term superiority is due to balancing investment opportunities with total risk.

<table>
<thead>
<tr>
<th>AMEX Biotechnology - Pharmaceuticals</th>
<th>HFRI Healthcare/ Biotechnology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial investment</td>
<td>100</td>
</tr>
<tr>
<td>Dec-07</td>
<td>113</td>
</tr>
<tr>
<td>Dec-08</td>
<td>122</td>
</tr>
<tr>
<td>Dec-09</td>
<td>274</td>
</tr>
<tr>
<td>Dec-00</td>
<td>442</td>
</tr>
<tr>
<td>Dec-01</td>
<td>420</td>
</tr>
<tr>
<td>Jul-02</td>
<td>262</td>
</tr>
<tr>
<td>Return 97-99</td>
<td>174%</td>
</tr>
<tr>
<td>Return 00-02</td>
<td>8%</td>
</tr>
<tr>
<td>Under water</td>
<td>-43%</td>
</tr>
<tr>
<td>Loss recovery return*</td>
<td>75%</td>
</tr>
<tr>
<td>Recovery at 8% pa</td>
<td>Nov-03</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>NYSE Financials</th>
<th>HFRI Financials</th>
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</thead>
<tbody>
<tr>
<td>Initial investment</td>
<td>100</td>
</tr>
<tr>
<td>Dec-07</td>
<td>141</td>
</tr>
<tr>
<td>Dec-08</td>
<td>148</td>
</tr>
<tr>
<td>Dec-09</td>
<td>147</td>
</tr>
<tr>
<td>Dec-00</td>
<td>184</td>
</tr>
<tr>
<td>Dec-01</td>
<td>169</td>
</tr>
<tr>
<td>Jul-02</td>
<td>151</td>
</tr>
<tr>
<td>Return 97-99</td>
<td>47%</td>
</tr>
<tr>
<td>Return 00-02</td>
<td>3%</td>
</tr>
<tr>
<td>Under water</td>
<td>-18%</td>
</tr>
<tr>
<td>Loss recovery return*</td>
<td>22%</td>
</tr>
<tr>
<td>Recovery at 8% pa</td>
<td>Feb-05</td>
</tr>
</tbody>
</table>

Source: Hedge Fund Research, Datastream
* Return required in recovery losses

Managing the downside will take you shorter time to recover.
F. Consequences

- A manager is expected to keep losses under control.

- *It is unacceptable for a manager to lose more than 50% of market value.*

Investors expect losses to be kept under control.
F. Consequences  
(Continued)

- Fixed Income Arbitrage: Beacon Hill Plans to Close Hedge Funds

From Wall Street Journal Interactive

The WSJI reports Beacon Hill Asset Management informed its investors that the losses incurred by its two hedge funds, the Bristol Fund and the Safe Harbor Fund, were much greater than originally reported; the losses, as of Sept. 30, were 54% not 25%. Following these losses Beacon Hill has decided to close down its hedge funds and liquidate its remaining positions.
- Albourne Village Website, 10/21/02

Large losses are not tolerated.
G. Event Risk: Individual Managers

• Since it is unacceptable for an absolute-return manager to have large losses, individual managers pay particular attention to event risks.

• An example of an “event risk” analysis for a total-return portfolio follows …
G. Event Risk: Individual Managers
(Continued)

• This example portfolio consists of a long Russell 2000 vs. a short S&P 500 futures strategy and a long Municipal Bond vs. a short U.S. Bond futures strategy.

• These strategies are normally unrelated as illustrated in the graphs on the next slide.

These strategies are “normally” not correlated.
G. Event Risk: Individual Managers

(Continued)

There are no linear relationships “normally”.

<table>
<thead>
<tr>
<th>Period</th>
<th>Yield</th>
<th>TIME FRAME</th>
<th>Log (Relative Value)?</th>
<th>Y/N</th>
<th>Market</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Regression Type</th>
<th>Start Date</th>
<th>End Date</th>
<th>Filter</th>
<th>Log X</th>
<th>Periods</th>
<th>Slope</th>
<th>Intercept</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9/17/01</td>
<td>12/14/01</td>
<td>101</td>
<td>0</td>
<td>2</td>
<td>-774.4</td>
<td>458.0</td>
</tr>
<tr>
<td></td>
<td>9/20/01</td>
<td>9/6/01</td>
<td></td>
<td></td>
<td></td>
<td>1930.1</td>
<td>65.2</td>
</tr>
</tbody>
</table>

*Identifies latest observation

1) $Y = 458.77 + X$

2) $Y = 1930.1X + 65.26$
G. Event Risk: Individual Managers (Continued)

- But during a scenario test of the portfolio’s sensitivity to event risk, we find that the combination of the two trades results in an exposure to a liquidity shock.

