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Evaluating Alternate Beta Strategies

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In recent years, there has been a proliferation of alternatively weighted ("alternate beta") indices, such as fundamentally weighted indices, equal-weighted indices and low-volatility indices. We have surveyed a broad range of alternate beta strategies that have gained significant traction in the investment community.

Although alternate beta strategies aim to achieve better risk-adjusted performance than cap-weighted portfolios, we find that they are often constructed with more specific objectives in mind. These objectives include achieving a systematic value tilt, lowering portfolio volatility or reducing stock-specific risks, and may define the essence and main applications of different strategies.

Some recent studies suggest that all alternate beta strategies have exposure to the value and small-cap factors, which explains their outperformance over the market. However, we find that, while the examined alternate beta strategies are to a large degree driven by the well-known equity risk factors (market, value, small-cap, momentum and volatility), the primary factor drivers of individual strategies are often distinct, and in turn may define the risk and return profile of the strategy.

These findings suggest that when evaluating an alternate beta strategy, a starting point for investors may be to examine its objective and risk drivers in the context of those investors' own investment objectives and preferences for risk-taking.

When it comes to implementation, our analysis suggests that portfolio construction methodologies can have significant implications for the risk and return profiles of alternate beta strategies, and should therefore be examined carefully. Implementation costs, as well as simplicity and transparency, may also be considered important evaluation criteria.

We caution that alternate beta strategies often take substantial active risks, which are largely driven by their factor exposures. As factor returns can be volatile over time, all alternate beta strategies may experience periods of significant underperformance relative to the cap-weighted market portfolio. However, as common equity risk factors may not be correlated, we find that combining alternate beta strategies that are driven by distinct sets of risk factors may significantly reduce active risk and improve the information ratio.

1: Back to Basics

Since the first market capitalization-weighted ("cap-weighted") equity index was introduced by Standard & Poor's in 1923, cap-weighted indexing has become the dominant form of index investing. Today, cap-weighted indices account for the vast majority of assets in index-linked investment products such as ETFs and index funds, as well as trading volumes in exchange-traded and over-the-counter ("OTC") index futures, options, and other derivatives.

In recent years, there has been a proliferation of alternatively weighted indices, such as fundamentally weighted indices, equal-weighted indices, and low-volatility indices.

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Correspondingly, there have been more debates about the role of alternatively weighted indices (or "alternate beta") in investment portfolios.

While some proponents of alternate beta argue that market cap-weighted indices are "inefficient," most market participants believe that market-cap weighting will always be the dominant form of indexing. It not only is the most representative gauge of the market, but also has the lowest implementation cost due to its investment capacity and automatic self-rebalancing. In addition, as the cap-weighted portfolio is the only portfolio that all investors can collectively hold, it represents the ultimate benchmark, where outperformance and underperformance become a zero-sum game relative to the market.

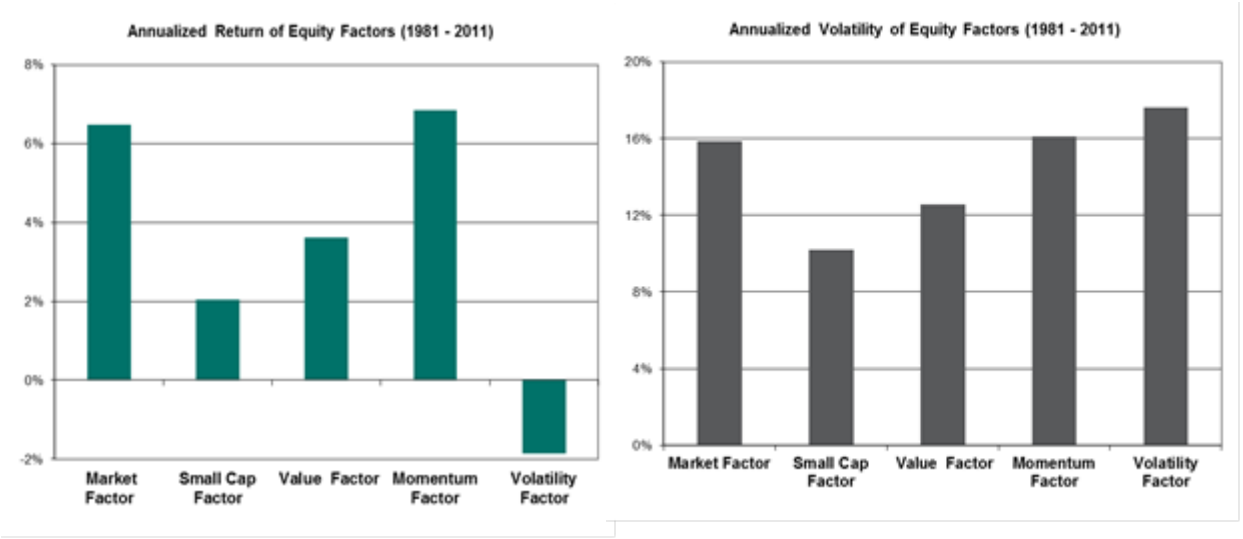
The key to understanding alternate equity beta strategies is the extensive empirical evidence showing that stock returns are driven not just by the overall market factor, but also by other common risk factors that are related to the characteristics of the stocks. Notably, small-cap and value stocks have historically behaved differently from large-cap and growth stocks, respectively, and have generated higher long-term returns. Fama and French (1992, 1993) found that a three-factor model of market, small-cap and value factors would explain more than 90% of diversified portfolio returns, which significantly improves the explanatory power of a single-factor model, such as the Capital Asset Pricing Model (CAPM). Many studies (e.g., Jegadeesh and Titman (1993) and Carhart (1997)) identify momentum as another common equity risk factor, due to the persistence in the relative performance of past winners and past losers. Last but not least, empirical research (e.g., Haugen and Baker (1991) and Clarke, Silva, and Thorley (2006, 2010)) has shown that an equity portfolio's exposure to the volatility factor can also significantly impact its risk and return, and -- contrary to finance theory -- holding high-volatility stocks has not been compensated by higher long-term returns than holding low-volatility stocks. To a certain degree, this range of empirical evidence has motivated the attempts to achieve better risk-adjusted returns than the cap-weighted portfolio, by tilting a portfolio's exposure to certain common equity factors, such as small-cap, value and volatility.

