Five Types of Risk and a Fistful of Dollars: Practical Risk Analysis for Investors

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Abstract: *Financial planners and longer term investors face more kinds of investment risk than do "traders" who make frequent trades and have shorter holding periods. The five broad categories of risk investors face include market-related risk, momentum risk, intrinsic value risk, residual risk, and attribution drift risk. We demonstrate the impact of controlling each of these on portfolio performance. Using data from 1990 through 2011, an equity portfolio strategy incorporating controls for all five risk categories produced higher returns and lower volatility than an equally weighted benchmark portfolio without these controls.*

This issue of the Journal went to press in April 2012.

There is a fundamental difference between investing and "trading." Investment looks at longer holding periods while trading strategies focus on short-term holdings. Many institutional funds that appear to be long-term, investment-oriented pools are still essentially trading operations as they fine-tune their holdings daily through investing new proceeds and disinvesting with distributions. In contrast, the investments managed by many financial planners may be monitored on a daily basis but could go months or even years without significant trading activity.

This fundamental difference in anticipated holding periods and planning horizons means that financial planners often face a very different investment problem than the one discussed by "investment professionals" who focus on quick arbitrage trades and frequent minor adjustments to those portfolios they do maintain. Unfortunately, it is our experience that most of the discussion on how to manage investment risk is aimed more at the second group—traders with very short time horizons, than those in the first group—investors who seek to have medium to long-term horizons.

For example, the investment risk tools presented in typical college finance and investment classes are based on statistical distributions of returns and are inherently short-term trading measures.[1] While such measures may be used by investors with longer holding periods and investment horizons, investors face more types of risk than are captured in typical returns-based models. This makes sense in that the longer you hold a portfolio, the more things can go wrong. Therefore, rather than defining "risk" as just what is measured by short-term, returns-based analysis, we extend risk analysis to cover five broad categories.

The Five Categories of Risk

The first broad category includes the familiar Modern Portfolio Theory (MPT) families of returns-based models and is generally short-term in application. The second category focuses on momentum, which reflects "tastes and trends" for particular investments or investment styles. The third category reflects changes and fluctuations in the intrinsic value of the investment as impacted by the economy. The fourth category reflects "residual risk," which is the measurable fluctuation over time that is not attributable to the general economy; residual risk may be company, industry, or regionally related. The fifth category reflects "attribution instability risk" and is measured by the portion of the variance in the price series that is unexplained by general economic factors; attribution instability risk measures the extent to which there isn't a stable relationship between the general economy and the asset price. Finally, there is "uncertainty" (different from risk)—the totally unexpected, unpredictable surprises that sometimes arise and which include what is sometimes termed "Black Swan risk."

Traders, and most academic investment professors we've talked with, who are primarily interested in short-term and returns-based analysis, focus on the first two risk categories—the market based (MPT) and momentum measures. Not focusing on fundamental valuation (intrinsic value) is understandable in short-term and returns-based analysis because the change in intrinsic value of an investment from week to week may not be measurable; the fundamental valuation of a company made this week is likely to be about the same as if it were made last week. Therefore, intrinsic value isn't a factor when comparing the stock price from last week to this week, or yesterday to today.[2] The other broad categories—residual risk, attribution instability risk, and uncertainty—are usually assumed to be idiosyncratic or "firm-specific" randomness that is averaged out, at least in the short run, in a well-diversified portfolio (though many traders don't actually do portfolio level calculations to assess whether this happens or not). Investors, on the other hand, need to consider these additional issues.

We have developed several ways to think about each of the major risk categories and have developed portfolio optimization methods that help address the issues of economic uncertainty. In the remainder of this paper, we will discuss methods for investors to address each of these and will illustrate these methods using the recent period from September 15, 2010 through September 23, 2011.[3] This paper is primarily a "concept article" with examples to help financial service professionals become familiar with these broad risk categories. A future article will explore in greater depth the historical performance of portfolios constructed with these methods.

