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The theory and implications of expanding traditional portfolios

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Executive summary. Traditionally, investors have focused on portfolios consisting of long-term allocations to the three primary asset classes—stocks, bonds, and cash. However, since the early 2000s, several forces have combined to cause investors to not only incorporate more tactical or short-term positions but also evaluate asset classes and strategies outside of the traditional investment set. The unsettled investing environment since 2000, together with the growing availability of alternative investment strategies and vehicles (such as exchange-traded funds [ETFs] designed to invest in previously unavailable asset classes or sub-asset classes), as well as the attention paid to the investment approach of endowments such as Harvard’s and Yale’s, have led to an increased acceptance of moving beyond the traditional investment realm.

This update to our 2007 analysis discusses why an investor may consider expanding a traditional portfolio. We show that including nontraditional asset classes and strategies can work, we discuss the implementation risks for nontraditional asset classes and strategies, and we offer some best practices for investors interested in moving beyond the three traditional asset classes.

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Financial models often recommend allocations to nontraditional asset classes and strategies or to segments of the traditional markets that would have led to a better experience historically than stocks, bonds, and cash. However, when exploring the implications of expanding a traditional portfolio, investors often overlook the challenges of implementing the recommended changes. Indeed, in a simple but important example, shifting the focus from the top few endowments (which have been very successful) to the average endowment paints a very different performance story. For example, over the ten years ended June 30, 2011 (the latest performance data as of this writing), the fund-weighted average endowment returned 5.34% per year, a return very similar to that of a hypothetical investor in an indexed 70% stock/30% bond portfolio (+5.66% per year).¹

Expanding the portfolio can work

Nontraditional asset classes and investment strategies can offer several important advantages relative to long-term strategic allocations to stocks, bonds, and cash. First, these assets and strategies can provide performance that is less correlated to traditional market forces. In other words, an expanded portfolio may offer returns that are more absolute—leading to an expectation of fewer negative returns—than the returns of traditional

portfolios. Second, expanding a portfolio often offers diversification in the form of lower expected volatility because of the low long-term correlations between the returns of nontraditional assets and those of stocks and bonds.² Finally, markets are highly efficient, but not perfectly efficient. As a result, some managers may be able to exploit the behavioral biases of the broad investment community, while others may possess a superior ability to separate information from noise or to identify unique opportunities among securities or segments of the markets.

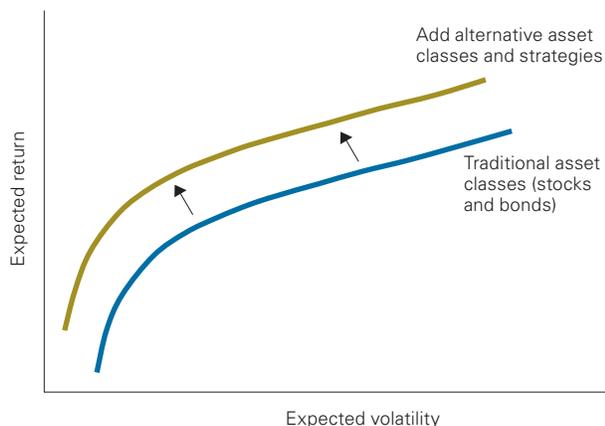
Given the expectation of low correlation and excess returns relative to traditional portfolios, an expanded portfolio, theoretically, can improve expected risk-adjusted returns. However, excess returns or perceived diversification benefits should be pursued only if those benefits are expected to persist after accounting for the additional risks and costs of execution, including the difficulty of accessing top-tier managers. Investors can increase their chances of success by identifying and sticking with a set of best practices that we discuss throughout this paper as they seek to include additional asset classes and investment strategies in their portfolios. We believe these best practices can help investors increase their probability of improving the traditional efficient frontier as demonstrated in **Figure 1**.

Notes on risk: All investing is subject to risk. Past performance is no guarantee of future returns. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index. Be aware that fluctuations in the financial markets and other factors may cause declines in the value of your account. There is no guarantee that any particular asset allocation or mix of funds will meet your investment objectives or provide you with a given level of income. Diversification does not ensure a profit or protect against a loss in a declining market. Investments in bond funds are subject to interest rate, credit, and inflation risk. Funds that concentrate on a relatively narrow market sector face the risk of higher share-price volatility.

1 Endowment returns and counts were obtained from the 2011 NACUBO-Commonfund Study of Endowments. The hypothetical 70/30 portfolio was represented by the Dow Jones U.S. Total Stock Market Index (49%), MSCI All Country World ex USA Index (21%), and Barclays Capital U.S. Aggregate Bond Index (30%). We found similar results using a 60/40 portfolio (the 10-year return was 5.76%).