Figure 1 shows the historical return and volatility of these most recognized equity factors for the U.S. equity market over the last 30 years. The market factor represents the excess return from investing in the cap-weighted U.S. equity market. The small-cap, value, momentum and volatility factors represent the returns from portfolios that are long small-cap stocks and short large-cap stocks, long high book-to-market stocks and short low book-to-market stocks, long past winners and short past losers, and long high volatility stocks and short low volatility stocks, respectively.

It's notable that the small-cap, value and momentum factors have historically been associated with substantial positive returns. If such trends were to continue, this implies that portfolios that systematically overweight small-cap, value and momentum stocks can outperform the market. On the other hand, as the volatility factor has historically offered negative returns, portfolios with a tilt to low-volatility stocks would have been better rewarded than the market. Some academics and practitioners believe that the premiums associated with small-cap, value, momentum and low-volatility stocks may be potentially attributed to biases in investor behavior, or compensation for taking extra risk.

Another important observation exhibited in Figure 1 is that, much like the market factor, the small-cap, value, momentum and volatility factors have been very volatile. In other words, the potential reward derived from systematically tilting the portfolio towards any of these factors can vary significantly from one period to another. The results shown in Figure 1 suggest that these well-known common risk factors can all significantly impact both the risk and return of equity portfolios.

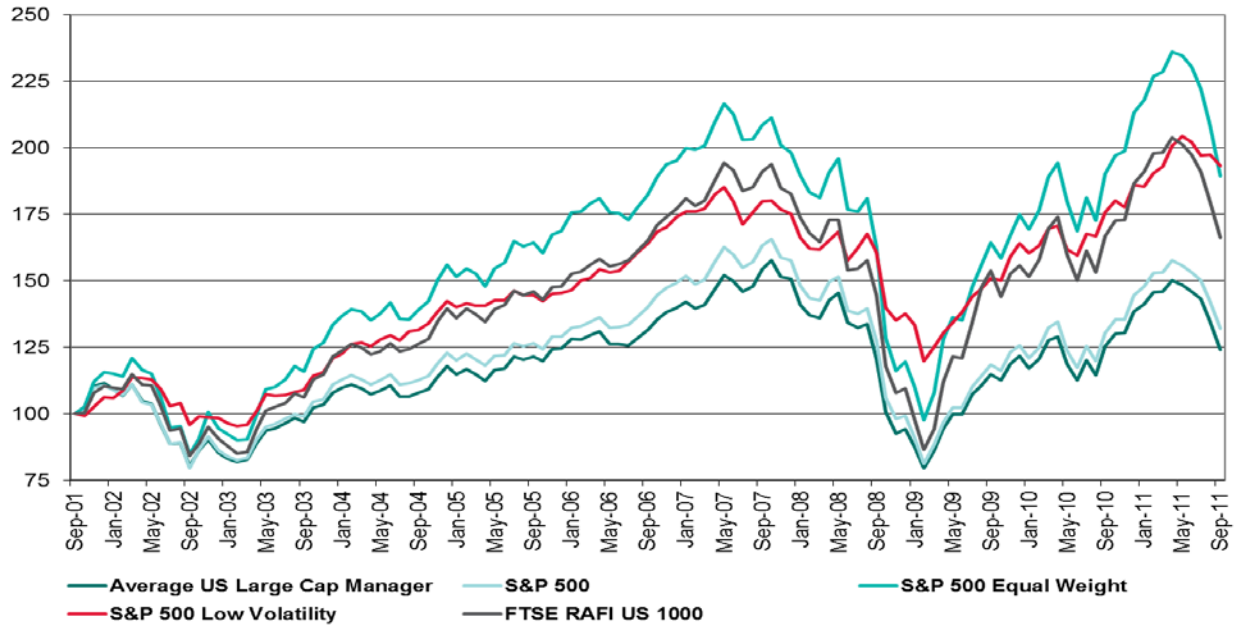
Figure 1: Historical Return and Volatility of Common Equity Risk Factors (1981-2011)



Source: Kenneth French's website, Analytic Investors LLC, S&P Dow Jones Indices. Data from January 1, 1981 to October 31, 2011. The returns of the market, small-cap, value and momentum factors are from Kenneth French's website. The returns of the volatility factor are from Analytic Investors LLC. Charts are provided for illustrative purposes. Past performance is not a guarantee of future results.

The impressive recent performance of some alternate beta strategies, when compared with the average returns of active managers, may have also contributed to the growing interest in alternate beta strategies. For instance, Figure 2 shows that simple equal-weighted and low-volatility strategies have significantly outperformed the S&P 500® over the last ten years. By comparison, the average U.S. large-cap manager has lagged the S&P 500.