A Modern Portfolio Theory Benchmark

To illustrate these different types of risk, we created a number of portfolios as of September 15, 2010 from stocks that were components in the S&P 500 and monitored their performance over the following year. While the risks we discuss are generally important across Morningstar "style box" categories, industry classifications, and even asset types including equities, REITs, bonds, and currencies, we used the components of the S&P 500 as the buylist for these illustrations because most financial service professionals have familiarity with them. Rather than testing all combinations of portfolios, we consider each risk sequentially. So, we begin by looking at a downside beta filter, described below. We then add in a momentum measure, and so on. For comparison purposes, we benchmark the resulting portfolios to Dimensional Fund Advisors (DFA) U.S. Core Equity 1 Portfolio (DFEOX), which is a monthly rebalanced[4] fund managed according to the Fama-French[5] "three-factor" model.[6] The choice of this benchmark is discussed further in Chong, Jennings, and Phillips.[7] To the extent that the DFEOX overweights on small capitalization stocks when following the Fama-French strategy, one might anticipate that the DFEOX would have a performance edge over either the S&P or portfolios formed by selecting S&P components as we demonstrate later in this paper.

For reference purposes, Figure 1 shows the performance of DFEOX and the S&P 500 index, measured by SPX, during the example period.

As might be expected, at least over this period the

Fama-French three-factor model-based DFEOX fund significantly outperformed SPX up until the market downturn in late July 2011. Over the entire study period, SPX returned about 1% while DFEOX returned about 2.1%. However, the higher return is not the whole story. The DFEOX and SPX manifest different amounts of downside risk as measured by the lower semideviation, a version of standard deviation that just uses negative returns. The lower semideviation for SPX was 0.029 and that for DFEOX was only a little higher at 0.031. These numbers will be used later for standardizing returns per unit risk and comparing the various portfolios.

FIGURE 1

Performance Comparison between DFEOX and SPX, September 15, 2010 - September 23, 2011

FIGURE 2

Performance Comparison between Dbeta7, DFEOX, and SPX, September 15, 2010 - September 23, 2011

Market-Related Risk

To begin the specific demonstration of risk analysis methods for investors, consider the ubiquitous Capital Asset Pricing Model (CAPM) beta. As traditionally computed, beta is the slope of a line relating asset (or portfolio) returns to some benchmark (often the S&P 500 index) returns and is viewed as a measure of market risk. Past research[8] has demonstrated that commercially available estimates of beta are often computed differently by different providers so that the same stock could be viewed as being a low beta or high beta stock, depending on the source of the estimates. Beta also has the feature that it essentially assumes that downside risk and upside potential are symmetric. When they are not, one can have a situation where an asset with tremendous upside movement and little downside movement would appear to be riskier than another asset with moderate upside or downside movement.[9] To address the asymmetry problem, the "downside beta" (beta calculated for an asset using days when the benchmark goes down) has been proposed as an alternative to traditional CAPM beta. Equally weighted portfolios of common stocks created using downside beta as an investment selection criterion can outperform actively managed portfolios created using more complicated returns-based models.[10]

Applying beta, whether overall or downside, as an investment selection criterion can impact portfolio performance when there is a widespread movement in the marketplace, such as a market bubble. When a market event like 2008 or the recent "global sovereign credit crisis" (e.g., U.S. credit rating, Greece financial problems) occurs, assets tend to decline with the market regardless of the quality of the individual investment. Reducing the exposure to downside beta helps to reduce losses when such overall market events occur.

The first demonstration uses an equally weighted portfolio of stocks selected solely by whether the downside beta for each stock being considered exceeded 0.7 or not. Those stocks that did not exceed 0.7 were included. The values of this portfolio (labeled "Dbeta7") are plotted along with DFEOX and SPX in Figure 2.

The portfolio obtained just by selecting stocks with a downside beta less than the historic median value of 0.7 returned about 6.4%, with a lower semideviation of 0.02, compared to the 2.1% return and 0.031 lower semideviation of DFEOX. Up until August, the passively managed downside beta portfolio and DFEOX were very similar, but during the August market decline the passive portfolio maintained more of its value than did DFEOX.

