BY DEBORAH KIDD, CFA

Measures of Risk-Adjusted Return:
Let's Not Forget Treynor and Jensen

The Treynor ratio and Jensen's alpha are risk-adjusted performance measures that isolate the portion of a portfolio's return explained by its sensitivity to market risk. Practitioners who use these measures should understand how the exclusion of idiosyncratic risk and the limitations of beta affect the interpretation of the metrics.

The recent global financial crisis served as a stark reminder to investors that market risk is the dominant risk in a portfolio—and that it cannot be eliminated through diversification. This article, the second in a series to examine risk-adjusted performance measures, focuses on two metrics that quantify excess return to market risk: the Treynor ratio and Jensen's alpha. Both measures are based on the capital asset pricing model (CAPM). According to the CAPM, the expected return of an asset depends on two factors: the risk-free rate and the market risk premium, scaled by the asset's beta. Thus, the Treynor ratio and Jensen's alpha evaluate a portfolio's performance in relation to the degree of market risk assumed by the manager.

TREYNOR RATIO

The Treynor ratio is named after Jack Treynor—though it is not the ratio Treynor intended to develop. The ratio originated from his 1965 paper pioneering an innovative concept of performance evaluation that went beyond rate of return: how to evaluate portfolio performance "with the market effect subtracted" (Treynor 2008, p. 17). Treynor developed his index to measure reward to volatility, which was later misinterpreted as beta. In 1966, Sharpe expanded upon Treynor's work to develop the reward-to-variability ratio (the Sharpe ratio). In the same way that the Sharpe ratio measures excess return per unit of total risk, or standard deviation, the Treynor ratio measures excess return per unit of market risk. The numerator of the Treynor ratio is the difference between the portfolio's return and the risk-free rate. The denominator is the portfolio's beta. The calculation for the Treynor ratio is identical to that of the Sharpe ratio except that beta instead of standard deviation is used in the denominator:

$$T_p = (\bar{R}_p - \bar{r}_f) / \beta_p.$$

R_p represents the average return of the portfolio for the period, and r_f is the average risk-free rate for the period. β_p is the portfolio's beta for the period (less the beta of the risk-free asset, which is zero). Beta represents the portfolio's sensitivity to market movements; it quantifies the degree of benchmark-related risk inherent in the portfolio. Beta is calculated as the covariance between the portfolio returns and the benchmark returns divided by the variance of the benchmark. A beta of 1 indicates that the portfolio's returns vary around the portfolio's mean to the same magnitude and in the same direction as the benchmark returns vary around the benchmark mean; it does not mean that the portfolio will have the same returns as the benchmark. Betas greater than 1 or less than 1 indicate corresponding degrees of more or less sensitivity to market movements. A beta of zero does not signify a lack of volatility relative to the market but rather a lack of correlation with market volatility.

The use of beta as the sole measure of portfolio risk is both the point and the criticism of the Treynor ratio. The CAPM makes the assumption that a portfolio's total risk comprises systematic risk, or market risk, and idiosyncratic risk specific to individual securities. The CAPM does not reward idiosyncratic risk because it asserts that

such risk can be eliminated through proper diversification; market risk, however, is not diversifiable. Because the Treynor ratio does not capture the effect of idiosyncratic risk, it is most relevant when applied to a diversified portfolio. Investors should be aware that it will understate the relationship of return to total risk for a portfolio that contains diversifiable risk. A poorly diversified portfolio with a relatively low beta but higher total risk can appear to have a superior risk-adjusted return profile compared with a well-diversified portfolio with a higher beta.

Investors should also consider the appropriateness of the benchmark index for the portfolio being evaluated. In a well-known study by Roll (1978), even small changes in the proxy used for the market had large effects on risk-adjusted ratios. A portfolio with a low beta relative to a highly volatile index could have a higher Treynor ratio than it would if the ratio were based on a higher beta relative to a less volatile index. Without knowing the benchmark index, an investor selecting the portfolio with the higher Treynor ratio and lower beta might inadvertently choose a portfolio that falls outside his or her risk parameters.

Investors can evaluate the appropriateness of the benchmark index by considering the R^2, or coefficient of determination, between the portfolio and its benchmark. R^2 measures the degree of the relationship between the portfolio and the benchmark returns. A high R^2 implies that the portfolio and benchmark returns are likely being driven by similar risk factors. An R^2 of .80, for example, implies that 80 percent of the variations in a portfolio's returns can be related to variations in the benchmark's returns, whereas 20 percent is not explained by such variations. A higher R^2 can lend more weight to a portfolio's beta, whereas a low R^2 indicates that the portfolio returns are not well correlated with the benchmark returns.

JENSEN'S ALPHA

Jensen's alpha, also known as *ex post* alpha, was developed by Michael Jensen in 1968 as a tool to identify skilled mutual fund managers in an absolute rather than a relative manner. Jensen wanted to answer the question, Was the manager able to consistently earn returns higher than expected given the level of market-related risk taken? Jensen's alpha is derived from the CAPM equation; it is the difference between the fund's return and the theoretical return required to compensate the investor for the degree of systematic risk taken.

The equation for Jensen's alpha for a single period is as follows:

$$\text{Jensen's alpha} = (R_p - r_f) - \beta_p \times (R_m - r_f),$$

where

R_p = return of the portfolio
r_f = risk-free rate of return
β_p = portfolio beta
R_m = return of the market index

Jensen's alpha is the excess return over and above the expected return derived according to the CAPM. The alpha is expressed in basis points, so evidence of skill is readily observable. A positive alpha indicates manager skill; the higher the alpha, the better the manager performed on a risk-adjusted basis. A negative alpha indicates that the manager failed to generate the return that would be expected under the CAPM for the amount of market risk taken.