Figure 2: Recent Performance of Alternate Beta Strategies vs. Active Managers (U.S. Equity Market)



Source: S&P Dow Jones Indices, CRSP. Data from September 30, 2001 to September 30, 2011. "Average US Large Cap Manager" represents the monthly average returns of U.S. large-cap managers in the CRSP database. Some of the S&P 500 Equal Weight Index and S&P 500 Low Volatility Index data included in this chart may reflect hypothetical historical performance. Charts are provided for illustrative purposes. Past performance is not a guarantee of future results.

In the next section, we evaluate various alternate equity beta strategies by examining the similarities and differences in their objectives, underlying risk drivers, portfolio construction methodologies, and historical risk and return profiles.

2: Comparing Alternate Equity Beta Strategies

The authors of several recent studies have compared the increasingly long list of alternate equity beta strategies. For instance, Chow, Hsu, Kalesnik and Little (2011) surveyed various "heuristic-based" (experience-based) and "optimization-based" weighting strategies. Using a four-factor model of market, small-cap, value and momentum factors, the authors identified the source of outperformance as exposure to the value and small-cap factors, and found no statistically significant alpha after adjustment for the factor exposures. Melas, Briand and Urwin (2011) proposed a generalized framework and characterized all "risk-based" and "return-based" strategies as special cases of mean-variance portfolio construction, subject to various assumptions about expected risk and return. Dash and Loggie (2008) suggested that all index weighting schemes can be generalized as being weighted a certain factor raised to a power; if it is desired to amplify the influence of certain factor, an exponent can be applied.

One simple way to understand alternate beta strategies is that, while they all aim to achieve a better risk-adjusted performance than the cap-weighted portfolio, most have a more specific objective, either explicitly or implicitly (see Figure 3). For instance, fundamentally weighted indices and dividend-weighted indices are essentially both value strategies that tilt portfolios towards value stocks. The minimum-variance strategy and other non-optimized low-volatility strategies are designed with the same objective of achieving lower portfolio volatility than the cap-weighted portfolio, and have lower market beta and negative exposure to the volatility factor. The portfolio construction process (e.g., whether it is heuristic-based or optimization-based), while important, is secondary to the objective and underlying risk drivers of the strategy.

Other often cited indexing strategies that attempt to achieve more desirable risk characteristics than the cap-weighted portfolio include (but are not limited to) equal-weighted (Dash and Loggie, 2008), equal risk contribution (Maillard, Roncalli and Teiletche, 2010), and diversity-weighted (Fernholz, Garvy, and Hannon, 1998) strategies. It is important to note that these strategies differ significantly from minimum-variance or other low-volatility strategies. Low-volatility equity strategies aim to reduce portfolio volatility, primarily by taking fewer systematic risks (e.g., by holding low-beta stocks); they typically represent relatively concentrated portfolios and may therefore have higher stock-specific risks than the cap-weighted portfolio. In comparison, equal-weighted, equal risk contribution and diversity-weighted strategies typically do not reduce portfolio volatility as they do not reduce systematic risks; they are designed to reduce stock-specific risks and are less concentrated than the market portfolio. We classify these three strategies that reduce stock-specific risks and portfolio concentration risks into the same category, simply termed "diversification strategies."

Figure 3: Alternate Equity Beta Strategies by Objective

Strategy by Objective	Example	Most Significant Factor Exposure
Value Strategies *Value Factor Tilt*	Fundamentally Weighted Dividend-Weighted	Value Exposure
Low-Volatility Strategies *Reduce Portfolio Volatility*	Minimum-Variance Non-Optimized Low-Volatility	Lower Market Beta & Negative Volatility Exposure
Diversification Strategies *Reduce Stock-Specific Risks*	Equal-Weighted Equal Risk Contribution Diversity-Weighted	Small-Cap Exposure
Momentum Strategies *Momentum Factor Tilt*	Momentum Tilt	Momentum Exposure

Source: S&P Dow Jones Indices.

Unlike previous studies on the subject, our empirical analysis in this section focuses on comparing and contrasting alternate beta strategies with similar objectives and risk drivers. In particular, we focus on representative value strategies, low-volatility strategies and diversification strategies, as there are significantly different indexing strategies within each of these groups. Within each strategy group, we aim to shed some light on the differences in the portfolio construction models implied by representative strategies, as these differences may significantly impact the underlying risk exposures of the strategies. Overall, such an approach is also very helpful in highlighting the key risk drivers and characteristics that distinguish each particular group of strategies. We also review the risk and return profiles of the strategies. However, we believe that these risk/return profiles are primarily functions of the objectives, portfolio construction methodologies and risk exposures of the strategies concerned.

2.1: Alternatively Weighted Value Strategies

We compared three alternatively weighted value strategy indices (see Figure 4). Both the FTSE RAFI (fundamental indices, Arnott, Hsu and Moore, 2005) and MSCI Value Weighted Indices (Subramanian, Kulkarni, Kouzmenko, and Melas, 2011) use weightings that are based on accounting measures of size (such as book value and sales), rather than on index constituents' market capitalization. Asness (2006) illustrated mathematically that such fundamental indexing is precisely equivalent to a value tilt away from cap-weighted indices.

Despite many methodological differences, the most significant difference between the FTSE RAFI and MSCI Value Weighted Indices is that the former selects the index constituents from the whole stock universe, based on fundamental measures, while the latter only reweights all constituents of the associated cap-weighted MSCI index, without any stock selection process based on fundamental data. This implies that the FTSE RAFI Indices may have a stronger value tilt and greater exposure to small-cap stocks.

