BY DEBORAH KIDD, CFA

The Sharpe Ratio and the Information Ratio

The Sharpe ratio and the information ratio are routinely used in performance assessment; they are among the original risk-adjusted performance measures. Though they are simple metrics, practitioners should take care not to use them naively. This article highlights shortcomings of the two ratios and provides a framework for evaluating each ratio each within the appropriate context.

Perhaps nothing has revolutionized the performance measurement industry more than the introduction of the Sharpe ratio in 1966. Building upon his own groundbreaking work as one of the originators of the capital asset pricing model (CAPM), William Sharpe designed the first performance metric to isolate excess return per unit of total risk taken. Performance evaluation has since evolved to include the analysis of such risks as disaggregating idiosyncratic and systematic risk and the evaluation of higher moments and downside risk associated with tail loss. This article is the first in a series that defines and reviews various performance measurement metrics and provides guidance to the practitioner on their proper use and interpretation. We begin with the two best-known and most widely used metrics: the Sharpe ratio and the information ratio. These relatively simple tools can yield valuable performance information, yet they can be misleading if misinterpreted, misused, or manipulated.

SHARPE RATIO

The Sharpe ratio is the industry standard for measuring risk-adjusted return. Sharpe originally developed this ratio as a single-period forecasting tool and named it the reward-to-variability ratio. The Sharpe ratio was designed as an *ex ante*, or forward-looking, ratio for determining what reward an investor could expect for investing in a risky asset versus a risk-free asset. The numerator of the ratio is the expected portfolio return less the risk-free rate, and the denominator is the portfolio's expected volatility or standard deviation of returns (less that of the risk-free asset's standard deviation, which is zero). The resulting ratio isolates the expected excess return that the portfolio could be expected to generate per unit of portfolio return variability. Sharpe's original version assumed that borrowing at the risk-free rate would finance the investment in the risky asset, a zero-investment strategy.

Throughout the years, users of the metric referred to it as the Sharpe measure or Sharpe ratio and began to employ it for measuring investment decisions *ex post*. The *ex post*, or historical, Sharpe ratio uses actual instead of expected returns and is calculated as

$$SR = \frac{\bar{R}_p - \bar{r}_f}{\hat{\sigma}_p}.$$

$\bar{R}_p$ represents the average return of the portfolio and $\bar{r}_f$ is the average return of the risk-free rate for the time period under evaluation. The average standard deviation of the portfolio is represented by $\hat{\sigma}_p$. The Sharpe ratio tells an investor what portion of a portfolio's performance is associated with risk taking. It measures a portfolio's added value relative to its total risk. A portfolio of risk-free assets or one with an excess return of zero would have a Sharpe ratio of zero.

As useful as the Sharpe ratio is, it has real limitations. It is based on the Markowitz mean–variance portfolio theory, which proposes that a portfolio can be described by just two measures: its mean and its standard deviation of returns. The Sharpe ratio measures only one dimension of risk: the variance. Thus, the Sharpe ratio is designed to be applied to investment strategies that have normal expected return distributions; it is not suitable for measuring investments that are expected to have asymmetric returns.

Even within a framework of normally distributed investment returns, the Sharpe ratio cannot tell an investor whether a high standard deviation is due to large upside deviations or downside deviations; the Sharpe ratio penalizes both equally. Negative Sharpe ratios—such as those arising during portfolio underperformance, which often occurs during bear markets—are also uninformative. Although some users advocate squaring the returns to generate a positive number, Sharpe himself dislikes this approach. He differentiates this as a separate ratio, called the "Sharpe ratio squared," and believes it obscures important negative information (Sharpe 1994). An alternative approach is to turn to another performance metric.

Expanding the time series gives rise to another consideration when evaluating a Sharpe ratio. An investor must consider the length of the time period used in the measurement; longer time periods tend to result in lower volatility measures. Spurgin (2001) showed that the annualized standard deviation of returns tends to be higher for shorter periods: Daily returns have higher standard deviations than weekly returns, which have higher standard deviations than monthly returns. He concluded that lengthening the measurement period can be a way to manipulate the Sharpe ratio. Sharpe recommended using short periods (for example, monthly) to measure risks and returns and then annualizing the data (Sharpe 1994). He believed using multiperiod returns complicates the ratio because of compounding or potential serial correlation.

