Using Downside Risk to Improve Performance Measurement

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INVESTMENT
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Outline

- Post-Modern Portfolio Theory
- Research and Case Studies
- Common Misconceptions of PMPT
- Summary and Expert Opinions

Differences between PMPT and MPT

- Risk measure:
  - Downside Risk vs. Standard Deviation
- Probability distribution:
  - Lognormal vs. Normal.

Standard Deviation

- Equates risk with uncertainty
- Square root of variance
- Implies symmetric, normal return distribution
- Upside volatility penalized same as downside volatility
- Measures risk relative to the mean
- Same risk for all goals

Post-Modern Portfolio Theory

Two Fundamental Advances on MPT:

- Downside risk replaces standard deviation
- PMPT permits non-normal return distributions

Downside Risk

- Defined by below-target semideviation
- Standard deviation of below-target returns
- Differentiates between risk and uncertainty
- Naturally incorporates skewness
- Recognizes that upside volatility is better than downside volatility
- Combines *frequency* and *magnitude* of bad outcomes
- No single riskless asset

Applications of PMPT

- Performance measurement
- Portfolio optimization/asset allocation

Elements of PMPT

The Goal

- Questions to Identify the Proper Goal:
  - What is at stake here?
  - What are we trying to accomplish?
  - When does it go from good to bad?

- Examples of Goals:
  - Minimum achievable return
  - Benchmark or index portfolio
  - Comparative universe median
  - Maintain pension contribution below specified amount
  - Achieve target wealth in order to retire

Elements of PMPT

Sortino Ratio

- [Return-Goal]/Downside Risk
- PMPT analog of Sharpe Ratio

  (Return-Riskfree Rate)/Standard Deviation

Elements of PMPT

Volatility Skewness

[Percent variance above the mean]/
[Percent variance below the mean]

Elements of PMPT

Downside Probability

Likelihood or frequency of failure

Elements of PMPT

Average Downside Deviation

Average deviation below the goal

Elements of PMPT

Three-Parameter Lognormal Distribution

- Permits positive and negative skewness
- Accommodates all asset classes, including options, derivatives and hedge funds
- Better representation of the shape of investment returns

Research

How Asymmetrical are Investment Returns?

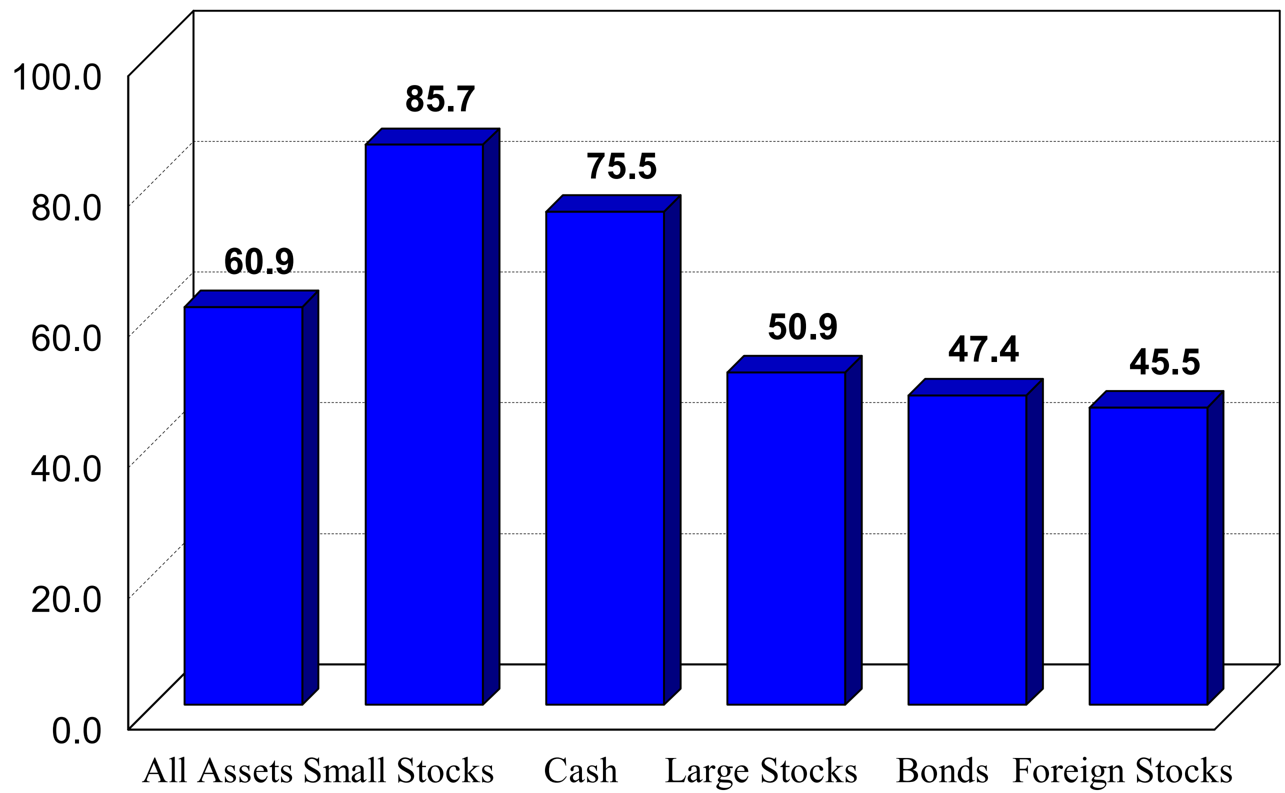
Scope of Analysis

ASSET CLASS	INDEX	DATES	YEARS
Large-Cap Stocks	S&P 500	1937-1993	57
Small-Cap Stocks	Russell 2000	1979-1993	15
Foreign Stocks	EAFE	1970-1993	24
Bonds	Lehman Aggregate	1973-1993	24
Cash Equivalents	90-Day T Bills	1937-1993	57

Time Periods Analyzed

- Consecutive 3-year periods: inception through 1993.
- Consecutive 5-year periods: inception through 1993.
- Consecutive 10-year periods: inception through 1993.
- Consecutive 20-year periods: inception through 1993.
- Consecutive decades through 1980's.
- Inception through 1993, 1990, 1985, 1980, 1975, 1970, 1965, 1960, 1955, 1950, 1945.