The S&P Pure Value Indices, launched in 2005, consist of value companies weighted in proportion to their relative value characteristics. This means that companies with stronger value characteristics will be assigned more weight than companies with weaker value characteristics, regardless of their size (whether measured by market capitalization or other accounting-based fundamental measures). This methodology gives the strategy a more significant value tilt than the fundamental indices.

Figure 4: Alternatively Weighted Value Strategy Indices

Index Component	FTSE RAFI Index Series	MSCI Value-Weighted Indices	S&P Pure Value Indices
Stock Selection	The companies with the largest RAFI fundamental values from the all-cap stock universe	All constituents of the relevant MSCI standard index (large- and mid-caps)	Value companies from the relevant S&P parent index
Weighting	Sales, Cash Flow, Book Value, and Dividends	Sales, Cash Flow, Book Value, and Earnings	Value Score derived from three value factors: Book Value to Price, Earnings to Price, and Sales to Price

Source: FTSE, MSCI, S&P Dow Jones Indices.

We analyzed the historical risk and return profiles of these three distinct alternatively weighted value strategy indices, represented by FTSE RAFI US 1000 Index, MSCI USA Value Weighted Index and S&P 500 Pure Value Index. Using a five-factor model of market, small-cap, value, momentum and volatility factors, we can also gain insights into the factors that drive the performance of the strategies. The results reveal interesting similarities and differences that can be attributed to the design of the specific index strategies.

Figure 5 shows that all three value strategies delivered positive returns relative to the S&P 500. Not surprisingly, all three strategies have substantial and statistically significant value factor exposure. The Value Weighted strategy has the lowest level of value exposure, as well as the lowest active risk (tracking error) relative to S&P 500. It is a less aggressive value strategy than its peers, since its portfolio construction does not involve stock selection. As the fundamental index, FTSE RAFI, contains far more stocks than the S&P 500 or MSCI USA universe, it essentially has an extra allocation to mid-cap stocks outside the S&P 500/MSCI USA. This also partially explains the fundamental index's more significant small-cap exposure compared to the Value Weighted strategy. Given that the S&P MidCap 400® has outperformed the S&P 500 by 3.9% per annum in the examined period (June 1995 – October 2011), the mid-cap exposure would have improved the return of the fundamental index. We also notice that the S&P Pure Value strategy has the most significant value and small-cap exposures,

and the highest active risk. Its stock selection and weighting mechanism based on relative value characteristics make it the most aggressive value strategy of the three in the study.

Importantly, none of the value strategies is associated with statistically significant alpha after an adjustment for factor exposures. The r-squared of the factor regressions is above 0.95 for the two fundamentally weighted strategies, indicating that these five well-known common equity factors account for the vast majority of the returns of the strategies. The r-squared is lower for the S&P Pure Value strategy, which is not surprising. The common equity factors can better explain the return of well-diversified portfolios, because such portfolios will be driven primarily by systematic factor risks. As the S&P Pure Value Index is by design more concentrated than the other two value strategy indices, it may incur higher stock-specific risks that cannot be explained by the common factors of market, small-cap, value, momentum and volatility. Overall, the observations confirm that all these strategies are beta strategies, and their outperformance over the market stems mainly from the value and, to a lesser extent, the small-cap factors.

Figure 5a: Value Strategy Indices: Historical Risk and Return Profile

Value Strategy Index	Total Return (%)	Volatility (%)	Sharpe Ratio	Active Return (%)	Active Risk (%)	Information Ratio
S&P 500	7.2	16.2	0.26			
Fundamental Index Strategy	10.0	17.1	0.41	2.8	5.9	0.47
Value Weighted Strategy	7.8	16.7	0.29	0.6	4.3	0.14
Pure Value Strategy	9.6	21.7	0.30	2.4	13.5	0.18

Source: S&P Dow Jones Indices, FTSE, MSCI. Data from June 30, 1995 to October 31, 2011. A P-Value of below 5% or 1% corresponds respectively to statistical significance at 5% or 1% levels. The analysis starts from June 30, 1995, as this is the earliest date for which performance data is available for all the examined indices. The Fundamental Index Strategy is represented by FTSE RAFI US 1000 Index, the Value Weighted Strategy is represented by MSCI USA Value Weighted Index, and the Pure-Value Strategy is represented by S&P 500 Pure Value Index. Some of the S&P 500 Pure Value Index data reflected in this chart may reflect hypothetical historical performance. Charts are provided for illustrative purposes. Past performance is not a guarantee of future results.

Figure 5b: Value Strategy Indices: Factor Exposures & Factor-Adjusted Alpha

Value Strategy Index	Annual Alpha (%)	Market Beta	Small-Cap Beta	Value Beta	Momentum Beta	Volatility Beta	R Square
Fundamental Index Strategy	1.28	0.995	0.153	0.365	0.058	-0.036	0.961
P-Value (%)	*(14.2)*	*(0.0)*	*(0.0)*	*(0.0)*	*(0.5)*	*(12.5)*	
Value-Weighted Strategy	-0.03	1.013	0.047	0.248	0.012	-0.042	0.984
P-Value (%)	*(95.0)*	*(0.0)*	*(1.2)*	*(0.0)*	*(32.7)*	*(0.4)*	
Pure-Value Strategy	-1.31	1.086	0.488	0.845	0.183	-0.094	0.876
P-Value (%)	*(51.0)*	*(0.0)*	*(0.0)*	*(0.0)*	*(0.0)*	*(7.9)*	

Source: S&P Dow Jones Indices, FTSE, MSCI. Data from June 30, 1995 to October 31, 2011. A P-Value of below 5% or 1% corresponds respectively to statistical significance at 5% or 1% levels. The analysis starts from June 30, 1995, as this is the earliest date for which performance data is available for all the examined indices. The Fundamental Index Strategy is represented by FTSE RAFI US 1000 Index, the Value Weighted Strategy is represented by MSCI USA Value Weighted Index, and the Pure-Value Strategy is represented by S&P 500 Pure Value Index. Some of the S&P 500 Pure Value Index data reflected in this chart may reflect hypothetical historical performance. Charts are provided for illustrative purposes. Past performance is not a guarantee of future results.