But, we are exposed to liquidity risk when there is a shock.
G. Event Risk: Individual Managers (Continued)

<table>
<thead>
<tr>
<th>Event</th>
<th>Maximum Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 1987 stock market crash</td>
<td>-4.11%</td>
</tr>
<tr>
<td>Gulf War in 1990</td>
<td>-4.12%</td>
</tr>
<tr>
<td><em>Fall 1998 bond market debacle</em></td>
<td>-6.42%</td>
</tr>
<tr>
<td>Aftermath of 9/11 attacks</td>
<td>-3.95%</td>
</tr>
</tbody>
</table>

One may have a return of -4% to -6% in the aftermath of different types of shocks.
G. Event Risk: Individual Managers (Continued)

- **Worst-Case Event**
  - Maximum Loss
  - Fall 1998 bond market debacle -6.42%

- **Value-at-Risk based on recent volatilities and correlations**
  - 3.67%

A flight-to-quality event is the worst scenario for the portfolio.
G. Event Risk: Individual Managers
(Continued)

• The short legs of each spread are the more liquid of the pair.

• So both of these trades are at risk to a flight-to-quality event as happened during the Fall of 1998.

During flight-to-quality events, a portfolio of long relatively illiquid instruments and short liquid instruments will do poorly.
G. Event Risk: Fund-of-Fund Managers

• Similarly fund-of-hedge-fund managers attempt to model their portfolio’s return distribution …

• … When all the strategies are influenced by a dominant event.

Similarly, Fund of Funds may be subject to event risk.
G. Event Risk: Fund-of-Fund Managers
(Continued)

• 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.

It may appear to be all right during “normal” times but not so when there is a crisis.
G. Event Risk: Fund-of-Fund Managers (Continued)

• 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.

Manager has to ensure that the portfolio is diversified during crises.
G. Event Risk: Fund-of-Fund Managers (Continued)

SCENARIO-DRIVEN RISK VISUALIZATION


The “Camel” distribution embodies returns from periods of shocks!
G. Extreme Risk

- **Conditional Value-at-Risk (CVaR) vs. Value-at-Risk (VaR)**

- “[Whereas] VaR measures the maximum loss for a given confidence interval, … CVaR corresponds to the expected loss conditional on the loss being greater than or equal to the VaR.”


The CVaR measures expected loss given loss $\geq$ VaR.
G. Extreme Risk
(Continued)

- When the goal is to keep extreme losses under control …

- ... CVaR should be used as the risk constraint during portfolio construction.

CVaR is preferred over VaR.
III. Hybrid View: A Blend of Asset Allocation and Absolute-Return Approaches

- Main Source of Returns Still from Asset Allocation
- Extra Returns through Niche Opportunities
- These Niche Opportunities are Risk Premia Strategies
- Investment Process for Risk Premia Strategies
- Performance Metrics ----Next Section

The last group believes that returns come from both asset allocation and risk premia strategies.
Outline

• Difference Between Traditional and Absolute Returns in Investment Management
• Current State of Risk Management and Performance Measurement
• Measure of Association: Implications for Investment Management
• Challenges Involved
Most returns are not “normal”.

Distribution of Hedge Fund Return

- Normal Distribution
- Negatively Skewed & Leptokurtic Distribution

Probability

Return
Portfolio Construction for Risk Premia Strategies

• In addition to CVaR, another measure is “modified VaR,” which takes into consideration the skewness and kurtosis of a distribution.

• Skewness describes how asymmetric a distribution is.

• Kurtosis is linked to the existence of extreme returns.