Frequency of Skewness by Asset Class

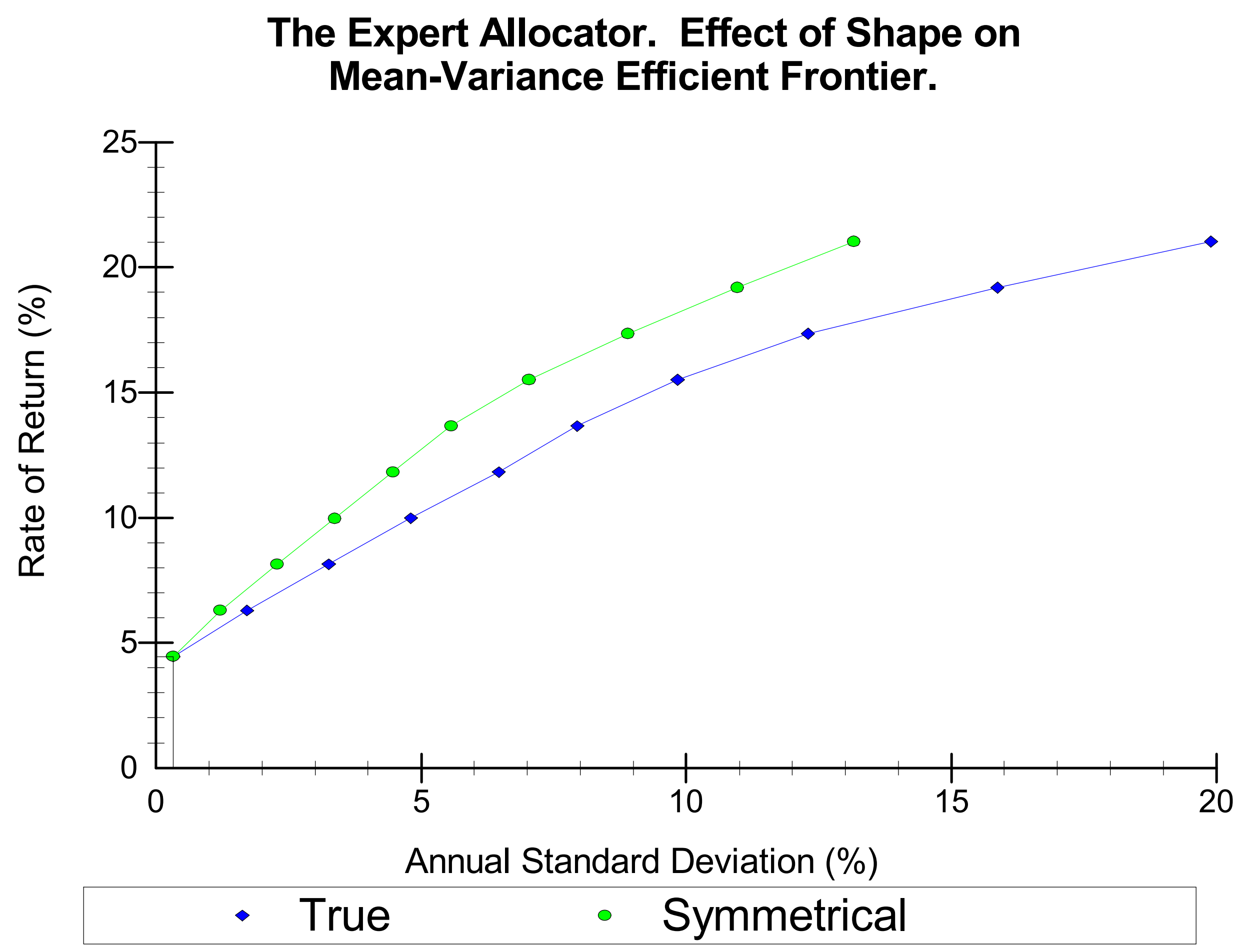


Conclusion...