2.2: Low-Volatitlity Strategies

Low-volatility equity investing has recently attracted increased investor interest, which may be partially attributed to the turbulent markets of the past few years. The objective of constructing equity portfolios with lower overall volatility can be achieved either by using mean-variance optimization or through a non-optimized approach (see Figure 6).

Mean-variance optimization requires both estimations of stocks' expected returns and a covariance matrix. As expected returns are notoriously difficult to estimate, a typical minimum-variance strategy "simplifies" the optimization by assuming that all stocks have the same expected returns.[1] In practice, as an unconstrained optimization may produce less representative portfolios, minimum-variance strategies typically impose some practical constraints on the optimization, such as limiting the portfolio turnover and exposures to individual sectors.

[1] Chopra and Ziemba (1993) discussed the effects of estimation errors on mean-variance optimization.

A simpler alternative methodology involves selecting those stocks that have been least volatile historically, and then weighting them by the inverse of those historical volatilities. This tilts the portfolio towards low-volatility stocks. As stock volatility tends to cluster (i.e., stocks with lower volatility in the past may continue to exhibit lower volatility in the following period), such an approach can also effectively reduce portfolio volatility. In contrast with the minimum-variance strategy, the non-optimized approach does not take into account correlations between stocks.[2]

Figure 6: Minimum-Variance Strategy vs. NonOptimized Low-Volatility Strategy

Component	Minimum-Variance Strategy	Non-Optimized Low Volatility Strategy
Portfolio Construction	Mean-variance optimization assuming same expected returns for all stocks	Low volatility stocks weighted by the inverse of their historical volatilities
Strategy Inputs	Volatilities and correlations (typically estimated using multi-factor risk model)	Historical volatilities
Portfolio Constraints	Typically impose various optimization constraints	Typically none
Complexity	More complex, due to the use of optimization and risk model	Simple
Portfolio Volatility	20-30% volatility reduction	20-30% volatility reduction

Source: S&P Dow Jones Indices.

To gain more insight into these two low-volatility strategies, we chose to analyze the MSCI Minimum Volatility Indices (Nielsen and Aylursubramanian, 2008), which are representative of the minimum-variance strategy, and the S&P Low Volatility Indices (Soe, 2011), which are representative of the non-optimized low-volatility strategy. Figure 7a presents the historical performance of the two strategies. An important observation is that both strategies effectively lowered annual portfolio volatility from 16.2% (S&P 500) to about 12%, for a reduction of about 25% in relative terms. Interestingly, although the minimum-variance strategy should in theory achieve lower volatility as it is the result of an optimization, both strategies have achieved almost the same realized volatility in the examined period. One possible explanation may be that the theoretical aim of achieving minimum risk may be dampened by the optimization constraints imposed in practice.

Figure 7b reveals the primary risk drivers that distinguish low-volatility strategies from other alternate-beta strategies: both types of low-volatility strategies have a market beta significantly below one, as well as strong negative exposure to the volatility factor. Another critical observation is that, when compared with the minimum-variance strategy, the non-optimized low-volatility strategy exhibits significantly higher active risk, lower market beta, and a more significant exposure to the volatility factor. This may be explained mainly by two differences in the designs of the strategies. First, the MSCI Minimum Volatility index imposes active constraints on sectors and other risk factors, while the S&P Low Volatility index does not involve active risk constraints. Secondly, the MSCI Minimum Volatility index is rebalanced on a semi-annual basis with a turnover constraint, while the S&P Low Volatility index is rebalanced on a quarterly basis and may have higher portfolio turnover. These differences make the S&P index a more aggressive low-volatility/low-beta strategy.

After adjustment for factor exposures, the alpha of the strategies was not statistically significant during the examined period.[3] The five-factor model explains over 90% of the return variation of the minimum-variance strategy, but has less explanatory power for the returns of the non-optimized low-volatility strategy. As noted earlier, this may in part be due to relatively high stock-specific risks.

It is worth noting that low-volatility equity strategies can reduce not only portfolio volatility, but also downside risks. Figure 7c compares the maximum drawdown of the low-volatility strategies with that of the S&P 500. Both the minimum-variance strategy and the non-optimized low-volatility strategy effectively reduced downside risk during the IT bubble and the recent financial crisis.

[2] The implication is that a volatile stock, which has a low correlation with the rest of the portfolio, may be included in the minimum-variance portfolio, due to its low marginal contribution to portfolio risk. By contrast, the non-optimized approach ignores correlation and will exclude such a stock as a result of its high volatility.

[3] As the S&P 500 Low Volatility Index shows a substantial alpha of 3% per annum during the examined period, we further tested using the available index data going back to 1990, and found an annual factor-adjusted alpha of 1.2%, without statistical significance.