It is not difficult for risk managers to capture different “shapes.”
**Skewness : The 3rd Moment**

*Skewness* refers to the asymmetry of a distribution

\[
\hat{S}(x) = \frac{1}{T\sigma_x^3} \sum_{t=1}^{T} (x_t - \bar{x})^3
\]

A distribution that is negatively skewed has a long tail on the left (negative) side of the distribution, indicating that the few outcomes that are below the mean are of greater magnitude than the larger number of outcomes above the mean.
Kurtosis characterises the relative spike or flatness of a given distribution when compared to a normal distribution:

\[
\hat{K}(x) = \frac{1}{T\hat{\sigma}_x^4} \sum_{t=1}^{T} (x_t - \hat{\mu}_x)^4
\]

A distribution that has wider tails and a taller narrower peak than the normal distribution is called leptokurtic ("fat tail" distribution) with high kurtosis.
Portfolio Construction for Risk Premia Strategies (Continued)

- On the following slide, the figure illustrates how the efficient frontier is affected when using modified VaR rather than VaR as the risk constraint.
- The sample portfolio includes absolute-return strategies, some of which have asymmetric payoffs.

Modified VaR incorporates risk associated with asymmetric distribution and fat tails.

It leads to higher VaR at each level of return.
Performance Metrics

• Due care must be used in relying on the Sharpe ratio as a performance metric for risk premia strategies.

• Four Yale University professors have derived an optimal strategy for maximizing the Sharpe ratio.

It is easy to sharpen the Shape ratio.
F. Performance Metrics
(Continued)

- 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.

In Practice

• Key Risk Measures
  – Standard Deviation, Downside Risk, Drawdown

• Key Performance Measures
  – Sharpe, Sortino, Calmar

• Supplemented by Other Quant Analysis
  – Time Window Analysis, Benchmark, Draw Down Analysis
  – Gain/loss, Up Capture, Down Capture, Recovery, Run-down
## Alternative Performance Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sortino Ratio</td>
<td>The ratio replaces the standard deviation in the Sharp ratio by the downside deviation from a threshold.</td>
</tr>
<tr>
<td>2. Omega</td>
<td>The ratio of the gain with respect to the threshold and the loss with respect to the same threshold.</td>
</tr>
<tr>
<td>3. Stutzer Index</td>
<td>The maximum possible decay rate of the probability (the excess returns over a threshold will be negative).</td>
</tr>
</tbody>
</table>

We can do more to incorporate the influence of 3\textsuperscript{rd} and 4\textsuperscript{th} moments.
We can do even more to incorporate the Minimum Acceptable Returns.

Assets A and B both have a mean return of 7.

Asset A has the higher Sharpe ratio.

C Keating and F Shadwick, “A Universal Performance Measure”, The Journal of Performance Measure, 6 (3)
Omega Measure (Continue)

But if your loss threshold is 8.5...

You need to consider the relative chances of a gain or loss with A or B to determine which is preferable.

Proportion of returns above 8.5:
Asset A 31%  Asset B 35%

We can work out the gain/loss ratio.
Omega Measure (Continue)

The area outlined in black is: 

\[ I_2(r) := \int_r^{\infty} (1 - F(x)) \, dx \]

The area outlined in red is: 

\[ I_1(r) := \int_{-\infty}^{r} F(x) \, dx \]

\( I_1 \) is associated with loss and \( I_2 \) is associated with gain.
Omega Measure (Continue)

The area outlined in black is:

\[ I_2(r) = \int_r^{\infty} (1 - F(x)) \, dx \]

The area outlined in red is:

\[ I_1(r) := \int_{-\infty}^{r} F(x) \, dx \]

Omega is the ratio \( \frac{I_2}{I_1} \)

\[ \Omega(r) := \frac{\int_r^{\infty} (1 - F(x)) \, dx}{\int_{-\infty}^{r} F(x) \, dx} \]

\( \Omega(r) \) is a measure of the relative probability weighted gains to losses at the return level \( r \).

The bigger this is, the better the quality of a bet on a return greater than \( r \).
But if your loss threshold is 8.5... You need to consider the relative chances of a gain or loss with A or B to determine which is preferable.

Proportion of returns above 8.5:
Asset A 31%  Asset B 35%

Asset A
\( \mu_A = 7, \sigma_A = 3 \)

Asset B
\( \mu_B = 7, \sigma_B = 4 \)

The Sharpe ratio says A is preferable to B. Omega says it depends on your loss threshold. Below the mean, A is preferable, above the mean, B is.