Momentum-Related Risk

While investment advisors may be happy with the gains obtained just by using downside beta filters, this is just the first step toward addressing investment risk issues. The next step addresses the second broad risk category related to asset momentum. From time to time, for whatever reason, an asset (or industry, or asset class) becomes popular (or unpopular) and its valuations change for a while to reflect those trends. Some traders have successfully harnessed momentum-based strategies for up to six-month holdings,[11] but for longer term investing, the asset prices tend to revert to their economic values.

While there are numerous ways to define momentum, for this study the ratio of the market price to the trailing year's high price was employed. This is always somewhere in the range of 0 to 1 since as the price rises above the past high price it becomes the new high price. A threshold value of 85% was used, though the specific number used isn't magic. What's important with this risk measure is to remove from consideration those assets that, for whatever reason, have fallen substantially in value. This might be because of a change in market taste, bad managerial decisions, regulatory changes, aggressive competition, or a myriad of other factors. Figure 3 compares an equally weighted stock portfolio obtained by selecting those with downside betas no greater than 0.7 and with a price to the trailing year high price ratio of at least 85%. It is labeled "+PtoHi" in the graph. The figure shows that adding the momentum filter made little difference through August but is associated with a lower decline thereafter. While DFEOX earned about 2.1%, the portfolio with the two returns-based risk filters earned about 10.6% and experienced a lower semideviation of 0.019.

Intrinsic Value Risk/General Economic Conditions Risk

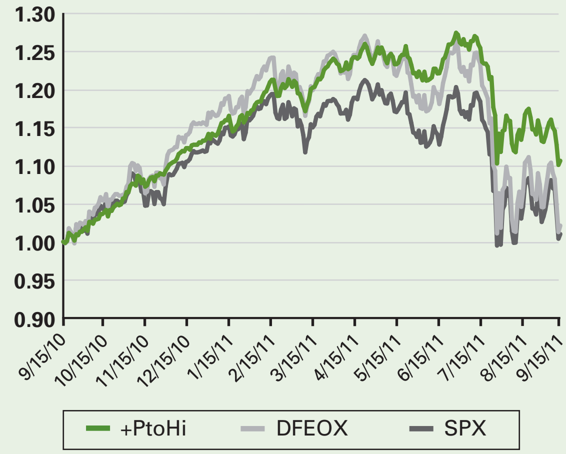
With the third portfolio, additional limits were imposed on intrinsic value risk measures. The intrinsic value of a company (and hence funds or portfolios investing in companies) is related to its long-term cash flow potential.[12] The intrinsic value of a company does not change much in a short period of time, so traders with shorter time horizons may not pay much attention to intrinsic value changes. However, from the perspective of an investor with longer holding periods, the day-to-day noise that so often drives short-term stock returns cancels out and it is changes in the intrinsic value of holdings that really drive long-term portfolio performance.

Over time, there is risk associated with the changes in intrinsic value of any asset. The intrinsic value of an asset may change due to changes in the economy; similarly, estimates of intrinsic value used by investors might be based on incorrect assumptions. Such estimates include the analysis of cash flows, financial statements, and other "fundamental" analyses. These analyses often involve making forecasts of what future profits and cash flows will be for the companies; like any forecasts, these may be subject to statistical error.

While it is true that there are several well-known, commercially available sources of intrinsic value analysis, these sources focus on the potential for gain rather than

FIGURE 3

Performance Comparison between +PtoHi, DFEOX, and SPX, September 15, 2010 - September 23, 2011



focusing on quantifying the risks to intrinsic value. For example, Stern Stewart's Economic Value Added (EVA)[13] provides a measurement of potential intrinsic value on individual analysis of financial statements; EVA has been shown to have some use as a portfolio construction tool.[14] Similarly, Morningstar[15] incorporates cash-flow analysis into its stars ratings for equities[16] to assess whether or not they see the equities as being over- or undervalued. Many analyst reports also assess the intrinsic value of investments to identify underpriced or overpriced securities. Using these products, it is difficult to assess the impact of "systematic" (e.g., economic) risk on the intrinsic value of an asset, let alone the overall intrinsic value of a portfolio.