Figure 7a: Low-Volatility Strategy Indices: Historical Risk and Return Profile

Low Volatility Strategy Index	Total Return (%)	Volatility (%)	Sharpe Ratio	Active Return (%)	Active Risk (%)	Information Ratio
S&P 500	2.0	16.2	-0.03			
Non-Optimized Low Volatility	6.8	12.0	0.36	4.8	11.6	0.42
Minimum-Variance Strategy	3.9	12.2	0.12	1.9	6.9	0.28

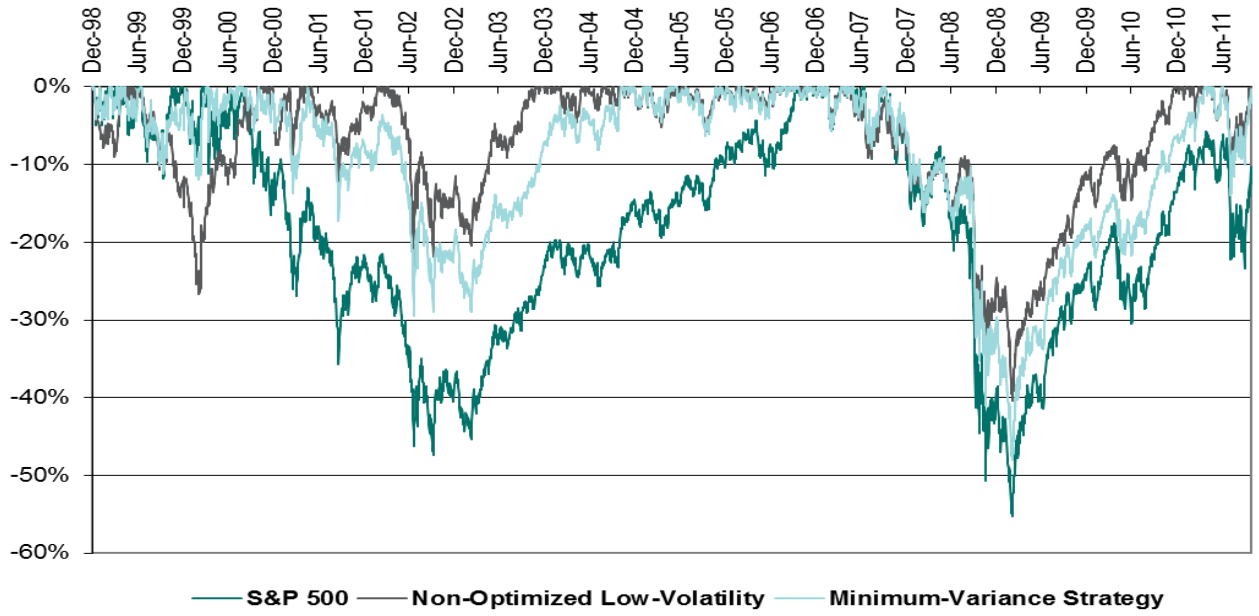
Source: S&P Dow Jones Indices, MSCI. Data from December 31, 1998 to October 31, 2011. A P-Value of below 5% or 1% corresponds respectively to statistical significance at 5% or 1% level. The analysis goes back to December 31, 1998 as this is the earliest date where index performance data is available for all examined indices. The Non-Optimized Low Volatility Strategy is represented by the S&P 500 Low Volatility Index and the Minimum Variance Strategy is represented by the MSCI USA Minimum Volatility Index. Some of the S&P 500 Low Volatility Index data reflected in this chart may reflect hypothetical historical performance. Charts are provided for illustrative purposes. Past performance is not a guarantee of future results.

Figure 7b: Low-Volatility Strategy Indices: Factor Exposures and Factor-Adjusted Alpha

Low Volatility Strategy Index	Annual Alpha (%)	Market Beta	Small-Cap Beta	Value Beta	Momentum Beta	Volatility Beta	R Square
Non-Optimized Low Volatility	3.01	0.782	0.140	0.214	0.094	-0.319	0.780
P-Value (%)	*(7.0)*	*(0.0)*	*(1.5)*	*(0.0)*	*(1.1)*	*(0.0)*	
Minimum-Variance Strategy	1.06	0.864	0.071	0.057	0.045	-0.193	0.921
P-Value (%)	*(29.7)*	*(0.0)*	*(4.2)*	*(8.3)*	*(4.4)*	*(0.0)*	

Source: S&P Dow Jones Indices, MSCI. Data from December 31, 1998 to October 31, 2011. A P-Value of below 5% or 1% corresponds respectively to statistical significance at 5% or 1% level. The analysis goes back to December 31, 1998 as this is the earliest date where index performance data is available for all examined indices. The Non-Optimized Low Volatility Strategy is represented by the S&P 500 Low Volatility Index and the Minimum Variance Strategy is represented by the MSCI USA Minimum Volatility Index. Some of the S&P 500 Low Volatility Index data reflected in this chart may reflect hypothetical historical performance. Charts are provided for illustrative purposes. Past performance is not a guarantee of future results.

Figure 7c: Maximum Drawdown of Low Volatility Strategy Indices



Source: S&P Dow Jones Indices, MSCI. Data from December 31, 1998 to October 31, 2011. The analysis goes back to December 31, 1998 as this is the earliest date where index performance data is available for all examined indices. The Non-Optimized Low Volatility Strategy is represented by the S&P 500 Low Volatility Index and the Minimum Variance Strategy is represented by the MSCI USA Minimum Volatility Index. Some of the S&P 500 Low Volatility Index data reflected in this chart may reflect hypothetical historical performance. Charts are provided for illustrative purposes. Past performance is not a guarantee of future results.

2.3: Diversification Strategies

The above analysis of minimum-variance and non-optimized low-volatility strategies confirms that the strategies reduce portfolio volatility primarily by reducing beta to the market and by virtue of their negative exposure to the volatility factor. In contrast, equal-weighted, equal risk contribution and diversity-weighted strategies aim to reduce stock-specific risks by holding portfolios that are less concentrated than the cap-weighted portfolio. In addition, unlike the low-volatility strategies, the three diversification strategies do not apply a stock selection screen, but rather reweight all the stocks in the selection universe.