May use it to compare across time for the same fund too!
Hedge Fund Index is not always preferred over MSCI Index
It depends on the threshold level.
Investors are assumed to be more risk averse, and the preference is for absolute return products.
<table>
<thead>
<tr>
<th></th>
<th>Sortino ratio</th>
<th>Omega</th>
<th>Stutzer index</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Identical Ranking</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. Indices</td>
<td>28</td>
<td>36</td>
<td>37</td>
</tr>
<tr>
<td>Mean (Avg.)</td>
<td>0.69%</td>
<td>0.76%</td>
<td>0.72%</td>
</tr>
<tr>
<td>Standard Deviation (Avg.)</td>
<td>2.79%</td>
<td>2.82%</td>
<td>2.67%</td>
</tr>
<tr>
<td>Skewness (Avg.)</td>
<td>-0.68</td>
<td>-0.75</td>
<td>-0.82</td>
</tr>
<tr>
<td>Kurtosis (Avg.)</td>
<td>6.48</td>
<td>7.18</td>
<td>7.22</td>
</tr>
<tr>
<td><strong>Ranking Upgraded</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. indices</td>
<td>8</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Mean (Avg.)</td>
<td>0.91%</td>
<td>0.74%</td>
<td>0.99%</td>
</tr>
<tr>
<td>Standard Deviation (Avg.)</td>
<td>2.79%</td>
<td>1.41%</td>
<td>2.49%</td>
</tr>
<tr>
<td>Skewness (Avg.)</td>
<td>0.08</td>
<td>-0.45</td>
<td>0.23</td>
</tr>
<tr>
<td>Kurtosis (Avg.)</td>
<td>3.95</td>
<td>4.09</td>
<td>3.69</td>
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<td><strong>Ranking Downgraded</strong></td>
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<tr>
<td>No. indices</td>
<td>8</td>
<td>5</td>
<td>4</td>
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<tr>
<td>Mean (Avg.)</td>
<td>0.79%</td>
<td>0.73%</td>
<td>0.90%</td>
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<tr>
<td>Standard Deviation (Avg.)</td>
<td>1.65%</td>
<td>1.58%</td>
<td>1.88%</td>
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<tr>
<td>Skewness (Avg.)</td>
<td>-2.86</td>
<td>-2.60</td>
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<td>Kurtosis (Avg.)</td>
<td>17.71</td>
<td>16.85</td>
<td>19.17</td>
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</table>


Third and fourth moments do make a difference to ranking.
Outline

• Difference Between Traditional and Absolute Returns in Investment Management
• Current State of Risk Management and Performance Measurement
• Measure of Association: Implications for Investment Management
• Challenges Involved
Measure of Association

• Correlation
  – Parametric Measurement: Linear Dependence
    • Pearson’s product moment correlation coefficient
  – Market Neutrality: Correlation = 0

• Concordance
  – If large (small) value of one is associated with large (small) value of another
  – Kendall’s tau and Spearman’s rho
  – Market Neutrality: if \((x_i - x_j)(y_i - y_j) = 0\), disconcordance