2 Although seemingly a straightforward model input, correlations can be dynamic over time. As a result, actual results achieved by combining asset classes and strategies may not match the expected results that were based on long-term static relationships. For more on this topic, including the impact of the global financial crisis on correlations, see Philips, Walker, and Kinniry (2012).

Figure 1. Hypothetical example of the benefits of expanding a portfolio



Source: Vanguard.

Although successfully expanding a portfolio by including other asset classes and strategies is simple in theory, execution is often more difficult than expected. Because most asset classes and investment strategies are imperfectly correlated, we would expect that a portfolio diversified across multiple options would be more “efficient” than a portfolio invested in traditional asset classes.

Figure 2, on page 4, uses historical “index” returns³ to demonstrate the efficiency gains over time. The figure compares the risk-adjusted returns of a “traditional” portfolio consisting of U.S. stocks, international stocks, and U.S. bonds to the results of an “expanded” portfolio that adds commodities, public real estate, private equity, venture capital, and hedge funds (long/short and market neutral).

For our risk adjustment, we simply divided the 36-month return by the 36-month standard deviation of returns.

This analysis showed that the expanded portfolio would have led to higher risk-adjusted returns than the traditional portfolio over most of the period evaluated. In fact, this type of analysis is often used to justify the inclusion of such investments in a portfolio.

Digging a bit deeper into the calculation, the traditional portfolio generated higher returns than the expanded portfolio in 38% of the three-year periods and actually outperformed the expanded portfolio on average by about 42 basis points per year from 1985 through 1999. However, despite the similar performance, the traditional portfolio realized higher volatility in all of the three-year periods. So the higher risk-adjusted returns were largely a function of the lower volatility of the expanded portfolio. This is exactly the result expected from the process of diversification. Of course, one potential concern with this type of analysis is that the returns of many alternative asset managers are reported infrequently and with few requirements. As a result of this self-reporting, appraisal-based pricing, and smoothed return series, alternative investment benchmarks (i.e., hedge funds, private equity, and commercial real estate⁴) often appear much less volatile than an investor would likely experience. And as we demonstrated earlier with the average endowment, using available managers or products can deliver a far different result from the theoretical objective.

³ As discussed later in greater detail, private equity, venture capital, and hedge-fund indexes are actually peer groups of individual funds that are by definition uninvestable. As a result, the risk-adjusted returns in Figure 2 are hypothetical and unachievable by investors who must use individual actively managed mandates to implement a recommended allocation. It is important to note that the dispersion around the category average can be significant.

⁴ For additional information on investing in commercial real estate, see Philips, Walker, and Zilbering (2011).

Figure 2. Hypothetical risk-adjusted returns suggest further diversification can work

36-month rolling risk-adjusted returns



Notes: To calculate risk-adjusted returns, we divided the 36-month annualized return by the standard deviation of those returns across the same period. For the traditional portfolio we assumed 70% in equities and 30% in bonds. Within equities we assumed a constant 30% exposure to foreign equities and 70% exposure to U.S. equities. For the expanded portfolio we assumed a constant 30% allocation to a basket of alternatives reallocated proportionally from the traditional portfolio. Because not all alternatives have a history that extends to 1984, we included each alternative as data became available. As a result, for the period from 1984 through 1985 we allocated 10% to REITs, 10% to commodities, and 10% to venture capital. From 1986 through 1993 we allocated 10% to REITs, 10% to commodities, 5% to venture capital, and 5% to private equity. From 1994 onward, we allocated 5% each to REITs, commodities, venture capital, private equity, long/short hedge funds, and market-neutral hedge funds.

Sources: Authors' calculations using data from Thomson Reuters Datastream and Cambridge Associates. U.S. stocks represented by the MSCI USA Index from January 1984 through December 1986 and Dow Jones U.S. Total Stock Market Index thereafter. International stocks represented by the MSCI World ex USA Index through December 1987 and the MSCI All Country World ex USA Index thereafter. U.S. bonds represented by the Barclays Capital U.S. Aggregate Bond Index. REITs represented by the FTSE NAREIT Equity REIT Index. Commodities represented by the Standard & Poor's GSCI Total Return Commodities Index. Venture capital and private equity represented by the respective Cambridge Indexes. Long/short and market neutral hedge funds represented by the respective Dow Jones Credit Suisse Hedge Fund Indexes.

Finally, one important challenge is that history may not repeat. For example, the periods since the global financial crisis have seen the expanded portfolio generally underperform the traditional portfolio on a risk-adjusted basis (the underperformance of the expanded portfolio has been primarily the result of lower returns since 2008 versus the traditional portfolio).