FIGURE 4

Performance Comparison between +CMRI, DFEOX, and SPX, September 15, 2010 - September 23, 2011

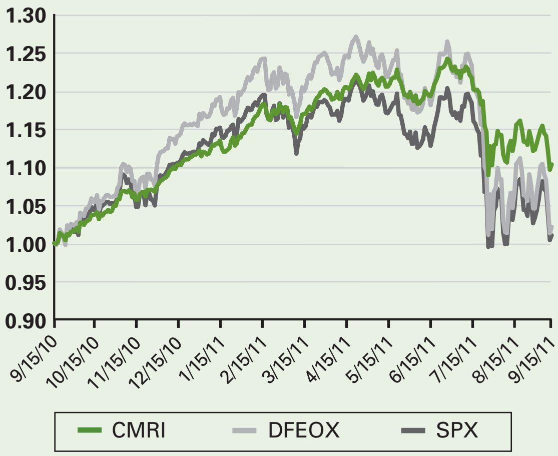


FIGURE 5

Performance Comparison between +RRI, DFEOX, and SPX, September 15, 2010 - September 23, 2011

To better facilitate risk analysis associated with intrinsic value, some data providers take an econometric approach. Two recent papers[17] explore in greater detail the Eta® model, from which the following econometric-based measures are derived. One such measure, the Composite MacroRisk Index (CMRI), assesses the level of economic risk in an investment,[18] while another economic-based measure is the residual risk. An associated statistical measure reports the extent to which economic factors "explain" the asset value over time (also referred to as attribution instability risk). The Eta model tends to explain over 90% of the variance in asset prices. Using these measures to estimate the risk to intrinsic value, due to economic factors, allows asset selection and portfolio construction to be performed that better reflects the expected holding periods of investors (rather than traders).

In the next demonstration, the portfolio is limited to stocks meeting the previous downside beta and momentum criteria but also with a total CMRI of less than 350. The CMRI measures the absolute amount of responsiveness to a group of key economic indicators and is derived from an econometric analysis of asset prices. As previously stated, the CMRI assesses an asset's risk due to key economic factors. Figure 4 shows the values of the new equally weighted portfolio (labeled as "+CMRI") along with the benchmarks of DFEOX and SPX. This third portfolio returned 10.3% with a lower semideviation of 0.018.

Residual Risk

Another form of systematic risk is that associated with a company or industry but not associated with general economic conditions. One measure of this is the Residual Risk Index (RRI). It is obtained by measuring the amount of the asset value that remains unexplained by the general economy[19] and is expressed as a percentage of asset price.

The fourth portfolio incorporates the RRI, restricting holdings to those stocks meeting the previous criteria but for which the RRI is less than 20%.

This portfolio (labeled as "+RRI") is shown in Figure 5 along with DFEOX and SPX. Over the evaluation period, the new portfolio returned 10.5% with a lower semideviation of 0.017.

Attribution Instability Risk

The fifth equally weighed portfolio adds a measure for "attribution instability risk." This refers to the risk that the investment changes its relationship to the overall economy. If R^2 is the measure of how well an econometric model—using economic (macrorisk) factors—fits the price data, then $1 - R^2$ is the attribution instability risk. In this portfolio, we limited the measure of attribution instability risk to 5%. The resulting portfolio, shown in Figure 6 (labeled "+R2"), returned 10.7% and had a lower semideviation of 0.019.