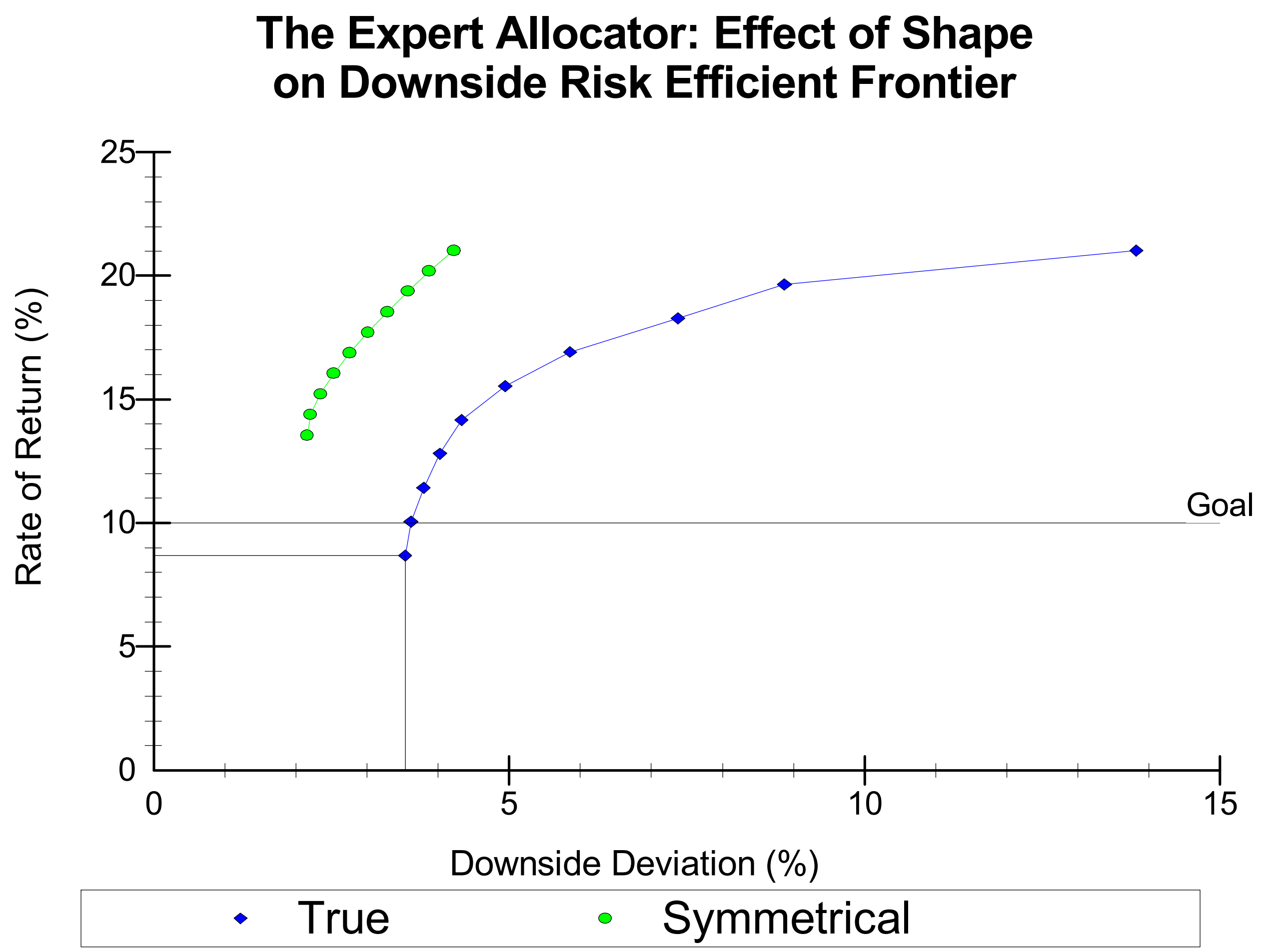
THE INVESTMENT WORLD

IS NOT ALWAYS SYMMETRICAL!