Best practices for evaluating potential portfolio enhancements

The remainder of this paper discusses a number of important considerations and best practices in implementing a portfolio that expands beyond the traditional asset classes.

Understand the model

First, understanding the opportunities and limitations of financial models permits a consideration of alternative outcomes and allows for the possibility of a portfolio's not meeting expectations. Indeed, even expectations based on inputs that are well understood and models that are well executed can lead to disappointing outcomes that result from the cyclical nature of the financial markets. For example, expectations—whether for forward price/earnings ratios or asset-class returns—are typically based to some extent on available historical data for returns, volatility, and correlations. A fundamental truth is that the future may not look like the past. Our research has found that forecasting returns, risks, correlations, and cross-correlations is difficult for asset classes, sub-asset classes, or investment strategies, particularly in the short term or when there is abundant noise in the data.

Risk of chasing the efficient frontier. To account for time-period differences, investors should evaluate portfolio recommendations across many time periods, not just the longest possible period. For example, would commodities and real estate have been recommended by a model in 1998? Would private equity and venture capital have been recommended in 2002? Although these investments can lead to higher average risk-adjusted returns and improvements to the average expected efficient frontier, the frontier can be very sensitive to the inputs, particularly following periods of poor or exceptional performance by a particular asset, and can break down over shorter periods.

As an example, **Figure 3**, on page 6, presents a performance summary of portfolios created using traditional unconstrained mean-variance optimization.⁵ For each portfolio, we used returns, volatilities, and correlations from 1988 up to the construction date of the given portfolio to determine the most “efficient” combination of asset and sub-asset classes. We then evaluated those portfolios relative to a benchmark portfolio⁶ for the next three-year period. For example, for the portfolio constructed on January 1, 2000, we evaluated asset and sub-asset class data from January 1, 1988, through December 31, 1999. We chose the portfolio that would provide the same expected volatility of the benchmark portfolio to be our “optimal” portfolio. Over the subsequent three years, we compared the performance of the optimal portfolio to the performance of the benchmark portfolio to determine the effectiveness of the model recommendations.

The results of our real-time evaluation showed that the allocations recommended by the model tended to chase past performance. For example, for the portfolio created on January 1, 2000, we identified a large recommended overweighting to large-cap growth stocks. This should not be a surprise to those familiar with mean-variance models, but it underscores the challenges involved with relying solely on model output to create and manage portfolios.

5 We replicated Figure 3 using constraints with respect to the maximum possible weights for each possible investment, as follows: High-yield bonds, international REITs, mid-cap growth, mid-cap value, U.S. REITs, and commodities were limited to 10% maximum weight; small-cap growth and small-cap value were limited to 5% maximum weight; international equities were limited to 50% maximum weight; emerging market stocks were limited to 20% maximum weight; international bonds, as well as large-cap growth and large-cap value stocks, were limited to 30% maximum weight. U.S. bonds were permitted to range from 0% to 100% of the portfolio. The results using these constraints were similar to those of the unconstrained analysis, although less extreme. The optimized portfolio underperformed the benchmark portfolio in three of the six periods and on average over time. The optimized portfolio realized higher volatility in all six periods and lower risk-adjusted returns than the benchmark portfolio on average over the full period.

6 Our benchmark portfolio was represented by a balanced portfolio of 60% stocks and 40% bonds. Of the stock portion, 70% was in U.S. equities and 30% in international equities, including emerging markets. Within the U.S. and international allocations, the allocations to sub-asset classes (including REITs) were weighted according to their historical market weights.

Figure 3. Using history to optimize a portfolio can lead to suboptimal performance

Analysis period	Test period	Significant allocations	Benchmark results		Optimized portfolio results		Relative performance of optimized portfolio	
			Annualized returns	Annualized return volatility	Annualized returns	Annualized return volatility	Excess return	Excess volatility
1/1/1988– 12/31/1993	1/1/1994– 12/31/1996	Emerging markets	12.34%	6.61%	3.59%	6.72%	–8.75%	0.12%
1/1/1988– 12/31/1996	1/1/1997– 12/31/1999	Commodities, emerging markets	17.22	9.79	8.01	11.28	–9.21	1.49
1/1/1988– 12/31/1999	1/1/2000– 12/31/2002	Large-cap growth	–5.91	10.24	–6.96	11.88	–1.04	1.64
1/1/1988– 12/31/2002	1/1/2003– 12/31/2005	Mid-cap value	12.26	6.01	17.39	6.90	5.13	0.89
1/1/1988– 12/31/2005	1/1/2006– 12/31/2008	Mid-cap value, commodities	–2.31	10.56	–5.53	12.75	–3.22	2.19
1/1/1988– 12/31/2008	1/1/2009– 12/31/2011	Mid-cap value, emerging markets	11.29	11.94	13.88	12.40	2.59	0.46
Full period			7.14%	9.62%	4.67%	10.80%	–2.47%	1.18%