FIGURE 6

Performance Comparison between +R2, DFEOX, and SPX, September 15, 2010 - September 23, 2011

Weighting Portfolios to Reduce Black Swan Risk

The final risk that should be considered by longer term investors is that of reducing exposure to uncertainty, the so-called Black Swan risk. The portfolios above were all constructed as equally weighted portfolios. However, a portfolio constructed to reduce the exposure to economic risk might be expected to perform better in bad times. The following portfolio was constructed using the same five filters previously described but weighting the portfolio to reduce the overall CMRI

FIGURE 7

Economic Exposure of DFEOX, +R2, and +minCMRI on September 15, 2010

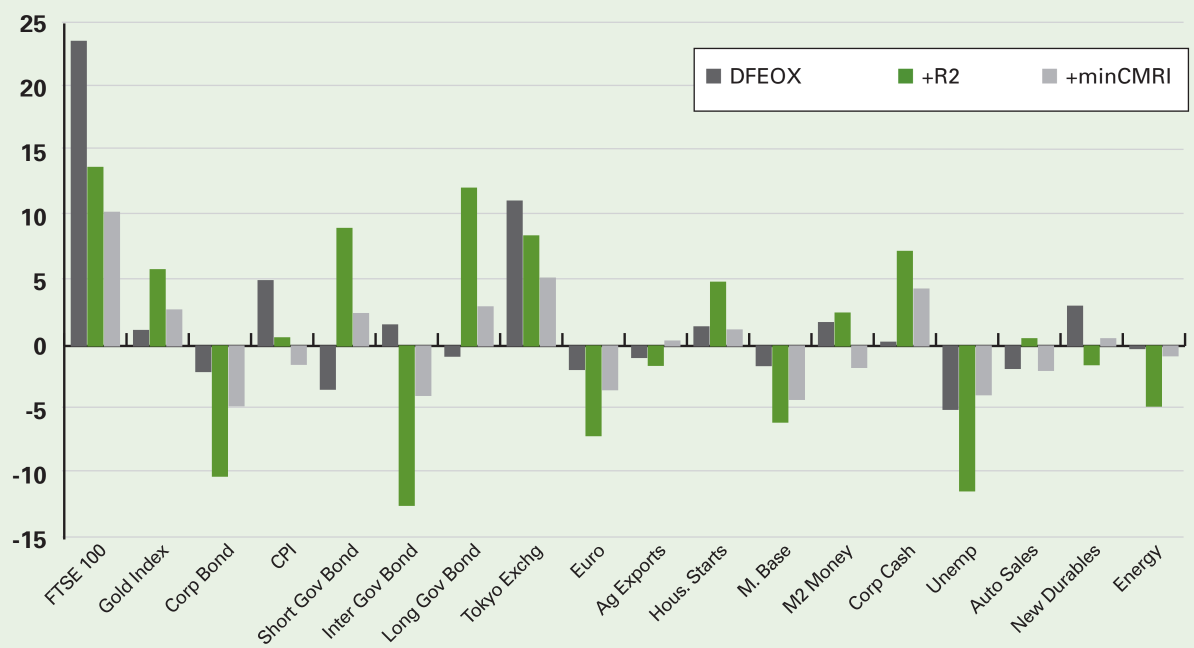


FIGURE 8

Performance Comparison between +minCMRI, DFEOX, and SPX, September 15, 2010 - September 23, 2011

as of the creation date. A 10% maximum holding constraint on any single position was also imposed. This portfolio is labeled as "+minCMRI."

Figure 7 illustrates the reduction in economic exposure to 18 key variables. Each bar shows the expected change in the portfolio value from a shock to the corresponding economic factor. The first set of bars (black) is for DFEOX which had an overall CMRI of 59. The second set (green) is for the equally weighted portfolio constructed using all five risk measures; it had an overall CMRI of 120. The third set of bars (gray) is for the portfolio constructed to minimize overall economic exposure, and the resulting CMRI was 56. Note that while DFEOX and the optimized portfolio had similar CMRI values, the DFEOX profile has greater variation in the sizes of its bars. The optimization process attempts to smooth out the exposure so that there is similar impact from each economic factor.

Finally, Figure 8 compares the historical performance of DFEOX, SPX, and the optimized "handful of risks" portfolio (+minCMRI). The optimized portfolio provided an overall return of 13.1% and demonstrated a lower semideviation of 0.02.