Because Jensen's alpha is derived from the CAPM and relies on beta, it is also subject to the same constraints as the Treynor ratio. It accounts for market risk only, not total risk, and is sensitive to the choice of market index. In addition, because it is expressed as an actual return, Jensen's alpha will be understated relative to the theoretical return of the CAPM to the extent that transaction costs matter.

How Do They Compare? The Treynor ratio, like the Sharpe ratio, is most effectively used as a ranking tool rather than on a stand-alone basis. Investors can compare funds or portfolios of funds with varying amounts of market risk to determine how they rank according to risk-adjusted return. The ratio is most informative when the portfolios or funds being compared are benchmarked to the same market index or when a fund is compared with its own benchmark index.

As with the Sharpe ratio, the value of the Treynor ratio is relative: Higher is better. Jensen's alpha, on the other hand, can be used in an absolute context; the existence and degree of manager skill are apparent by the sign and the size of the alpha. For either measure to be meaningful, the benchmark index must be appropriate for the portfolio under consideration.

It is possible for a manager to appear skilled on a reward-to-systematic-risk basis but unskilled on a reward-to-total-risk basis. An investor comparing the Treynor ratio and the Sharpe ratio of a fund should realize that a

significant difference between the two can indicate a portfolio with a meaningful proportion of idiosyncratic risk relative to total risk. Conversely, a fully diversified portfolio will be ranked identically according to the two ratios.

Both the Treynor ratio and Jensen's alpha have been criticized for their reliance on the CAPM's underlying principles, which have been challenged as unrealistic. In addition to the model's assumptions regarding beta and costless transactions, the model's mean–variance assumption limits the application of the two performance metrics to strategies that are expected to have normally distributed returns; they are not useful for asymmetrical return strategies. The CAPM has also been criticized for its use of a single factor to determine excess return. Although the Treynor ratio has typically been confined to the use of beta in the denominator, in practice the equation for Jensen's alpha has been expanded to various multifactor models, such as the arbitrage pricing theory model, the Fama–French three-factor model, and the Carhart four-factor model.

The Treynor ratio and Jensen's alpha are generally used to analyze past performance. Any insight investors hope to gain into future performance depends to a large degree on beta. Beta is often thought of in a forward-looking sense, yet it is based on historical price movements and predictability is limited. Portfolio betas are inherently more stable than the underlying individual security betas but are subject to change as underlying betas and covariances change over time. When assessing whether past performance is likely to continue, an investor should evaluate whether the period under measurement differs from current economic and market forecasts and whether the manager is expected to employ the same relative strategy going forward.

An important concept to remember is that beta quantifies the degree to which a portfolio's returns are influenced by the same factors that influence the market return; the market does not actually *cause* the portfolio returns. Rosenberg and Guy (1976a, 1976b) demonstrated that for this reason, beta is more useful as a forecasting tool when projected fundamental factors are included in the beta regression analysis. A portfolio with a heightened sensitivity to interest rates, for example, will have a higher beta going forward if increased uncertainty surrounding interest rates is expected to have a significant impact on market volatility in the future. A beta calculated over a shorter period can also have more relevance as a forecasting tool than a beta calculated over multiple years if current economic conditions differ from the past and are anticipated to persist. Finally, evaluating the R^2 of the portfolio beta can give an indication of whether the degree of correlation between the market index and the portfolio is meaningful. In short, a portfolio's beta indicates how much risk the manager took relative to the market; the Treynor ratio and Jensen's alpha assess whether the manager was able to generate excess return for taking that risk. ◆

BIBLIOGRAPHY

Bailey, Jeffery V., Thomas M. Richards, and David E. Tierney. 2007. "Evaluating Portfolio Performance." In *Managing Investment Portfolios: A Dynamic Process*. 3rd ed. Edited by John L. Maginn, Donald L. Tuttle, Jerald E. Pinto, and Dennis W. McLeavey (Hoboken, NJ: John Wiley & Sons):766–771.

Feibel, Bruce J. 2003. *Investment Performance Measurement* (Hoboken, NJ: John Wiley & Sons):169–177, 191–196.

Jensen, Michael C. 2009. "Problems in Selection of Security Portfolios: The Performance of Mutual Funds in the Period 1945–1964." In *Classics in Investment Performance Measurement.* Edited by David Spaulding and James A. Tzitzouris, Jr. (Somerset, NJ: TSG Publishing):141–170. Reprinted from *Journal of Finance*, vol. 23, no. 2 (May 1968):389–416.

Roll, Richard. 1978. "Ambiguity When Performance Is Measured by the Securities Market Line." *Journal of Finance*, vol. 33, no. 4 (September):1051–1069.

Rosenberg, Barr, and James Guy. 1976a. "Prediction of Beta from Investment Fundamentals: Part One." *Financial Analysts Journal*, vol. 32, no. 3 (May/June):60–72.

———. 1976b. "Prediction of Beta from Investment Fundamentals, Part Two." *Financial Analysts Journal*, vol. 32, no. 4 (July/August):62–70.

Spaulding, David, and James A. Tzitzouris, Jr., eds. 2009. *Classics in Investment Performance Measurement.* (Somerset, NJ: TSG Publishing):93–94.

Treynor, Jack, interview by Steve Buser. 2008. American Finance Association (15 June): www.afajof.org/association/historyfinance.asp.

Treynor, Jack L. 2009. "How to Rate Management of Investment Funds." In *Classics in Investment Performance Measurement.* Edited by David Spaulding and James A. Tzitzouris, Jr. (Somerset, NJ: TSG Publishing):95–116. Reprinted from *Harvard Business Review*, vol. 43, no. 1 (January/February 1965):63–75.

Deborah Kidd, CFA, is Senior Vice President at Boyd Watterson Asset Management, LLC.