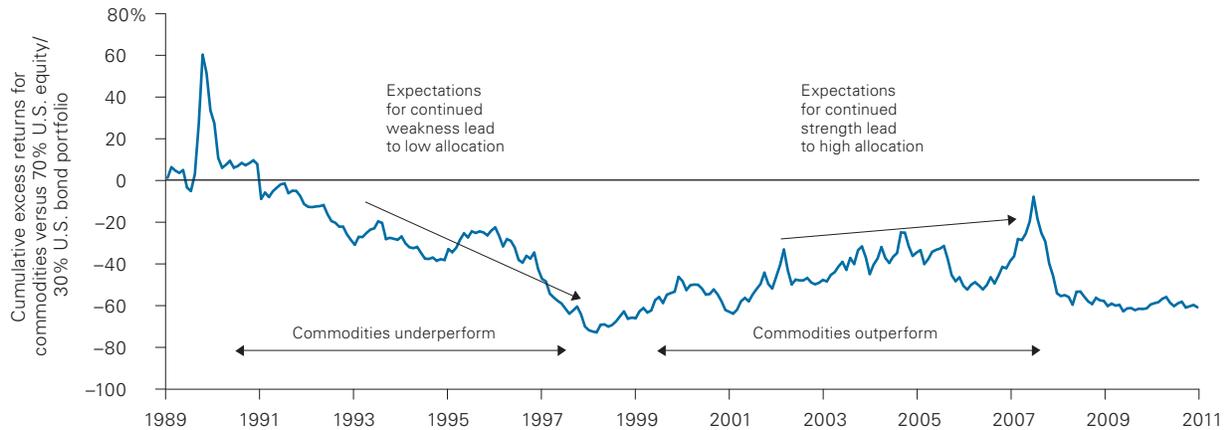
Notes: Differences in relative performance calculations are due to rounding. Representative indexes are as follows: For bonds, the Barclays Capital U.S. Aggregate Bond Index; for international stocks, the MSCI EAFE Index and MSCI Emerging Markets Index; for U.S. stocks we used indexes from Standard and Poor's from 1988 through November 2002 (500, 500 Growth, 500 Value, 400, 400 Growth, 400 Value, 600, 600 Growth, and 600 Value) and indexes from MSCI thereafter (Prime Market 750, 750 Growth, 750 Value, 450, 450 Growth, 450 Value, 1750, 1750 Growth, and 1750 Value); for REITs we used the FTSE NAREIT Equity REIT Index; for international REITs we used the FTSE EPRA/NAREIT Global ex US REITs Index; for commodities we used the S&P GSCI Total Return Index; for high-yield bonds we used the Barclays Capital Global High Yield Index; and for international bonds we used the Barclays Capital Global Aggregate ex U.S. Index. See also description in the text and footnotes 5 and 6.

Sources: Vanguard and Zephyr Associates: Asset Allocator.

The patterns that emerge from Figure 3 are consistent with an embedded momentum bias. As is well known, mean-variance optimization overweights asset and sub-asset classes that boast the best risk-adjusted returns—in effect, those that have recently outperformed. More advanced approaches can limit overweightings and underweightings, but these techniques may change only the potential magnitude of tilts, not

their direction or the reliance on properly timing the entrance and exit points. Whichever market cycle a given model is focused on will inevitably break down, and those investments with superior trailing performance will likely produce below-market returns. As a result, while many investors use a model for their portfolio recommendations, we believe that a well-documented qualitative overlay can help mitigate such time-period dependency.

Figure 4. Recency bias can influence forward expectations



Sources: Vanguard, using data from Thomson Reuters Datastream. U.S. equities represented by the Dow Jones U.S. Total Stock Market Index; U.S. bonds represented by the Barclays Capital U.S. Aggregate Bond Index; commodities represented by the S&P GSCI Total Return Index. Data as of 12/31/2011.

