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Contributions

What's the Proper Beta? Financial Advisors and the 'Two-Beta Trap'

by Thomas H. Eyssell, Ph.D.

Financial advisors must assess security risk in order to construct appropriate portfolios for their clients. For over two decades, it has been understood that a key measure of risk is the beta coefficient, which measures the relationship between an asset's returns and the returns on an index. Less well understood, however, is that the appropriate use for a beta coefficient is determined by its method of calculation and the assumptions of the underlying estimation process. In this article, we (1) consider the practice of providing equity mutual fund betas estimated with both a broad-based market index and a narrower "Best Fit" index, (2) demonstrate that the two betas are not generally interchangeable and (3) specify the circumstances under which the use of one or the other is more appropriate. We also demonstrate that choosing between the two solely on the basis of the R-squared statistic ignores differences in both the underlying premises and in their possible uses.

by Thomas H. Eyssell, Ph.D.

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Clients charge their financial advisors to construct investment portfolios that will provide a return sufficient to achieve client financial goals, while minimizing the risk incurred to achieve that return. At a minimum, this requires the advisor to assemble a portfolio appropriate for the client's level of risk tolerance. Thus, advisors must assess security risk in order to construct portfolios appropriate for their clients.

For over two decades, investment advisors have understood that a key measure of portfolio risk is a security's beta coefficient, which measures the relationship between a security's returns and those of an index. Less well understood, however, is that the appropriate use of a beta coefficient is determined by how it is calculated, and the assumptions underlying the estimation process.

This article considers the common practice of providing equity mutual fund betas estimated using both a broad-based market index and a narrower "Best Fit" index, and specify the circumstances under which the use of one or the other beta is more appropriate.

Morningstar's Beta Estimation Process

Morningstar Inc. routinely provides two betas for the open-end equity funds that appear in its publications. Both betas are slope coefficient estimates from the following linear regression equation:

$$R_{jt} - R_{ft} = a_j + b_j (I_t - R_{ft}) + e_{jt}$$

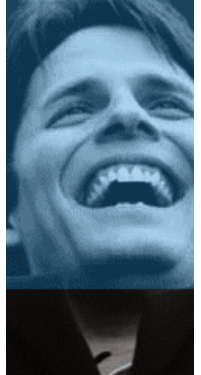
R_{jt} is the monthly return for fund j over the most recent consecutive 36 months; R_{ft} is the U.S. Treasury rate for each month; a_j and b_j are the intercept and slope coefficient estimates; I_t is the monthly return on an index in month t ; and e_{jt} is a random error term. The gist of the model is that monthly returns in excess of the risk-free rate (that is, $R_{jt} - R_{ft}$) for each fund are compared with the analogous values for an index, and the estimated slope coefficient, b_j (or "beta") describes the relationship between the fund's excess returns and those of the index. The index takes a number of different values: the Standard & Poor's (S&P) 500 index is a proxy for the overall market, while narrower indices are proxies for specific sectors.

To estimate the reported beta coefficients for each stock fund, Morningstar follows a two-step process. First, the monthly excess returns of a given fund are regressed against those of the S&P 500 index. This results in the reported "Standard Index" beta values. Next, Morningstar identifies the "Best Fit" index by regressing the fund's monthly returns against the following sector indexes:

- JSE Gold
- MSCI Pacific
- MSCI Pacific ex Japan
- MSCI World ex U.S.
- MSCI EASEA
- MSCI Europe
- MSCI All Country
- Russell 2000
- S&P Midcap 400
- Wilshire 4500
- Wilshire REIT
- S&P 500
- LB Long-Term Treasury
- LB High-Yield

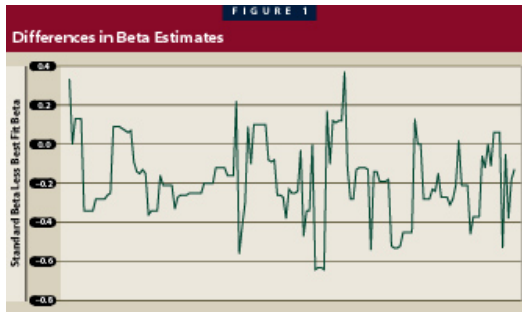
The Best Fit index is that which is most highly correlated with the fund—that is, the index that yields the highest R-squared value. (Note: R-squared is a statistic that measures the direction and the strength of the relationship between two variables.)

The differences in estimated betas resulting from this procedure are striking. Using data for domestic aggressive growth equity funds from the April 2002 edition of Morningstar's *Principia Pro* database, we find that the Standard Index betas range from .25 to 2.90, while the Best Fit beta estimates range from .38 to 2.37.



The average Standard Index beta is 1.31 and the average Best Fit beta is 1.13. The difference between these two values is statistically significant.