Optimization Case Studies

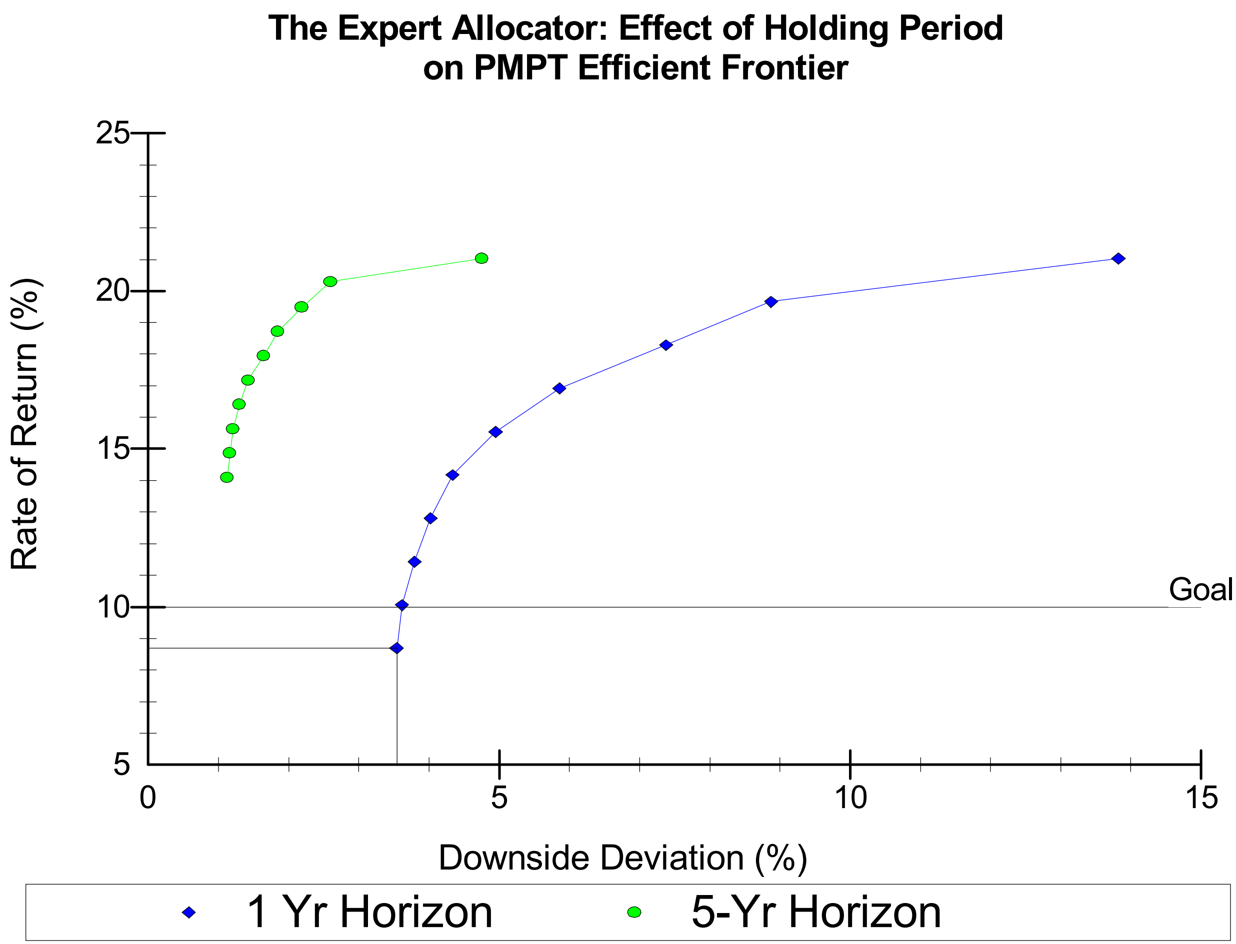


Inputs: Stocks, Bonds, Cash returns 1991-1995



Inputs: Stocks, Bonds, Cash returns 1991-1995

Optimization: 1-year holding period; 10.0% goal



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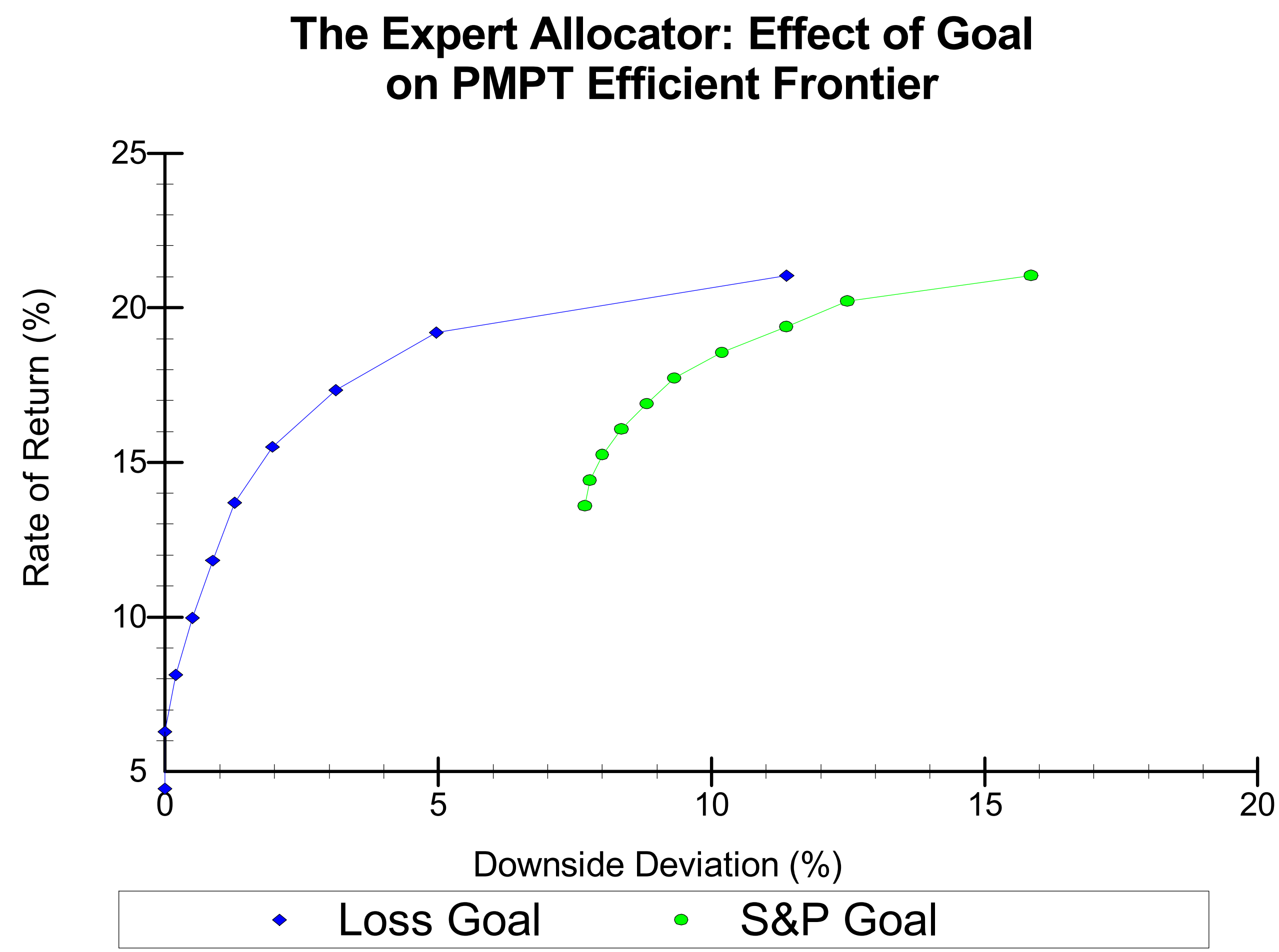

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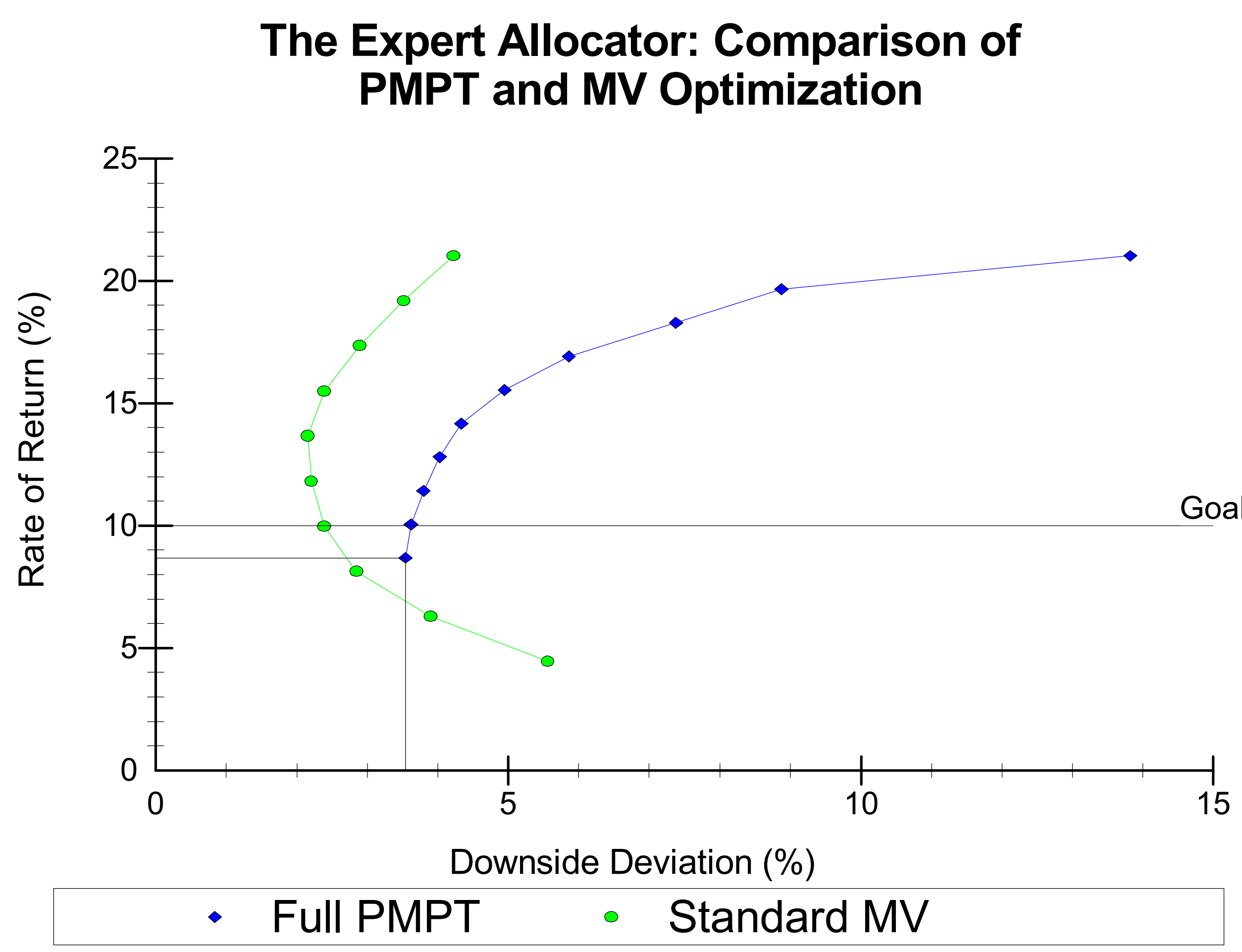