All of the portfolios are compared in Table 1, which also provides the ratio of periodic returns to lower semideviation.

Conclusion and Practical Implications

Investors face more kinds of risks than do short-term traders. Financial planners with longer time horizons may be able to incorporate the risk-reduction methods discussed above into their asset selection and portfolio construction processes or, if they use external portfolio managers or research providers, can verify that all five types of risk are being considered.

The question remains how best to create a portfolio after the low volatility buylist is constructed. Should it be equally weighted? Maximum Sharpe ratio? Something else? These issues, along with a more thorough analysis of the long-term performance of low volatility portfolios constructed using "five-risk filtering" are the subject of future research. However, Table 2 presents a few summary statistics for a theoretical stock portfolio of major market stocks created using 9/15/1990 data and then updated annually using then current data.

Because of the potential for survivorship bias when

TABLE 1

Summary Statistics, September 15, 2010 — September 23, 2011

Returns measures	SPX	DFEOX	Dbeta7	+PtoHi	+CMRI	+RRI	+R2	+min CMRI
Total return	1.01%	2.12%	6.38%	10.62%	10.30%	10.48%	10.71%	13.08%
Annualized return	0.98%	2.06%	6.19%	10.29%	9.98%	10.16%	10.37%	12.66%
TT month return	1.03%	2.33%	5.69%	10.45%	9.90%	10.31%	9.37%	12.63%
Standard deviation	0.042	0.046	0.028	0.027	0.026	0.025	0.029	0.031
Upper semideviation	0.024	0.026	0.013	0.015	0.014	0.014	0.016	0.019
Lower semideviation	0.029	0.031	0.020	0.019	0.018	0.017	0.019	0.020
Total return to lower semideviation ratio	0.348	0.684	3.190	5.589	5.722	6.165	5.637	6.540

doing retrospective performance research like this, we do not report absolute statistics but only relative statistics compared to a benchmark that also is subject to potential survivorship bias. (An equally weighted benchmark of S&P 500 "survivor stocks" was used for this. DFEOX could not be used for such a long comparison because of its shorter trading history.)

Table 2 compares relative statistics for 1-year, 5-year, 10-year, and 15-year returns. On average, since 1990, the "five-risks" portfolio had a 1.4% higher return each year than did the benchmark. The relative average over each overlapping 10-year period indicates that the five-risks portfolio had a relative average return that was 8.64% greater than the benchmark. On the other hand, the average 1-year standard deviation of returns was 2.7% lower for the five-risks portfolio than for the benchmark. The 10-year standard deviation of returns for the five-risks portfolio was 28.3% lower than for the benchmark.

The five-risks portfolio incorporated no other information than reducing downside exposure and, for the most part, the portfolio did have lower long-term volatility. But, the five-risks portfolio also had substantially higher relative mean and relative median returns, greater high values, and also greater low values when compared to the benchmark.

While it may be true that over time there are greater chances for positive outcomes as well as negative outcomes, even if positive outcomes were just as likely as negative outcomes, it takes a much larger positive outcome to offset losses; a 10% gain doesn't offset a prior 10% loss in a portfolio. Over the past 20 years of turbulent markets, this illustrates that focusing on a broader set of risks reduces downside volatility and was associated with significant gains.

The conclusion is simple: Investors have different needs than traders and, at least in the recent market turmoil, those investors who had their hands on the five types of risk gained a fistful of dollars. ■

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(1) The longer term focus of university "Fundamentals of Corporate Finance" courses covers topics at least as suited to the needs of the longer term investor as those covered in typical "Modern Portfolio Theory and Investments" courses, yet when we observe faculty discussing training for financial planners and investors, the emphasis seems to be more often on material from the investments course than the corporate finance course. This may reflect a more serious disconnect between some academic finance programs and the real world of financial services and personal financial planning.