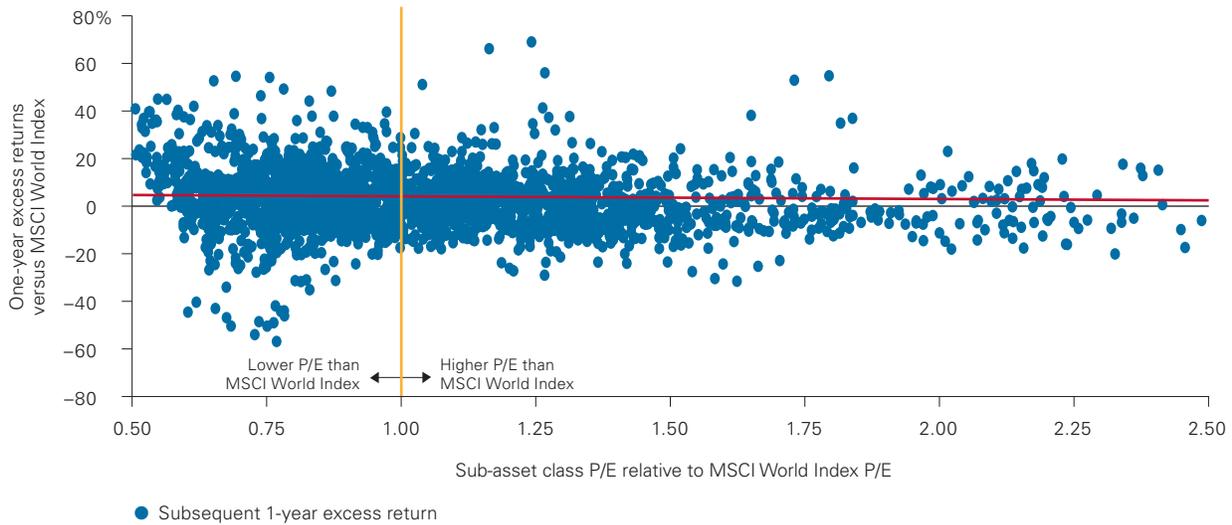
Set appropriate expectations

A second key point to bear in mind is that managing expectations can be a critical component in successfully implementing any portfolio. For example, the theoretical benefit to investing in commodities may be implemented using a broad commodities index fund or ETF. But while the risk and return expectations derived from these systematic exposures may lead to better theoretical long-term performance, the timing of the implementation and even the model recommendations are often subject to considerable variance over time due largely to recency bias (Figure 4). For example, risk-and-return expectations for commodities in 2000, following several years of poor performance relative to the equity and fixed income markets, were considerably different from expectations in 2008, following a period of relative outperformance. This is because expectations are often extrapolated from history.

In another example, investors might use price/earnings ratios to position their portfolios in “undervalued” assets that are expected to outperform certain “overvalued” assets. This is because P/E ratios are commonly cited as the best available tools to forecast long-term equity returns (Davis, Aliaga-Díaz, and Ren, 2009). Challenges can arise, however when too much faith is placed in the historical relationship or if near-term forecasts are implemented based on long-term tools.⁷ Figure 5, on page 8, demonstrates this challenge by comparing P/E ratios to excess returns (versus a broad equity benchmark) across a range of equity sub-asset classes. To perform the analysis, we calculated the ratio of the P/E for a given market segment versus the P/E for the MSCI World Index. If the ratio was greater than 1, the segment could be considered overvalued relative to the world equity market, and vice versa. We then measured the excess returns

⁷ The importance of using long-term relationships cannot be overemphasized. Vanguard uses such relationships in our own *Economic and Capital Markets Outlook* (Davis, Wallick, and Aliaga-Díaz, 2012).

Figure 5. Using relative valuations to position a portfolio may not succeed



Sources: Vanguard calculations, using data from Thomson Reuters Datastream. Global equity market represented by the MSCI World Index. Equity sub-asset classes include Russell 1000 Growth Index, Russell 1000 Value Index, Russell Midcap Growth Index, Russell Midcap Value Index, Russell 2000 Growth Index, Russell 2000 Value Index, MSCI EAFE Growth Index, MSCI EAFE Value Index, and MSCI Emerging Markets Index. P/E data starts on 12/31/1986 for all categories except emerging markets, which starts on 11/30/1995. Return data through 12/31/2011.

