IT Insights

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Standard Deviation: Caveat Emptor

How would you rate your investment manager's performance? Good? Poor? Average? Depending on the scorecard you use, you might get different answers. Because a manager's evaluation—good or bad—can have serious implications, selection of an appropriate risk measure is critical for investment practitioners.

Here we present performance analysis using two different approaches. The first uses standard deviation as the risk measure, and the second, downside deviation. To illustrate their applications, performance for two equity managers for the 10 years ending September 30, 2000 is compared. The differences are striking: *using mean-variance analysis, both managers afforded roughly the same risk-adjusted performance, but based on downside risk, one manager outperformed the other by a significant margin.*

Standard Deviation: the Old Way

Traditionally standard deviation is used to represent risk. It measures the dispersion of returns from the average. The greater the standard deviation, the greater the variability of returns and, hence, the greater the risk.

But standard deviation doesn't always provide a good description of a portfolio's risk for three important reasons:

First, standard deviation is stated in relation to the *average* return. In reality, though, the average has little meaning for most investors. Risk is usually perceived as failing to achieve a specific goal and failure carries certain consequences.

For example, a pension plan sponsor requires an 8% annual return for the fund in order to keep contributions below a certain dollar amount. While higher returns are welcomed, lower returns would cause contributions to rise. The farther the return falls below 8%, the greater the amount by which contributions would rise. The same applies to an individual investor who is funding retirement.

Secondly, standard deviation assumes that investment risk is synonymous with total variability. This means that above-average returns and below-average returns are considered to be equally risky. As such, above-average returns actually *add* to the overall risk of the portfolio.

Third, standard deviation assumes that returns are normally distributed, or bell-shaped. Research shows that returns for many assets are frequently not normally-distributed.[1]

If the distribution is positively skewed (i.e., where there are more returns *above* the median than *below* it), performance was actually achieved with *less risk* than standard deviation suggests (see Figure 1). Vice versa with negatively skewed distributions—standard deviation *overstates* risk.

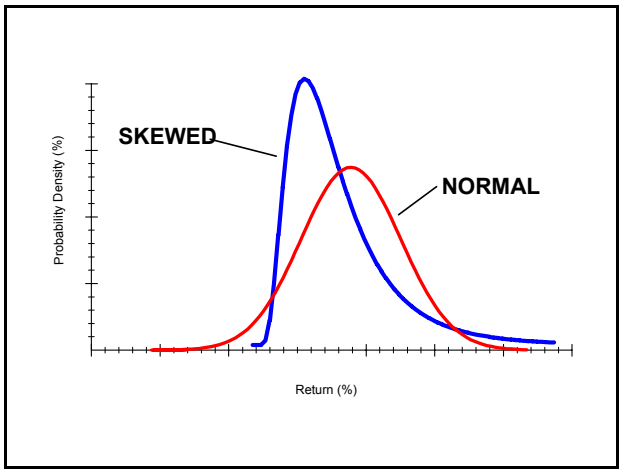

Figure 1: Normal and Skewed Return Distributions

As a result of these limitations, misleading conclusions may be drawn when interpreting risk and return results using standard deviation alone. There is, fortunately, a better way—downside risk.

Downside Risk: A Better Way

In recent years, downside risk analysis has been gaining wide acceptance. Downside risk, measured by downside deviation[2], explicitly incorporates an investor's goal and defines risk as not achieving that goal. As such, a portfolio's riskiness may be perceived differently by investors with different goals.

One very important benefit of downside risk is that it distinguishes between "good" and "bad" returns: Good returns are greater than the goal, and bad returns are less than the goal. Only the latter represent risk. And the farther below the goal, the greater the risk.

Finally, downside risk captures a portfolio's true risk by accommodating both bell-shaped *and* skewed return distributions.

The Proof is in the Pudding

Return and risk characteristics for Davis Selected Large Cap Value and Lincoln Capital Growth portfolios for the 10-year period ending September 30, 2000 are presented below. Using standard deviation and downside deviation, there are striking differences in how the managers compare in terms of risk and risk-adjusted performance.

Mean-Variance Analysis:

Performance was very similar for both managers using mean-variance. Lincoln squeaked by Davis, earning 22.22% versus 21.86%. Lincoln showed slightly greater variability with 14.85% standard deviation compared to Davis' 14.56%. Notice in Figure 2, which shows normal distribution curves, how both managers' distributions are virtually identical.

Table 1 Mean-Variance Analysis

	Lincoln	Davis	% Diff
Annualized Return	22.22%	21.86%	2%
Standard Deviation	14.85%	14.56%	2%
Sharpe Ratio	1.17	1.17	0%
Distribution Shape:			
% Upside Volatility	50.0%	50.0%	0%
% Downside Volatility	50.0%	50.0%	0%

For risk-adjusted performance, both managers tied with Sharpe Ratios of 1.17.

Downside Risk Analysis:

Downside risk statistics for Lincoln and Davis are presented in Table 2 at three goals—0%, 8%, and 12%—to illustrate goals for different investors.

Lincoln actually was substantially less risky than Davis at all goals—between 42% and 91% lower. The reason for this is that a larger portion of Lincoln's variability is on the upside (62% versus 44% for Davis). This is reflected in the shape of its return distribution illustrated in Figure 3.