Figure 1 plots the difference between each Best Fit beta and the corresponding Standard Index beta. Were the two betas interchangeable, the plotted line would fluctuate narrowly around zero. The plotted differences vary widely, however, between about $-.60$ and about $+.40$. Clearly, the Standard Index and Best Fit betas are not perfect substitutes for one another. This leads to a key question for the advisor: "What's the proper beta for the advisor to use in assessing risk?"



Advising the Advisor

Given the two different published beta estimates, how should advisors use them? In its *Principia Pro* product, Morningstar defines beta in the following fashion:

[a] measure of a fund's sensitivity to market movements. The beta of the market is 1.00, by definition. Morningstar calculates beta by comparing a fund's excess return over Treasury bills to the market's excess return over Treasury bills. A beta of 1.10, for example, shows that the fund's excess return is expected to be 10% better than the market's excess return. A beta of 0.85 indicates that the fund's excess return is expected to perform 15% worse than the market's excess return during up markets and 15% better during down markets. *When there is a low corresponding R-squared for the fund, however, all the MPT statistics, including beta, are less meaningful (italics added).*

Similarly, when it comes to evaluating the provided betas, Morningstar states that R-squared is

[a] statistic that reflects the percentage of a fund's movements that are explained by movements in its benchmark index....R-squared can also be used to ascertain the significance of a particular beta. *Generally, a higher R-squared will indicate a more reliable beta figure. If the R-squared is lower, then the beta is less relevant to the fund's performance (italics added).*

An advisor could reasonably infer that he or she should simply choose the beta with the highest R-squared value, regardless of the index. Doing so, however, ignores fundamental differences in the two models, violates key assumptions of capital market theory, and, most important, exposes the advisor to the potential for serious errors in portfolio construction.

The Two-Beta Trap

The importance of understanding how a beta is estimated, and the impact of the estimation process on its use, is the subject of a groundbreaking article by Nobel laureate Harry Markowitz. He describes the "Two-Beta Trap" as follows:

The first meaning of beta arose in early attempts to use mean-variance analysis to aid in the management of actual portfolios—that is, in "normative portfolio analysis." The second meaning [of beta] arose in the assumption in the theory of capital markets that investors in fact use mean-variance analysis—that is, in positive mean-variance theory.¹

In other words, one type of beta estimate is a statistic used to reduce the computational effort required to put together a diversified portfolio of financial assets, be they individual stocks or mutual funds. Classical portfolio analysis requires the analyst to compute all possible relationships among portfolio components; a 100-security portfolio would contain 5,050 of these. Given that classical portfolio analysis was developed in the 1950s and early 1960s, this was beyond the computing capability of most portfolio managers.

To reduce the computational burden, William Sharpe developed the "diagonal model." A key premise of this model is that security returns are largely explainable as the result of correlation with some common factor, which is represented by the index (I) in the earlier equation.² The diagonal model requires no assumptions about investor rationality or market efficiency. Most important, there is no special role for the market portfolio. Thus, the index used in the diagonal model need not be a broad market index. *In the diagonal model, any index is potentially appropriate.*

How should the advisor use the Best Fit beta? The Best Fit beta is consistent with Sharpe's diagonal model and requires none of the capital market theory or assumptions that underlie the capital asset pricing model (CAPM). Rather, it provides a statistical measure of the relationship between a fund and a benchmark. The only requirement placed on the index is a statistical one: the index should be composed of many securities, but it need not represent any particular group of securities, or even a large portion of all those that exist. It need not, therefore, be a proxy for the market as a whole. Thus, the Best Fit beta is, at most, a measure of risk against a particular benchmark, but not against the market as a whole.

The process used by Morningstar to select the Best Fit index is consistent with the premise of the diagonal model: *the Best Fit index is simply the index whose returns correlate most highly with that of the portfolio under review, regardless of the breadth of the index.*

On the other hand, the use of a broad market index such as the S&P 500 index as the default index choice (hence the name Standard Index) to estimate a beta suggests that a broad market index is of special importance. (This is also implied by Morningstar's reporting of the Standard Index betas for all open-end equity funds, regardless of a fund's stated objective.)

Such reliance on a broad market portfolio indicates that what is being estimated is the empirical form of the CAPM, where the "market portfolio" is central to the theory describing the relationship between return and risk. Unlike Sharpe's diagonal model, which simply uses relationships in historical data to describe the way things are, the CAPM is developed from capital market theory, and describes the way things *would be* in the theorist's highly idealized world of rational investors and informationally efficient markets. In capital market theory, rational investors will concern themselves only with the risk of their portfolio relative to the market as a whole, which is measured by a beta estimated against a broad market index. In other words, the assumptions required to use the Standard Index beta, and the interpretation of the estimated portfolio beta, are substantially different than those of the Best Fit beta.