INFORMATION RATIO

The information ratio (IR) is often referred to as a variation or generalized version of the Sharpe ratio. It evolved as users of the Sharpe ratio began substituting passive benchmarks for the risk-free rate. The information ratio tells an investor how much excess return is generated from the amount of excess risk taken relative to the benchmark. It is frequently used by investors to set portfolio constraints or objectives for their managers, such as tracking risk limits or attaining a minimum information ratio.

The information ratio is calculated by dividing the portfolio's mean excess return relative to its benchmark by the variability of that excess return:

$$IR_P = \frac{\bar{R}_p - \bar{R}_B}{\hat{\sigma}_{P-B}}.$$

The variable $\bar{R}_p$ represents the return of the portfolio for the time period under measurement and $\bar{R}_B$ represents the return of the benchmark. The term $\hat{\sigma}_{P-B}$ is the standard deviation of the difference in returns between the portfolio and its benchmark. The portfolio's excess return is also known as its active return, and the variability of the excess return is also referred to as active risk, tracking risk, or tracking error. A second form of the information ratio measures residual return to residual risk; it measures the components of performance that come from manager bets unrelated to the benchmark, such as idiosyncratic risk. Although the active return/active risk ratio is the more commonly used version, investors need to understand which version is being used because the two forms can yield very different results (Terhaar 2009).

The information ratio, like the Sharpe ratio, is based on the Markowitz mean–variance paradigm and is applicable to portfolios with normal expected return distributions. An information ratio can tell whether a manager outperformed his or her benchmark on a risk-adjusted basis, but it cannot tell specifically how the outperformance was achieved. Was it due to the manager's strategy (skill) or an unexpected surprise (luck)? Was it based on persistent small gains versus the benchmark or on one extreme, positive event? Moreover, is this the outcome the investor expected given the strategy and market conditions?

Investors should be aware that the information ratio is highly dependent on the time period under measurement and the chosen benchmark index. Favorable IRs can be generated by manipulating the measurement period to include or exclude certain performance periods. Market conditions during the time period under evaluation should also be considered. Were market returns dominated by a value or growth style or by cap size? Does the investor believe the style—and the manager's strategy in relation to it—will continue?

The choice of benchmark index will likely have a significant effect on the ratio. Goodwin (2009) showed that managers who were benchmarked against the S&P 500 Index as a proxy for the broad market index had lower information ratios than those benchmarked against the Russell 1000 Index. Similarly, managers who used the Russell 2500 as a proxy for the small-cap universe had notably poorer information ratios than managers measured against the Russell 2000. Roll (1978) also showed that even a small change in the market portfolio used as

a benchmark can yield vastly different measurement results. Additionally, investors should consider that benchmark indices lack transaction costs, so in a sense, the IR will be understated to the degree that transaction costs matter.

COMPARING THE TWO RATIOS

The Sharpe ratio and the information ratio are valuable tools when used correctly; used naively, they can be misleading or uninformative at best. Both ratios are most useful for evaluating portfolios with normal expected return distributions and are not applicable to such asymmetric return strategies as those frequently used by hedge funds.

The Sharpe ratio measures a portfolio's excess return to its total risk; it answers the question of how much an investor was compensated for investing in a risky asset versus a risk-free asset. All portfolios measured with the Sharpe ratio, then, have the same benchmark: the risk-free asset. The information ratio measures a portfolio's excess return relative to its benchmark tracking error. It answers the question of how much reward a manager generated in relation to the risks he or she took deviating from the benchmark. The information ratio is used for measuring active managers against a passive benchmark.

Neither the Sharpe ratio nor the information ratio takes into account dynamic correlations between asset classes. The Sharpe ratio should be used to evaluate individual portfolios or funds, whereas the information ratio can be used to measure the value of a multi-asset portfolio or an investor's total portfolio. Investors using the Sharpe ratio can rank or compare funds within their risk tolerance to see which funds have the best risk-adjusted returns. The information ratio, on the other hand, is best used by investors to measure or rank manager performance. It can be used as an absolute measure of manager skill.