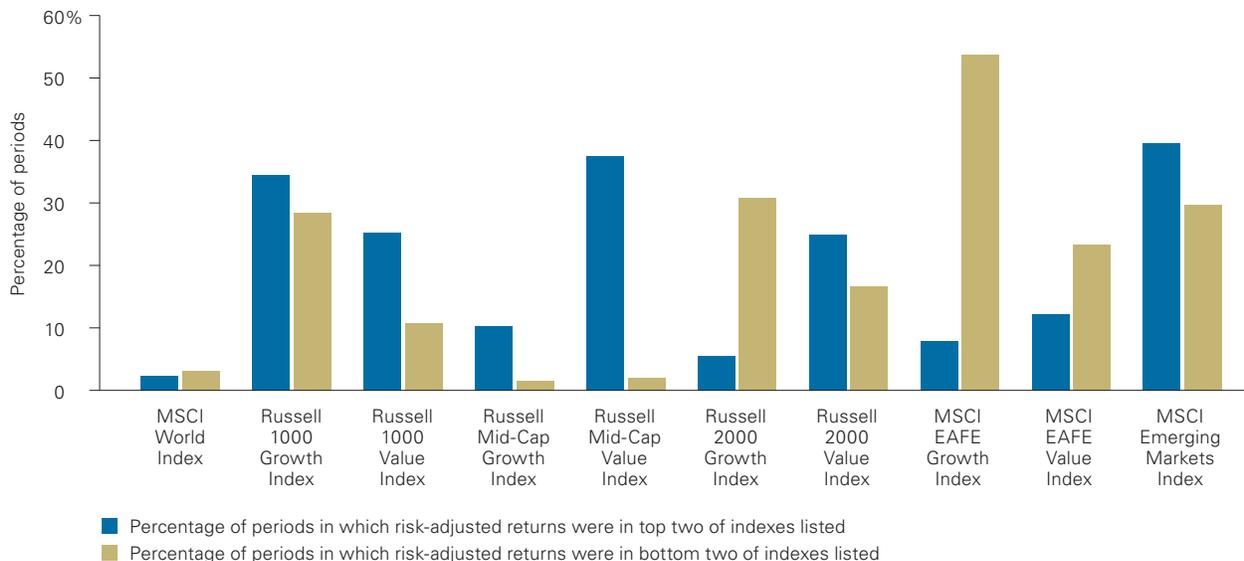
over the next 12 months for the segment versus the world. Theoretically, if a strong relationship was shown between relative valuations today and return differentials over the next year, we would see a strong downward sloping trend among the plotted points.

The red trend line in Figure 5 shows that, historically, there has essentially been no relationship between relative valuations and subsequent near-term excess returns. These results indicate that structuring a portfolio based on a market segment's relative attractiveness may not lead to near-term success, despite the long-term evidence that valuations are a reasonable place to start when forecasting returns.

Finally with regard to managing expectations, investors should apply realistic risk-and-return expectations to asset and sub-asset classes, understanding that over time, risk-adjusted returns for risky assets should be more similar than different. This means that an asset's high (or low) risk-adjusted return for a given time period relative to other risky assets should not be expected to continue in perpetuity. For example, **Figure 6** shows the percentage of periods in which a market segment was either in the top or bottom two with respect to risk-adjusted returns since 1990 (the earliest that all ten segments had three-year returns available). In other words, we ranked the segments each month based on trailing 36-month risk-adjusted returns. Emerging markets, for example, were either

Figure 6. Risk-adjusted returns can be volatile

Percentage of total periods in which three-year risk-adjusted return was ranked in the top or bottom two of the index segments listed



Sources: Vanguard calculations, using data from Thomson Reuters Datastream. Data cover the period 1/1/1990 through 12/31/2011. See Figure 4 for benchmarks.

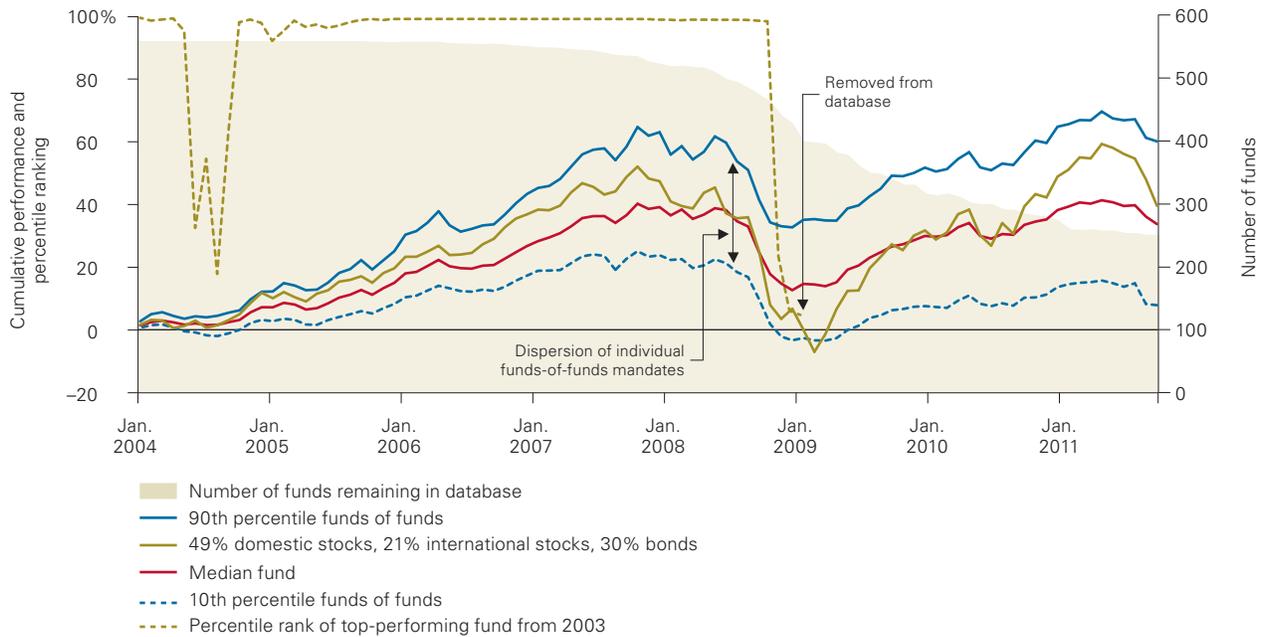
first or second nearly 40% of the time, but were also last or second to last 30% of the time. Of course, combining diverse risky assets should improve the overall risk-and-return profile of the aggregate portfolio, but if large changes to an asset allocation are predicted or recommended, careful attention should be paid to the model inputs and methodology.