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Does PMPT Optimization Give Better Results?

Period	PMPT ROR (%) vs. 10% MAR	MPT ROR (%)	PMPT Excess (bp)
1977-81	19.5	16.3	320
1978-82	23.2	18.3	490
1979-83	26.7	20.2	650
1980-84	15.2	14.7	50
1981-85	16.5	16.5	0
1982-86	28.8	24.3	450
1983-87	34.9	26.7	820
1984-88	35.8	26.5	930
1985-89	35.8	26.8	900
1986-90	16.8	14.6	220
1987-91	13.7	13.7	0
1988-92	14.1	14.0	10
1989-93	14.6	13.4	120
Average/Year	**21.2**	**17.7**	**350**

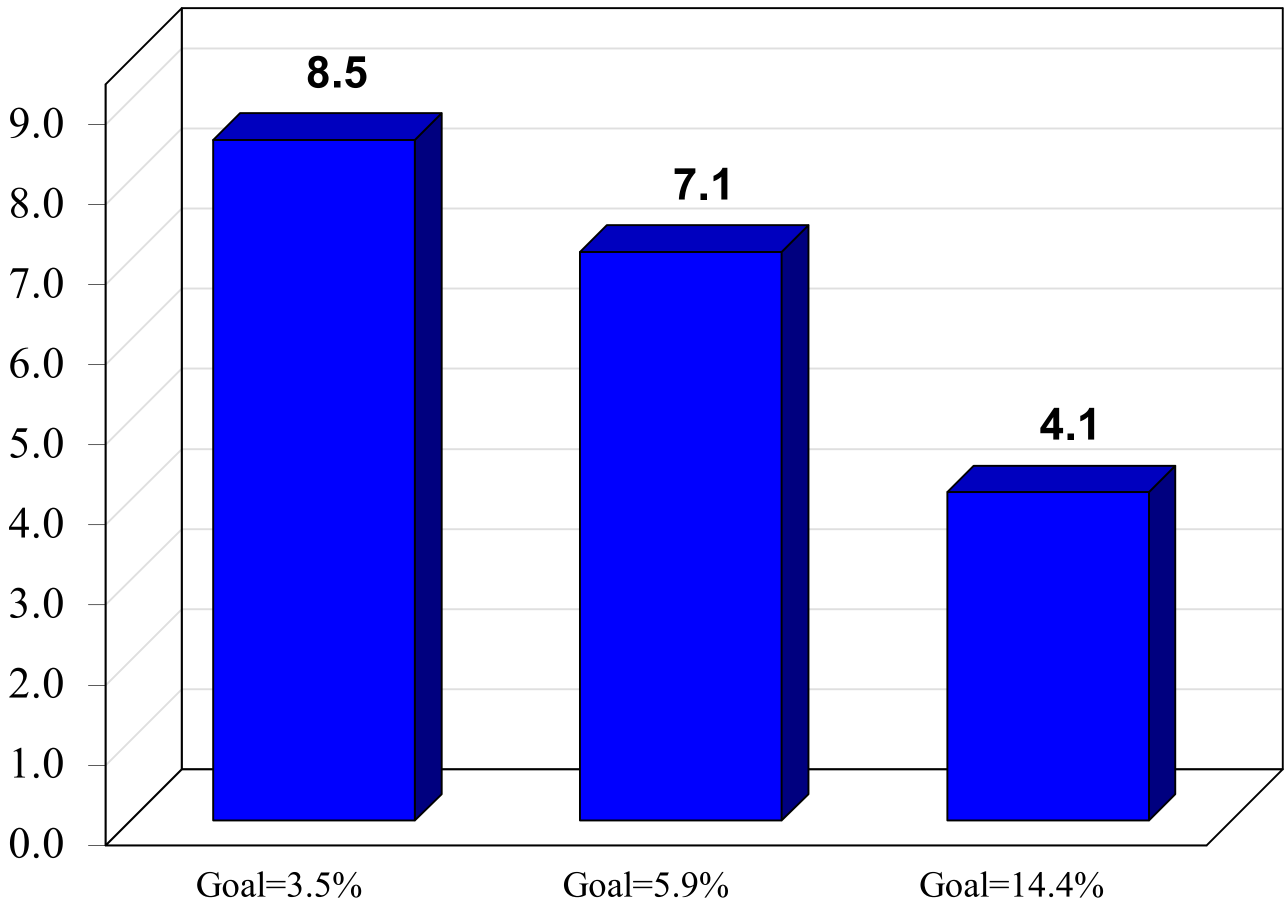
U.S. Large and Small-Cap Stocks, Bonds & Cash, International Stocks
Selected Portfolios Have Risk Equivalent to 60/40 U.S. Stock/Bond Mix