How does an investor know whether a Sharpe or information ratio is "good"? A simple rule of thumb is that higher is better. Because the Sharpe ratio is best used on a relative basis, the investment with the higher Sharpe ratio is the preferred investment. Evaluating the information ratio for portfolios is more challenging. Grinold and Kahn (2000) contended that top-quartile active equity managers generally have information ratios of .50 or higher. In another work, Grinold and Kahn (1995) rated an information ratio of 1.0 as "exceptional," .75 as "very

good," and .50 as "good." Goodwin (2009) measured IRs over a 10-year period and found that even among consistently outperforming long-only managers, very few are able to sustain an IR of .50 or higher, suggesting that the ranking criteria may be too high. Goodwin further suggested that IRs are most useful when comparing managers within their own style universe rather than among styles. A general consensus among the investment profession is that an IR of .20 or .30 is superior.

Investors should be mindful that very long time periods may increase a portfolio's Sharpe ratio due to lower volatility for longer periods. In contrast, information ratios based on longer periods are more valuable; they indicate persistence in manager skill. A final caveat is that performance metrics are based on historical data; one cannot assume the future will bear close resemblance to the past. ◆

REFERENCES

Bailey, Jeffery V., Thomas M. Richards, and David E. Tierney. 2009. "Evaluating Portfolio Performance." In *Investment Performance Measurement: Evaluation and Presenting Results*. Edited by Philip Lawton and Todd Jankowski. Hoboken, NJ: John Wiley & Sons:11–80. Reprinted from *Managing Investment Portfolios: A Dynamic Process*. 3rd ed. (Hoboken, NJ: John Wiley & Sons, 2007):717–780.

CFA Institute. 2010a. *2011 Level III CFA Program Curriculum*. vol. 5, reading 36. Charlottesville, VA: CFA Institute:87, 267–268.

———. 2010b. *2011 Level III CFA Program Curriculum*. vol. 6, reading 46. Charlottesville, VA: CFA Institute:171–176. Reprinted from Jeffery V. Bailey, Thomas M. Richards, and David E. Tierney. *Managing Investment Portfolios: A Dynamic Process*. 3rd ed. (Hoboken, NJ: John Wiley & Sons, 2007): 717–780.

———. 2010c. *2011 Level III CFA Program Curriculum*. vol. 6, reading 46. Charlottesville, VA: CFA Institute:230–231.

DeFusco, Richard A., Dennis W. McLeavey, Jerald E. Pinto, and David E. Runkle. 2004, 2007. *Quantitative Investment Analysis*. Charlottesville, VA: Association for Investment Management and Research:115–118, 496–505.

Goodwin, Thomas H. 2009. "The Information Ratio." In *Investment Performance Measurement: Evaluation and Presenting Results*. Edited by Philip Lawton and Todd Jankowski. Hoboken, NJ: John Wiley & Sons:705–718. Reprinted from *Financial Analysts Journal*, vol. 54, no. 4 (July/August 1998):34–43.

Grinold, Richard C., and Ronald N. Kahn. 1995. *Active Portfolio Management*. Chicago, IL: Richard D. Irwin.

———. 2000. *Active Portfolio Management*. 2nd Edition. New York: McGraw-Hill.

Lawton, Philip, and Todd Jankowski. 2009. *Investment Performance Measurement: Evaluation and Presenting Results*. Hoboken, NJ: John Wiley & Sons.

Roll, Richard. 1978. "Ambiguity when Performance is Measured by the Securities Market Line." *Journal of Finance*, vol. 33, no. 4:1051–1069.

Sharpe, William F. 1994. "The Sharpe Ratio." *Journal of Portfolio Management*, vol. 21, no. 1 (Fall):49–58.

Spurgin, R. 2001. "How to Game Your Sharpe Ratio." *Journal of Alternative Investments*, vol. 4, no. 3:38–46.

Terhaar, Kevin. 2009. "Return, Risk, and Performance Attribution." In *Investment Performance Measurement: Evaluation and Presenting Results*. Edited by Philip Lawton and Todd Jankowski. Hoboken, NJ: John Wiley & Sons:387–396. Reprinted from *AIMR Conference Proceedings: Benchmarks and Attribution Analysis*, vol. 2001, no. 3 (June 2001):21–27.

Deborah Kidd, CFA, is senior vice president, Boyd Watterson Asset Management, LLC.