Account for challenges of implementing skill-based strategies

A third consideration in implementing expanded portfolios is that for investments dependent on manager skill, such as private real estate, private equity, venture capital, and most hedge fund

strategies, developing expected risk-and-return characteristics is problematic at best. The same difficulties associated with forecasting returns for actively managed long-only mutual funds apply here, only with greater expected forecasting error. These strategies often feature low capacity, high costs, pricing uncertainty, confined market opportunities, and lack of transparency. In addition, these strategies tend to be subject to significant dispersion of return possibilities across strategies and managers. As a result, investors face a substantial risk that the portfolio will not perform in line with expectations based on manager databases or peer-group averages (often identified as "indexes," such as a hedge fund index).

Figure 7. The distribution of possible outcomes when implementing alternative strategies



Sources: Vanguard, using data from the Morningstar Hedge Fund Database. Data through September 30, 2011. Because many hedge funds report data on a quarter lag, we did not extend through December 31, as the results would be biased for the final quarter. In order to be considered, the funds must have reported returns for the three years before 1/1/2004.

As an example, **Figure 7**, examines the range of implementation possibilities of a recommended allocation to hedge funds. We use funds of funds to help overcome some of the challenges of manager selection.⁸

Figure 7 highlights three important outcomes that investors were subject to when implementing an asset allocation recommendation. First, we show the dispersion of cumulative returns for the 90th percentile fund and the 10th percentile fund. Notably, investors' experience in the best-performing funds is quite different from investors' experience in the worst-performing funds, again underscoring the importance of selecting a top manager. We also

show the median fund in red as well as our "traditional" portfolio from Figure 2 in gold. For most of the period measured, not only did the traditional portfolio outperform the median hedge fund of funds, but it performed very close to the 90th percentile fund during the bull market from 2004 through 2007. And from the bottom of the bear market in February 2009 through September 2011, the traditional portfolio again outperformed most funds of hedge funds. In fact, in terms of cumulative returns, despite the underperformance during the global financial crisis, the traditional portfolio outperformed most funds of hedge funds from start to finish.

⁸ Funds of funds involving private equity, private real estate, and hedge funds represent portfolios of individual funds. These funds provide greater diversification, breadth of investment, and access to often inaccessible managers. While funds of funds may reduce individual manager risk, they still do not represent an investment in beta, and investors can experience a wide distribution of returns. In addition, most funds of funds carry additional fees in addition to the fees of the underlying funds. These additional fees can make it even more difficult for an investor to achieve the "average" hedge fund return.

Second, in the beige shaded area of Figure 7, we show the number of funds remaining in the database over time. Our sample started on January 1, 2004, with 558 funds. By September 30, 2011, only 251 remained—a 55% attrition rate. However, even accounting for this attrition doesn't paint a complete picture of the actual investor experience, because performance reporting for hedge funds is voluntary. A fund may therefore stop reporting for any number of reasons, including, but not limited to, poor performance. Even with a bias toward funds with good performance, we see a wide dispersion of returns.