Performance Measurement
Case Study #1

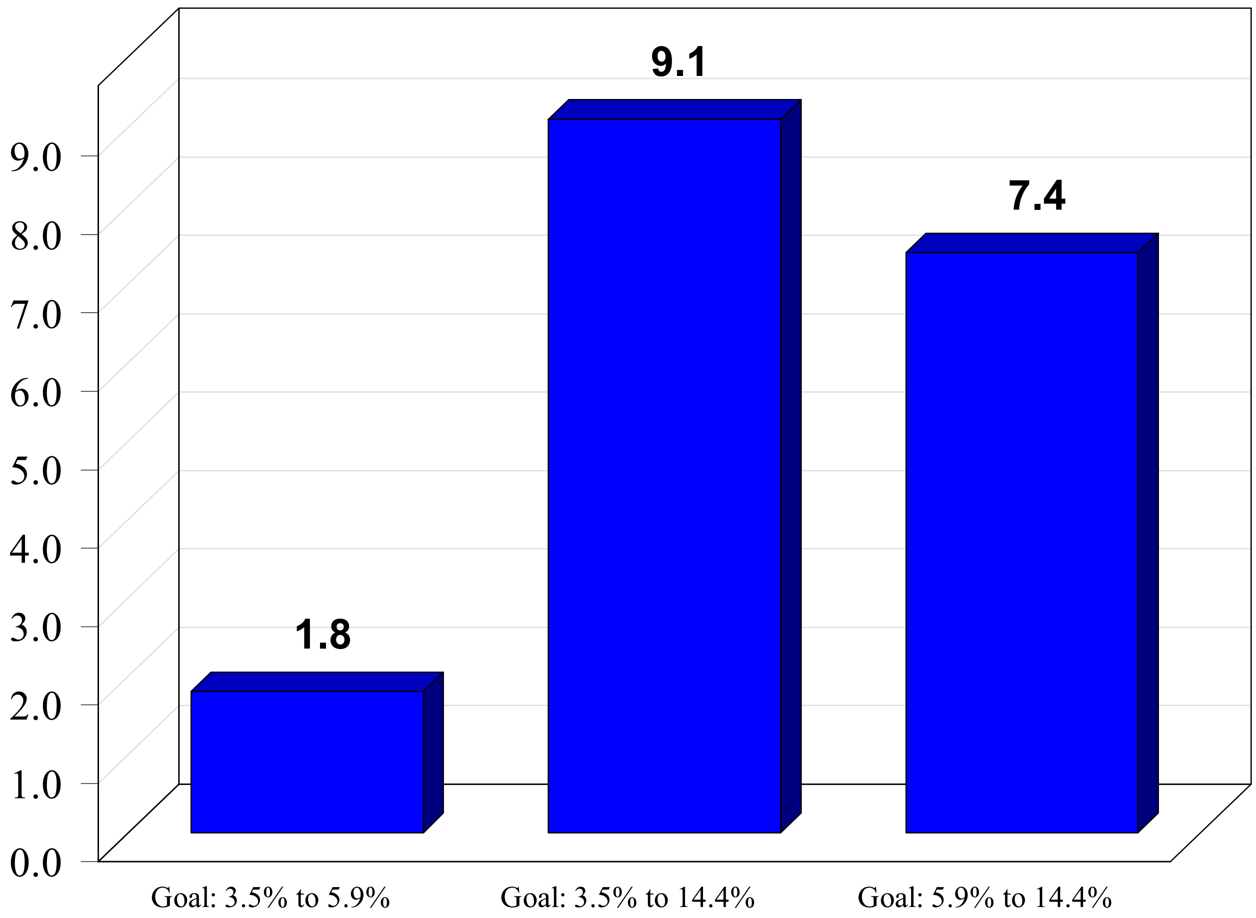
Methodology

- Bankers Trust/ICC manager database
- Random selection of 30 managers
- Calculate: Skewness; 10-year risk-adjusted returns: Sharpe, Sortino
- Compare changes in Risk-Adjusted return rankings at different Goals

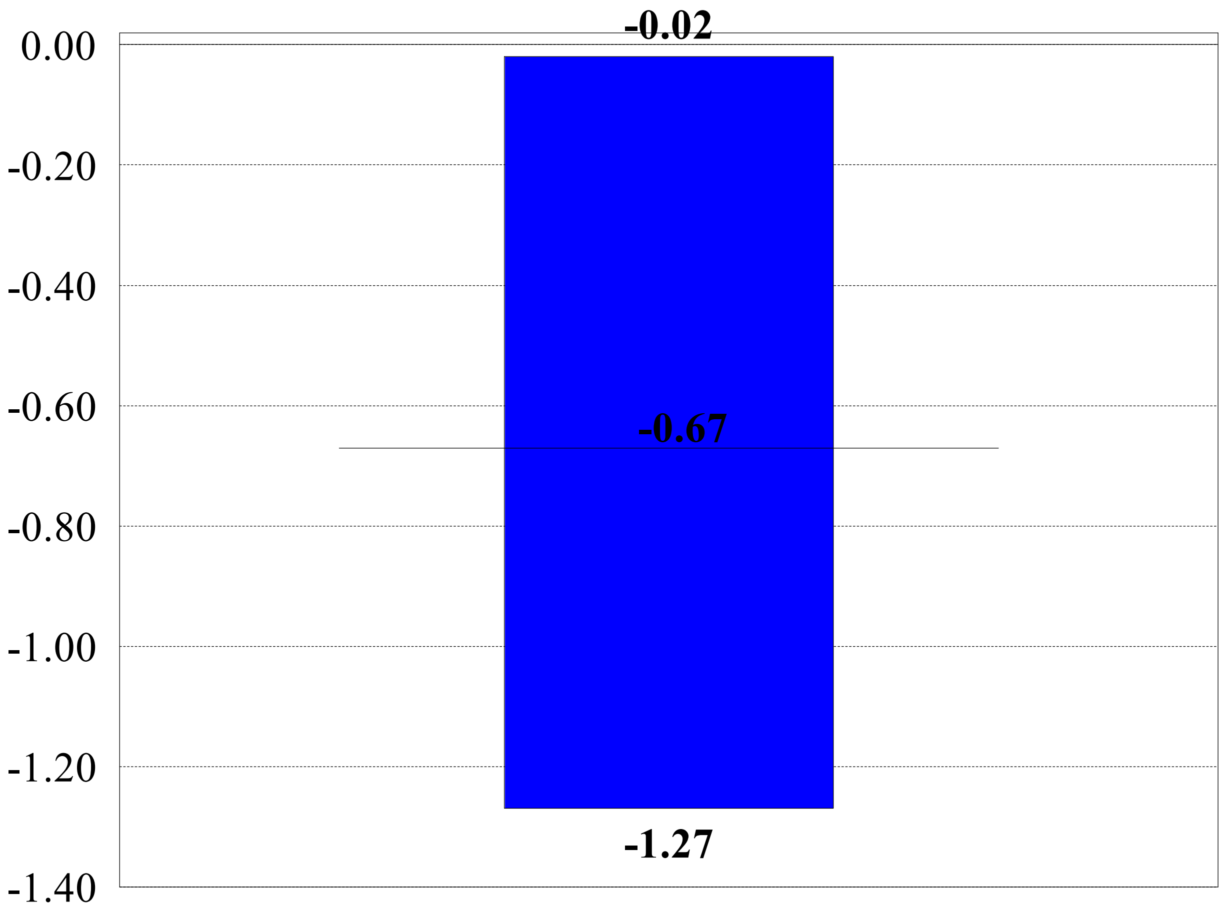
Effect on Rankings of Changing from Sharpe to Sortino Ratios