The equal-weighted strategy allocates the same portfolio weighting to each stock and is the simplest strategy to reduce concentration risk. This approach is also known as naïve diversification. Between January 1991 and October 2011, the S&P 500 Equal Weight Index outperformed the S&P 500 by 2.5% per annum, albeit with slightly higher volatility (16.9% versus 15.1%). The equal risk contribution approach (Maillard, Roncalli and Teiletche, 2010) takes into account not only stocks' weights but also their marginal risk contributions, so that each stock contributes equally to the total risk of the portfolio. Fernholz, Garvy, and Hannon (1998) measure the level of market concentration by "diversity." By taking the market-cap weights for individual securities and raising individual weights to a power between zero and one, the diversity-weighted portfolio essentially represents a middle ground between cap-weighted and equal-weighted portfolios. Due to its closer proximity to the cap-weighted portfolio, the diversity-weighted strategy has lower turnover and active risk than the equal-weighted strategy.

Figure 8a and 8b show the historical risk and return profiles and factor exposures for equal-weighted, diversity-weighted and equal risk contribution strategies. The analysis confirms that these strategies are very distinct from the low-volatility strategies. First, unlike low-volatility strategies, all three diversification strategies do not reduce volatility, and have a market beta that is fairly close to one. Secondly, the r-squared of the five-factor regression is strikingly close to one for all three strategies, which indicates that they represent very well-diversified portfolios that are driven almost completely by the common risk factors. In contrast, low-volatility strategies typically produce more concentrated portfolios with more significant stock-specific risks.

As all three diversification strategies systematically overweight small-cap stocks relative to the cap-weighted portfolio, they have exposure to the small-cap factor. By construction, the equal-weighted strategy has the most significant small-cap exposure, while diversity-weighted has the least aggressive small-cap tilt. Another important observation is that all three strategies have a statistically significant negative exposure to momentum, which results from their disciplined rebalancing away from stocks with higher past returns. This observation confirms that these strategies have an inherent contrarian bias.

Figure 8a: Diversification Strategy Indices: Historical Risk and Return Profile

Diversification Strategy Index	Total Return (%)	Volatility (%)	Sharpe Ratio	Active Return (%)	Active Risk (%)	Information Ratio
S&P 500	1.8	17.8	-0.01			
Equal-Weighted	3.5	21.5	0.08	1.7%	5.7	0.31
Diversity-Weighted	2.3	18.4	0.03	0.6%	1.2	0.49
Equal Risk Contribution	3.3	17.9	0.08	0.016	0.027	0.579

Source: S&P Dow Jones Indices, FTSE, Bloomberg. Data from January 31, 2006 to October 31, 2011. A P-Value of below 5% or 1% corresponds respectively to statistical significance at 5% or 1% level. The analysis goes back to January 31, 2006 as this is the earliest date where index performance data is available for all examined indices. The Equal-Weight Strategy is represented by S&P 500 Equal Weight Index; the Diversity-Weighted Strategy is simulated using the S&P 500 stock universe, following the methodology in Fernholz, Garvy, and Hannon (1998) and a parameter ρ of 0.76; the Equal Risk Contribution Strategy is represented by Lyxor SmartIX ERC USA Equity Index. Some of the data reflected in this chart may reflect hypothetical historical performance. Charts are provided for illustrative purposes. Past performance is not a guarantee of future results.

Figure 8b: Diversification Strategy Indices: Factor Exposures & Factor-Adjusted Alpha

Diversification Strategy Index	Annual Alpha (%)	Market Beta	Small-Cap Beta	Value Beta	Momentum Beta	Volatility Beta	R Square
Equal-Weighted	1.40	1.006	0.302	0.049	-0.101	0.068	0.991
P-Value (%)	*(12.7)*	*(0.0)*	*(0.0)*	*(22.1)*	*(0.0)*	*(0.4)*	
Diversity-Weighted	0.44	1.000	0.073	-0.012	-0.026	0.018	0.999
P-Value (%)	*(9.79)*	*(0.0)*	*(0.0)*	*(29.7)*	*(0.0)*	*(0.6)*	
Equal Risk Contribution	0.76	0.961	0.127	-0.116	-0.122	0.001	0.987
P-Value (%)	*(39.8)*	*(0.0)*	*(0.1)*	*(0.5)*	*(0.0)*	*(97.3)*	

Source: S&P Dow Jones Indices, FTSE, Bloomberg. Data from January 31, 2006 to October 31, 2011. A P-Value of below 5% or 1% corresponds respectively to statistical significance at 5% or 1% level. The analysis goes back to January 31, 2006 as this is the earliest date where index performance data is available for all examined indices. The Equal-Weight Strategy is represented by S&P 500 Equal Weight Index; the Diversity-Weighted Strategy is simulated using the S&P 500 stock universe, following the methodology in Fernholz, Garvy, and Hannon (1998) and a parameter ρ of 0.76; the Equal Risk Contribution Strategy is represented by Lyxor SmartIX ERC USA Equity Index. Some of the data reflected in this chart may reflect hypothetical historical performance. Charts are provided for illustrative purposes. Past performance is not a guarantee of future results.

3: Implementing Alternate Beta Strategies

In Section 3, we aim to build upon the empirical analysis of alternate equity beta strategies undertaken in Section 2 by discussing some key considerations and potential risks of alternate beta strategies.