Finally, the figure shows the percentile ranking for the top-performing fund over the three years ended December 31, 2003. Investors' experience in this fund in subsequent years was quite volatile. The best fund in 2003 had fallen to the 18th percentile by the middle of 2004. The fund then rebounded to the top 3% (97th percentile) of all surviving funds for close to the next four years, before falling again, this time to the 5th percentile, just before the fund dropped out of the database. This volatility underscores the difficulty in picking a top manager, sticking with him or her, and then consistently outperforming. Individual managers may fail because of high costs, the commoditization of a strategy, crowding, or risk concentrations that are difficult to detect with financial modeling. Further complicating manager selection is that many top managers are often unavailable for new investment.

These results help to cement the idea that average performance can be misleading. Investors should, therefore, use caution when they model and allocate assets to strategies or asset classes for which investable beta is not available or where the extent

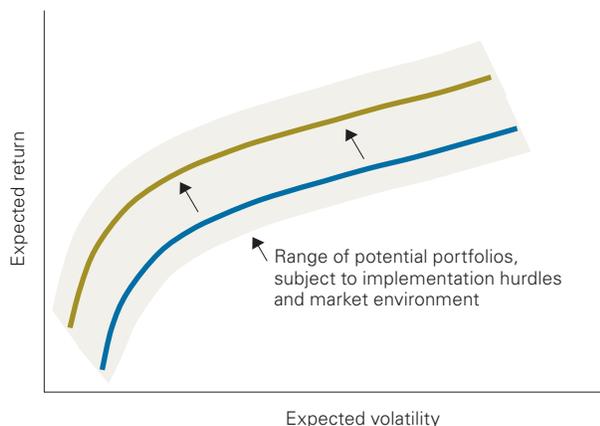
or quality of available index data is limited. It's not that these investments should not be employed, depending on the expectations of the client, but that historical return estimates based on manager databases are not consistently achievable, and their use must be incorporated in a more qualitative methodology instead of the traditional statistical framework.

To improve the chances of meeting expectations, investors should consider implementing skill-based strategies in liquid markets with broad diversification and risk controls, they should be aware of costs and control them to the extent possible, and they should avoid strategies with excessive leverage or concentration. Finally, investors should remain diligent in their implementation, review, and allocation processes.

Remain committed

While we believe these best practices represent a solid starting point, a fourth important consideration is that even the best plan can break down through a lack of commitment to the strategic allocation, including any rebalancing program that is built into the model inputs. For any asset class, combination of asset classes, or investment strategy, there will be periods of underperformance relative to other asset classes or strategies. Performance leadership is cyclical; no single asset, strategy, or portfolio consistently outperforms all others. As a result, investors must maintain the established asset allocation to capture the long-term benefits of a broadly diversified portfolio. They must have the courage and long-term perspective to stick with a strategy in bad times as well as good.

Figure 8. Active risk can lead to additional variation in the expected efficient frontier



Source: Vanguard.

Incorporate implementation uncertainty into forward expectations

To account for the various implementation hurdles facing investors, and the difficulty in making precision forecasts, it can be helpful to think of the future in terms of ranges of possible outcomes. For example, in **Figure 8** we modify our theoretical efficient frontier from Figure 1 to include a band around the two curves. This band can represent the possible successes or failures of implementing an expanded portfolio dependent on market cycles, managers employed, and the timing and magnitude of portfolio change. The more uncertain the probability of delivering the theoretical result, the wider the bands around the efficient frontier should be. This includes the additional risks incurred by including active alternative asset managers, whose results can be significantly different from peer-group averages or returns of industry “indexes.”

For a fiduciary (whether an institution, a family office, or a financial advisor), such wide potential tracking error to a policy portfolio can be of concern, particularly if that tracking error is to the downside. If investors understand that the theoretically optimal portfolio may occasionally turn suboptimal, their asset allocation decisions may be grounded and better planned for.

Conclusion

This paper has outlined what we believe is a better approach to discussing the future expected performance of a portfolio. We have identified some best practices for building expectations around new asset classes and alternative investment strategies. We believe investors who establish a framework for properly understanding a model, who set appropriate expectations, who acknowledge potential implementation limitations, and who remain committed stand a better chance of succeeding in the long term than investors who do not focus on these best practices. We have also discussed how expanding a traditional portfolio can work, but we cautioned that it will not *always* work and that investors must stick with established best practices to ensure the best chances of success.

Implementation of portfolio recommendations is an often overlooked step in the portfolio construction process. For example, when indexed investments are unavailable, investors are subject to the distribution of possible returns produced by available managers. Using the mean returns of those managers in a model will understate risk. In the end, investors must be aware of the quality of inputs, of how a model operates, of why a model is recommending a particular asset mix, and of the need to evaluate over different time periods, using various benchmarks and implementation schemes. Creating a range of expected future results, instead of single risk-and-return numbers, will decrease the likelihood for disappointment when the future does not replicate the past.

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