Effect of Goals on Average Absolute Sortino Ratio Rankings



Skewness of 30-Manager Sample

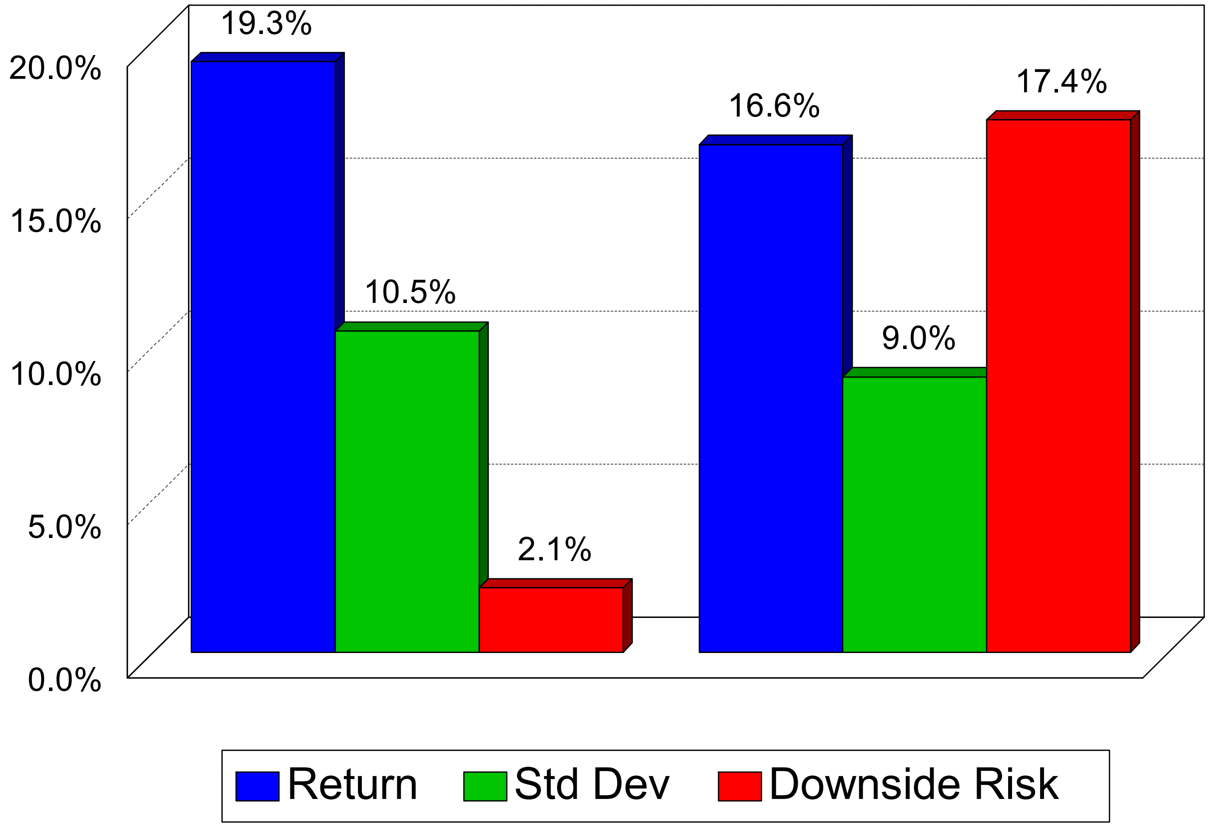


Performance Measurement Case Study #2

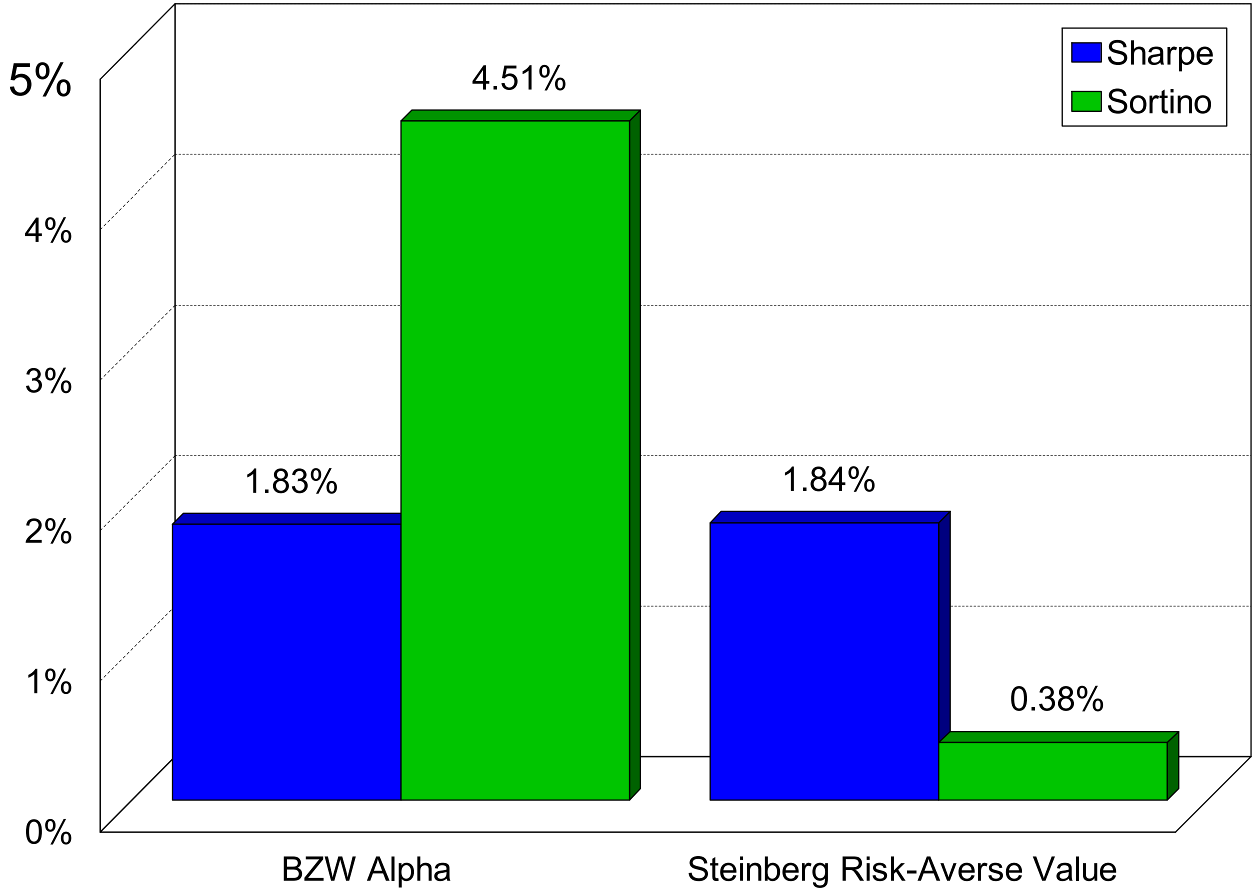
Performance analysis of two U.S. investment managers for period