Differences Between the Two Betas: Implications for Financial Advisors

Given the estimation process used, the Best Fit beta is the modern analog to the diagonal model, and therefore requires no theoretical background or assumptions; it is an artifact of the regression and, as such, has a largely statistical interpretation. Specifically, it is a measure of the direction and the strength of the relationship between the returns on the portfolio being examined and the index chosen, over a period of time. *Thus, the advisor should use the Best Fit beta when he or she seeks to characterize the historical risk characteristics of a given portfolio relative to a benchmark chosen because of its statistical similarity.*

Consider the following example. The Morningstar database reports that the Best Fit beta for Fidelity's Advanced Europe Capital Appreciation A fund is .96 as measured against the MSCI Europe index, but only .62 against the S&P 500 index. Similarly, the corresponding R-squared values are .89 and .39.³ What is the advisor to make of these substantive differences?

First, it is apparent that the two betas are not substitutes for one another. The value of the Best Fit beta is (.96) and suggests that the fund and the MSCI Europe stock index have performed similarly over the estimation period in terms of systematic risk. Given that 96.9 percent of the Fidelity Advanced Europe Capital Appreciation fund's holdings are non-U.S. stocks, and 94.9 percent of its assets possess European exposure, it is not at all surprising that its historical returns have mirrored those of the Europe stock index. This is confirmed by the reported R-squared of .89, which indicates a very strong positive statistical relationship between the returns on the fund and the index.

In other words, advisors who invest client funds in the Fidelity Europe fund can be reasonably confident that they have achieved some international diversification for their clients by putting them into a portfolio whose characteristics are approximated by that of the MSCI Europe index. However, given the relatively narrow nature of this index, it is wholly inappropriate to infer that this Best Fit beta is an overall measure of systematic risk in the CAPM sense, or to use the Best Fit beta to estimate the expected return on the Fidelity Europe fund.

The tenets of capital market theory indicate that one can obtain an estimate of any portfolio's systematic risk against a broad market index, and then use the CAPM to estimate the expected return on that portfolio. Advisors can use this expected return to estimate the investment necessary to finance a client's retirement (or other future financial need). *Because of the central role played by the broad market index in the CAPM, advisors who seek to attain a level of return sufficient to meet their clients' financial needs should use the Standard Index beta in this process.*

The Standard Index beta of the Fidelity Europe fund is .62. Assuming a risk-free rate of 4 percent and a market risk premium of 9 percent, the CAPM suggests that the expected return on the Fidelity Europe fund is 9.58 percent. Had the advisor used the Best Fit beta of .96, the expected return would have been estimated to be 12.64 percent, a difference of 306 basis points.⁴ Which return estimate should be used for financial planning purposes? Capital market theory leaves no question: *For the calculation of a systematic risk measure and, therefore, for estimating expected return, one should use the beta that has been estimated against the broad market index—that is, the Standard Index beta.*

Conclusion

It is clear that fund betas estimated using a broad-based market index and a narrower Best Fit index are likely to differ. Less obvious are the conditions under which the use of one or the other is appropriate. Choosing between these two solely on the basis of the R-squared statistic ignores differences in both the premises underlying the betas and in the possible uses to which they should be put. The Best Fit beta is a statistical construct consistent with Sharpe's "diagonal model" and is best used as a measure of the similarity of the risk characteristics of a fund to a particular benchmark.

The Standard Index beta, on the other hand, is more consistent with the CAPM beta described in capital market theory, and for which a broad market portfolio holds a crucial place. It is most appropriate for the advisor who seeks to estimate the expected returns on a portfolio. Given these differences, advisors must be cognizant of the use to which they intend to put a particular beta in order to choose the one that is most appropriate.

Endnotes

1. See Harry Markowitz, "The Two-Beta Trap," *Journal of Portfolio Management*, Fall 1984: 12–20.
2. See William Sharpe, "A Simplified Model for Portfolio Analysis," *Management Science*, January 1963: 277–293.
3. Morningstar describes the MSCI Europe index as follows: "Listed for Europe stock funds. This index measures the performance of stock markets in Austria, Belgium, Denmark, Finland, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, Ireland, Portugal, and the United Kingdom. Total returns date back to December 1981."
4. According to the capital asset pricing model (CAPM), the expected return on a risky portfolio is equal to the riskless rate plus a portfolio risk premium. The portfolio risk premium is equal to the market risk premium times the portfolio's beta. In the example, the expected return using the Standard Index beta is 9.58 percent ($4 + [.62 \times 9]$), while when using the Best Fit index, beta is 12.64 percent ($4 + [.96 \times 9]$).

Recommended Web Sites

- www.morningstar.com
- www.financialengines.com

- www.encycogov.com/A2MonitorSystems/AppA2MonitorSystems/AppBtoA2CAP_model/CAP_Model.asp
(provides a mathematical derivation of the CAPM)



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