• Copula

Correlation is a linear measure.
## Variable Correlation With S&P

<table>
<thead>
<tr>
<th></th>
<th>MAR</th>
<th>MAR</th>
<th>MAR</th>
<th>Alvest</th>
<th>Alvest</th>
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<th>Alvest</th>
<th>Alvest</th>
<th>Alvest</th>
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<tr>
<td>10%</td>
<td>0.721</td>
<td>0.439</td>
<td>0.149</td>
<td>0.825</td>
<td>0.755</td>
<td>0.621</td>
<td>0.768</td>
<td>0.627</td>
<td>0.784</td>
<td>0.909</td>
<td></td>
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<tr>
<td>10%-20%</td>
<td>-0.053</td>
<td>-0.287</td>
<td>0.008</td>
<td>0.110</td>
<td>0.333</td>
<td>0.190</td>
<td>0.049</td>
<td>-0.025</td>
<td>0.122</td>
<td>0.546</td>
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<tr>
<td>20%-30%</td>
<td>0.440</td>
<td>0.055</td>
<td>0.057</td>
<td>-0.019</td>
<td>-0.290</td>
<td>-0.416</td>
<td>-0.018</td>
<td>0.079</td>
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<tr>
<td>30%-40%</td>
<td>0.514</td>
<td>0.465</td>
<td>0.461</td>
<td>0.304</td>
<td>0.477</td>
<td>0.618</td>
<td>0.259</td>
<td>0.290</td>
<td>0.276</td>
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<tr>
<td>40%-50%</td>
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<td>0.135</td>
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<td>50%-60%</td>
<td>0.318</td>
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<td>0.255</td>
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<td>0.260</td>
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<td>0.430</td>
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<td>60%-70%</td>
<td>0.183</td>
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<td>70%-80%</td>
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<td>-0.102</td>
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<td>-0.222</td>
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<td>80%-90%</td>
<td>-0.070</td>
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<td>0.702</td>
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<td>90%-100%</td>
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<td>-0.273</td>
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<td>-0.029</td>
<td>-0.117</td>
<td>0.580</td>
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**How market neutral is Market Neutral Strategies?**
Market Neutral Strategies are not always market neutral!

<table>
<thead>
<tr>
<th></th>
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<th>MAR</th>
<th>MAR</th>
<th>Alvest</th>
<th>Alvest</th>
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<td></td>
<td>Market Neutral</td>
<td>Market Neutral Arbitrage</td>
<td>Market Neutral Long/Short</td>
<td>Event Driven</td>
<td>Relative Value</td>
<td>Long/Short</td>
<td>Merger Arb</td>
<td>Cap Stru Arb</td>
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<td>MSCI Global</td>
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<td>Worst</td>
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<td>&lt;0.1</td>
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<td>0.715</td>
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<td>&lt;0.5</td>
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<td>0.557</td>
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<td>&lt;0.9</td>
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<td>0.603</td>
<td>0.582</td>
<td>0.308</td>
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<td>0.338</td>
<td>0.248</td>
<td>0.351</td>
<td>0.616</td>
<td>0.454</td>
<td>0.603</td>
<td>0.582</td>
<td>0.308</td>
<td>0.462</td>
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<td>0.238</td>
<td>0.657</td>
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<td>0.523</td>
<td>0.616</td>
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<td>0.061</td>
<td>0.030</td>
<td>0.249</td>
<td>0.104</td>
<td>0.147</td>
<td>-0.049</td>
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</table>

We need new techniques to account for asymmetric dependence.
Asymmetric Dependence

- Returns appear to be more highly correlated during market downturns than during market upturns
- Correlation structure is different at high/low cutoffs compared to middle of distribution
- Advantages of using copulas:
  - Copulas can be used to generate distributions where correlation increases at extreme cutoffs
  - It completely describes the dependence between and among n variables

Copulas have many advantages.
Copula

• Distribution Functions:
  – \( F(x) = P[X \leq x] \), \( G(y) = P[Y \leq y] \)

• Joint Distribution Function
  – \( H(x,y) = P[X \leq x, Y \leq y] \)

• Copula
  – \( C(u,v) = C(F(u), G(v)) = \text{Prob}[F(x) \leq u, G(y) \leq v] \)
  – Independent if \( C(u,v) = u v \)


You can plot a 3-D Copula corresponding to \( u \) and \( v \).
Implications

• Asset Allocation: Underestimate the associated risks?
  – Adjustment: using copula or correlation threshold

• Value-at Risk
  – Estimated copulas give Prob(extreme loss)
  – Trade-off depends on fat-tails


You may want to use the max correlation as a threshold.
Outline

• Difference Between Traditional and Absolute Returns in Investment Management
• Current State of Risk Management and Performance Measurement
• Measure of Association: Implications for Investment Management
• Challenges Involved
Risk Measurement Vs Risk Management

- Risk Measurement is more a science
- Risk Management is more an art
- Both depends on the sources of return and associated risk
- Both Senior Managers and Quants are important

It is easy to quantify risk, but sometimes it is quite difficult to manage it.
Risk Management

• Risk measures tend to solely focus on end-period losses.

• With the ability to leverage, one must also ensure that investors can tolerate the potential within-period losses.