1991-1995

Annualized Risk and Return

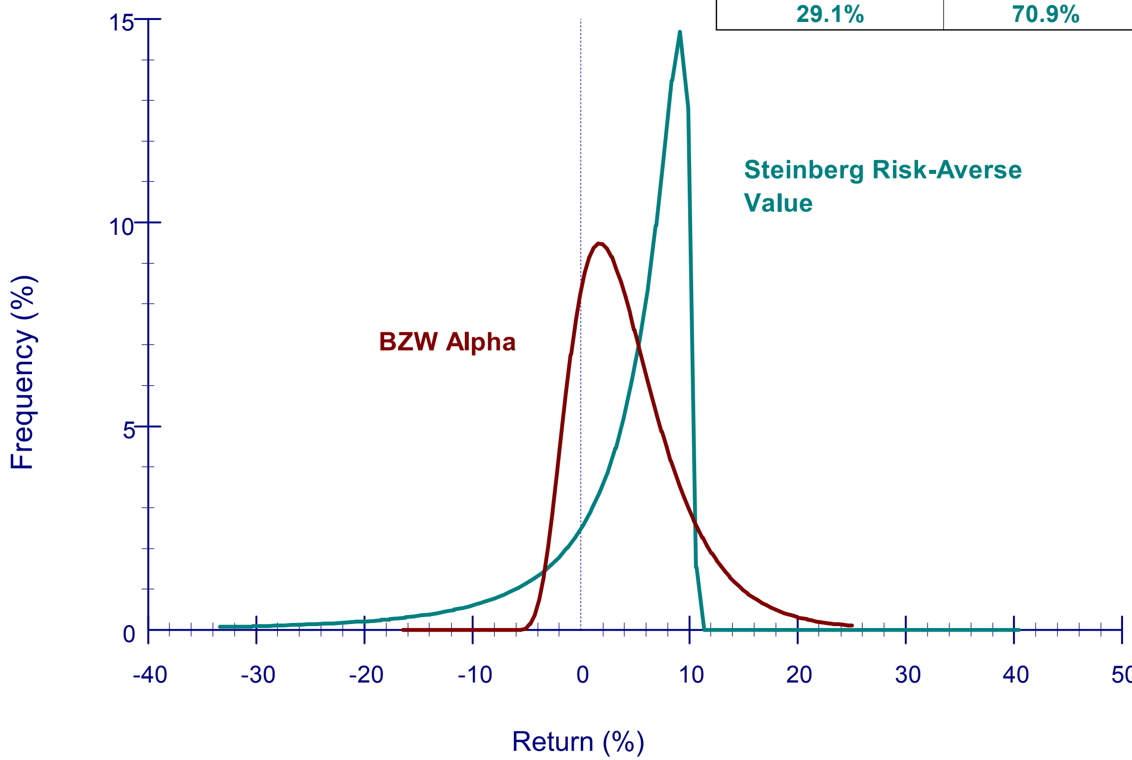


Risk-Adjusted Returns



Explanation of Differences Between PMPT & MPT Analyses

% Upside Vol	% Downside Vol	Vol Skewness
58.4%	41.6%	1.41
29.1%	70.9%	0.41



Calculating PMPT Values

- Use monthly or quarterly data. *Do not use annual.*
- Use continuous distribution. *Do not use discrete values.*
- Use integral calculus. *Do not use spreadsheet.*

Common Misconceptions About PMPT

- Can calculate DR from a spreadsheet
- DR measures is probability of failure
- DR focus implies conservatism
- DR is useful only for skewed distributions
- Only exotic strategies are skewed
- Results are almost same as MPT

Summary

- Asymmetry is not always necessary to differentiate between MPT and PMPT.
- Skewness of returns is significant.
- PMPT explicitly incorporates investor goals.
- DR handles skewness; SD does not.

Summary (continued)

- DR does not penalize upside volatility.
- DR is relative; Volatility risk is absolute.
- MV is subset of PMPT.
- Concepts are theoretically sound and experimentally validated.

Expert Opinions

- Markowitz (1992): *Since an investor worries about underperformance rather than overperformance, semideviation is a more appropriate measure of investor's risk than variance.*
- Sharpe (1963): *Under certain conditions the mean-variance approach leads to unsatisfactory predictions of investor behavior.*
- Many other researchers and practitioners.

The End

Thank you for taking the time to review this presentation.

For more information on PMPT and our investment software, please call us at 212/724-7535 or visit our website at www.invest-tech.com.

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