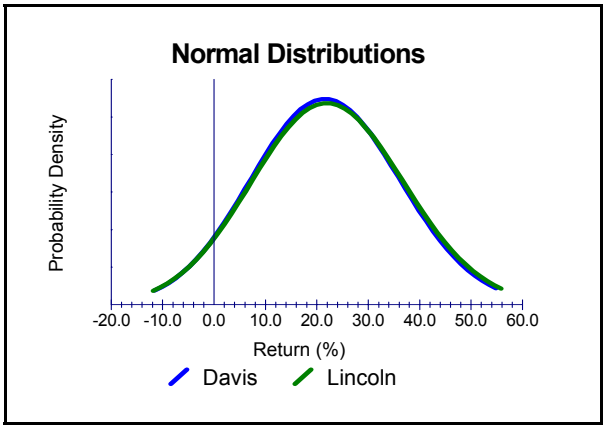

Figure 2: Normal Return Distributions

Notice that Lincoln's distribution is positively-skewed (longer tail at the higher end) whereas Davis' is negatively-skewed (longer tail at the lower end). As a result, Lincoln's performance was actually *less risky* than standard deviation suggests and Davis's was more risky.

Table 2 Downside Risk Analysis

	Lincoln	Davis	% Diff
Downside Deviation:			
at 0% goal	0.37%	4.30%	-91%
at 8% goal	2.52%	6.22%	-59%
at 12% goal	4.31%	7.47%	-42%
Sortino Ratio:			
at 0% goal	60.81	5.08	1,097%
at 8% goal	5.64	2.23	153%
at 12% goal	2.37	1.32	80%
Distribution Shape:			
% Upside Volatility	61.94%	43.67%	42%
% Downside Volatility	38.06%	56.33%	-32%

On the basis of return-per-unit-of-risk, Lincoln outperformed Davis by a significant margin. Using the Sortino Ratio,[3] Lincoln exceeded Davis at all goals.

The Bottom Line

Downside risk analysis provides effective and informative yardsticks in measuring portfolio performance

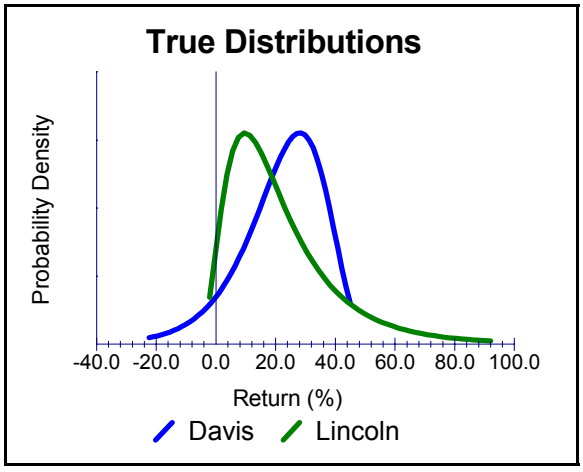

Figure 3 True Return Distributions

for several reasons:

- Downside deviation considers the investor's goal, standard deviation does not.
- Downside deviation defines risk in accordance with an investor's *perception* of risk, i.e., failure to meet the goal; standard deviation only measures the dispersion of returns around the average.
- With downside deviation, you can compare apples to apples (one portfolio's risk to another portfolio's risk); standard deviation is apples to oranges (unless both portfolio's average returns are the same).
- Downside deviation recognizes a portfolio's true return distribution (bell-shaped or skewed); standard deviation assumes all distributions are normal.

Risk Analysis with IT's Experts

With Investment Technologies' software, you can conduct both mean-variance analysis and downside risk analysis on your investment managers, mutual funds, and other portfolios. The Expert Performance Analyst helps you to understand *how* performance was achieved and whether there was compensation for the level of risk taken.

With the Expert Allocator for asset allocation, you can incorporate skewness in forecasts for asset returns and optimize using downside deviation as the risk measure. Traditional mean-variance optimization is also available.

We'll be happy to show you the software's powerful capabilities by constructing and evaluating sample cases that can incorporate your own assumptions and investment approach. For more information on the Experts, please call us at 203/364-9915 or visit our website at www.InvestmentTechnologies.com. ■

Footnotes:

[1]"New breed of tools available to assess risk," *Pensions & Investments*, November 13, 1995

[2]Downside deviation is measured by target semi-deviation (the square root of the probability-weighted squared below-target returns).

[3]Sortino Ratio is the ratio of excess return (actual return less the goal) to downside deviation.

SIDEBAR
Interpreting Downside Risk

When calculated using the same goal, a portfolio's downside risk can be compared directly with that of another. Thus a portfolio with 4.0% downside deviation is twice as risky as a portfolio with 2.0% downside deviation at the same goal.

Broken down into its component parts, downside deviation provides insights into the differences between investment strategies. Recall that downside deviation reflects both the frequency of falling short of a goal and the consequences of failure. These two components of downside deviation are termed downside frequency and average downside deviation, respectively.

As shown below, at an 8% goal Lincoln shows a downside frequency of 22.67% and average downside deviation of 4.38%. We may interpret these statistics as follows:

Lincoln failed to meet the 8% goal about 22% of the time (one in five times); in these instances, the average shortfall below the goal was 4.4%, and the average return, 3.6% (8.0% goal – 4.4%).

At 8% Goal	Lincoln	Davis
Downside Deviation	2.52%	6.22%
Downside Frequency	22.67%	15.66%
Average Downside Deviation	4.38%	11.02%

In comparison, Davis had a 15.66% downside frequency and 11.02% average downside deviation. Davis failed to meet the 8% goal about 16% of the time (roughly one in seven times); in these instances, the average shortfall was 11.0%, and the average return, -3.0% (8.0% goal – 11.0%).

The bottom line: Lincoln failed to meet the goal more often but missed it by much less. ■