- Kritzman, Mark, “Hidden Risks of Hedge Funds, and Asset Allocation versus Security Selection,” Presentation to QWAFAFEW, 2/12/02.

The more one leverages, the higher the risks along the way.
Accounting for Practical (Hidden) Risks

- Deviation from Factors Models
  - Average % of 10 Largest Holding over Reporting Period
  - Fractal Dimension or Inverse of Hurst Ratio

- Deviation from Style Benchmark

- Change in Fund Size
  - Average Gross Exposure
  - Active Use of Leverage

- Style Consistency

- Style Purity

- Asset Growth

- Leverage

- Asset Concentration

- Liquidity

- Average Day to Complete Sales
- Ratio of Position to Trading Volume

RISKS
<table>
<thead>
<tr>
<th>Sources Of Risks</th>
<th>To Penalise for</th>
<th>Suggested Measurement method</th>
<th>Predicted Discount to Returns</th>
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</thead>
<tbody>
<tr>
<td>Style Purity</td>
<td>Deviation from Self-reported Investment Style</td>
<td>Deviation from Style Benchmark</td>
<td>The higher the style “impurity” the higher the discount</td>
</tr>
<tr>
<td>Asset Growth</td>
<td>Unexpected increases in Fund Size (and Assets Under Management)</td>
<td>Change in Fund Size</td>
<td>The higher the increase in fund size in the period under review, the higher the discount</td>
</tr>
<tr>
<td>Leverage</td>
<td>Excessive Leverage</td>
<td>(a) Average gross exposure, (b) Active Use of Leverage (Computed from a comparison of returns with and without the use of leverage following the standards recommended by the Association for Investment Management and Research)</td>
<td>The higher the use of leverage the higher the discount</td>
</tr>
<tr>
<td>Liquidity</td>
<td>Low Asset Liquidity</td>
<td>(a) Average Day to Complete Sales, (b) Ratio of Position to Trading Volume</td>
<td>The higher the threat of “illiquidity” the higher the discount</td>
</tr>
<tr>
<td>Asset concentration</td>
<td>(a) Single Security Exposure, (b) Erratic Returns</td>
<td>(a) Average Percentage of 10 Largest Holding over reporting period, (b) Fractal Dimension or Inverse of Hurst Coefficient</td>
<td>The higher the asset concentration the higher the discount</td>
</tr>
</tbody>
</table>

If there were more transparency, we could make more adjustments.
No Substitution For Qualitative Analysis

• Understanding Strategy
• Evaluating Investment Decision Process
• Analysis of Risk Controls
• Determining Character/Talent of Manager
• Review of Funds Characteristics (Fees, Liquidity, Structure)
• On-Site Review of Operations


The practitioners use quantitative measures as a preliminary filter.
Common Factors Before An “Extreme Event” Occur

- Style Drift
- Key Person Risk
- Asset Drift
- Leverage, Common Investor Effect, Emerging Market, Merger Arbitrage, Fund Split Between Two Locations

Experience matters.
Concluding Remarks

• Quantitative analysis is important
• Qualitative analysis is important, if not more
• Two competing views
  – More Transparency
    • Full disclosures of positions of segregated accounts
  – More Disclosures About Risk Management Function
    • Position-level information is not adequate to serve investor needs.

In some cases, a hedge fund will only be willing to offer low-level aggregate disclosure to investors. In that situation, one alternative is to verify the quality of a hedge fund’s risk management function …
Instead, risk management disclosure on the independence of a risk manager’s position, the authority of the risk manager, quality of the risk manager….. the involvement of traders and senior managers in the risk management process, the resources available to the risk management function and the nature of the risk manager’s report should be offered to investors.

- Barry Schachter, Sac Capital Advisors, quoted in Risk, July 2003
Thank You
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(not directly credited in presentation)

Source of Graphics (Continued)

• Slide 18, “Manager Style,” Style Analysis & Performance Analysis Software, Zephyr Associates Inc.,

• Slide 19, BARRA Risk Decomposition screenshot from BARRA Case Study: Fiduciary Trust International,

• Slide 33, cover of Against the Gods: The Remarkable Story of Risk by Peter Bernstein, John Wiley & Sons, Inc., 1996.

• Slide 37, graphs of RLX-SPX vs. MOB futures spreads, The Bloomberg.

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