(2) Yesterday's asset price was intrinsic value (V) plus daily noise (A). Today's asset price is intrinsic value (V) plus daily noise (B). From yesterday to today, assume that there is imperceptible change in the intrinsic value of the firm. Then, the stock return is based on the difference in prices, $(B + V) - (A + V) = (B - A)$, where $(B - A)$ is just the difference in noise terms. In a more common multiplicative model, $V^*(1 + a)$ and $V^*(1 + b)$ are yesterday's and today's prices. The continuous return is $\ln[V^*(1 + b)] - \ln[V^*(1 + a)] = \ln(1 + b) - \ln(1 + a)$ which is $b - a$. In either formulation, the intrinsic value portion hasn't changed and so isn't part of the returns-based computations, and risk measures based on returns won't reflect longer term changes in V.

TABLE 2

Comparison of Historical "Five Risks" Equally Weighted Portfolio to "Survivorship-Adjusted" S&P Benchmark

Ratios of	1 Year	5 Year	10 Year	15 Year
Mean	1.0140	1.0488	1.0864	1.1367
Median	1.2968	1.3499	1.1137	1.0897
Max	1.0933	1.0008	0.7021	1.0870
Min	1.0101	-0.1758	1.6913	1.0955
SD*	0.9729	0.9695	0.7178	1.2083

*SD, standard deviation.

(3) A period slightly longer than a year was used, which is an attempt to duplicate the behavior of planners performing portfolio adjustments in the week after portfolios qualify for long-term capital gains.
(4) E. Tower, "Classic and Enhanced Index Funds: Performance and Issues" (Duke University, 2009). Available at http://econ.duke.edu/Papers/PDF/05032009CHAPTER_13%20TOWER_working_paper_version.pdf.
(5) E.F. Fama and K. French, "The Cross-Section of Expected Stock Returns," *Journal of Finance* 47 (1992): 427–465.
(6) See http://www.dfaus.com/strategies/us-equity.html.
(7) J. Chong, W.P. Jennings, and G.M. Phillips, *Eta Analysis of Portfolios: The Economy Matters* (Northridge, CA: California State University, 2011).
(8) For example, W.P. Jennings and G.M. Phillips, "Fun with Beta! (Or, Applying Beta is a Risky Proposition)," Financial Planning and Analysis Round Table, Financial Management Association (October 2006).
(9) J. Chong and G.M. Phillips, "Beta Measures Market Risk Except When It Doesn't: Regime Switching Alpha and Errors in Beta," *Journal of Wealth Management* 14 (2011): 67–72.
(10) J. Chong, S. Pfeiffer, and G.M. Phillips, "Can Dual Beta Filtering Improve Investor Performance?" *Journal of Personal Finance* 10 (2011): 63–86.
(11) T.J. George and C.Y. Hwang, "The 52-Week High and Momentum Investing," *Journal of Finance* 59 (2004): 2145–2176.
(12) This is an area often taught in academic finance programs but more often by accountants or corporate finance professors than investment professors.
(13) D. Kyriazis and C. Anastassis, "The Validity of Economic Value Added Approach: An Empirical Application," *European Financial Management* 13 (2007): 71–100.
(14) D. Fountaine, D.J. Jordan, and G.M. Phillips, "Using Economic Value Added as a Portfolio Separation Criterion," *Quarterly Journal of Finance and Accounting* 47 (2008): 69–81.
(15) M.R. Morey and A.A. Gottesman, "Morningstar Mutual Fund Ratings Redux," *Journal of Investment Consulting* 8 (2006): 25–37.
(16) See http://news.morningstar.com/articlenet/article.aspx?id=4982#anchor6.
(17) Chong *et al.,* "Eta Analysis of Portfolios: The Economy Matters"; J. Chong and G.M. Phillips, "Can Typical Households Earn Hedge Fund Returns? An Analysis of the Eta® Replication Approach," *Journal of Derivatives and Hedge Funds* 18 (2012): 53–72.
(18) See http://www.macrorisk.com.
(19) The RRI is not to be confused with the R-squared, which measures the amount of asset value's variance explained by the model; the RRI is a value-based measure expressed as a percentage.