3.1: Key Considerations

Our comparison of alternate beta strategies suggests that, although such strategies aim to achieve a better risk-adjusted performance than the cap-weighted portfolio, they are constructed with more specific objectives and take very distinct risks. It is the specific strategy objective and risk drivers that define the expectation of the strategy performance in different market circumstances. For example, as low-volatility strategies take fewer systematic risks, they may be expected to deliver a smoother ride through market cycles than the cap-weighted portfolio, with less impressive performance in bull markets but better downside protection in bear markets. And if the investment objective is to reduce the potential impacts of stock-specific events (e.g., the Enron scandal, BP's disastrous oil spill), diversification strategies such as equal-weighted and equal risk contribution can be applied. The starting point for evaluating an alternate beta strategy may therefore be to examine its strategy objective and underlying risk drivers, and to ascertain whether they are consistent with the investor's investment objectives and preferences for risk-taking.

Our empirical analysis of representative value strategies, low-volatility strategies and diversification strategies indicates that different portfolio construction methodologies can have pronounced impacts on the risk and return profile of strategies with similar objectives and risk drivers. For instance, the significance of the factor tilt of the strategy can be impacted by a number of considerations: whether the strategy employs a stock selection screen based on the target characteristics, whether the strategy employs active constraints, the strategy's rebalancing policy, and so on. Factor exposure analysis is therefore useful in evaluating alternate beta strategies. Such analysis can give insights not only into the risk factors driving the strategy, but also into how aggressive the strategy is.

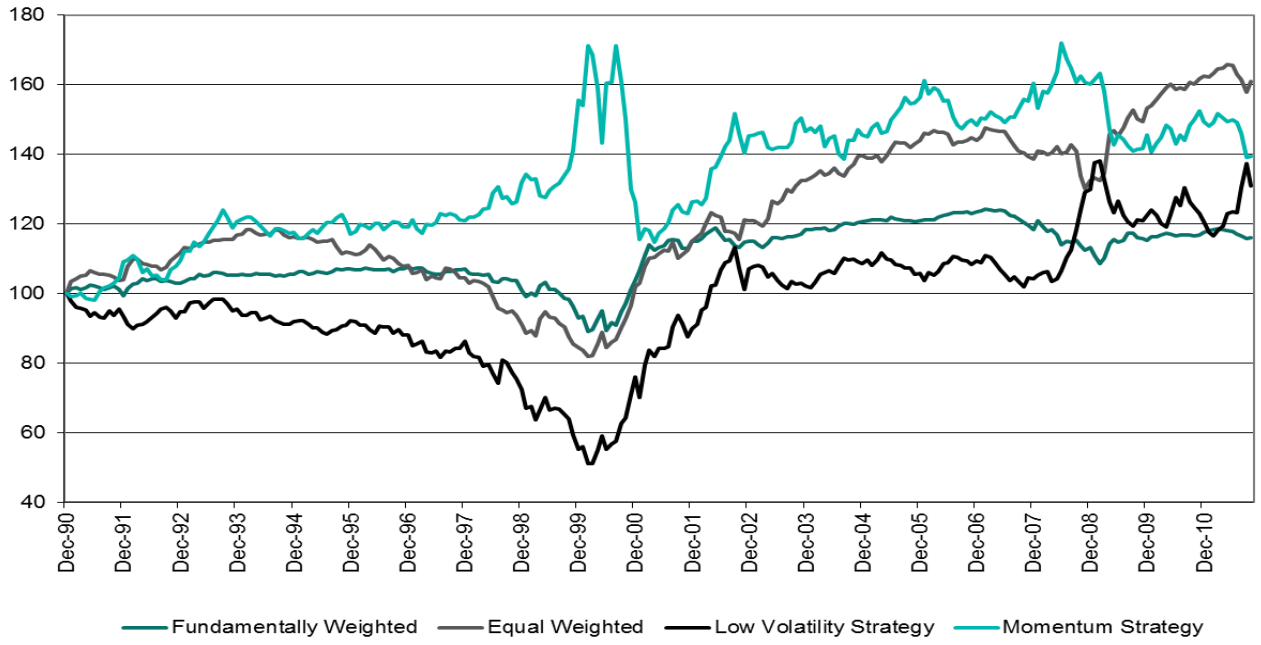
Some industry participants have highlighted implementation cost as one key criterion for evaluating alternate beta strategies.[4] Cost is certainly a key consideration for all passive strategies. Especially when evaluating alternate beta strategies with similar objectives and risk drivers, implementation cost -- which is impacted by portfolio turnover, liquidity and investment capacity -- should be a key criterion. However, the simplicity and transparency of the strategy should be an equally important evaluation criterion. Simplicity and transparency not only make the strategy more replicable, but also make the outcome of the strategy more clearly defined and easily interpretable. In addition, simplicity and transparency may also drive down the cost by guarding against potentially higher fees charged by more complex and proprietary strategies that may ultimately deliver similar beta exposures.

[4] For instance, Chow, Hsu, Kalesnik, and Little (2011).

3.2: Potential Risks of Alternate Beta Strategies

The alternate beta strategies we have discussed are subject to overall market risk much like the cap-weighted portfolio. In fact, with the exception of low-volatility strategies, the alternate beta strategies typically have a market beta that is close to one. However, as they aim to achieve a better risk-adjusted return than the cap-weighted portfolio, the alternate beta strategies are also subject to significant active risks relative to the market. Figure 9 shows the historical performance of representative alternate beta strategies relative to that of the cap-weighted portfolio. Although these alternate beta strategies have outperformed the market over the examined period, they have all experienced periods of significant underperformance.

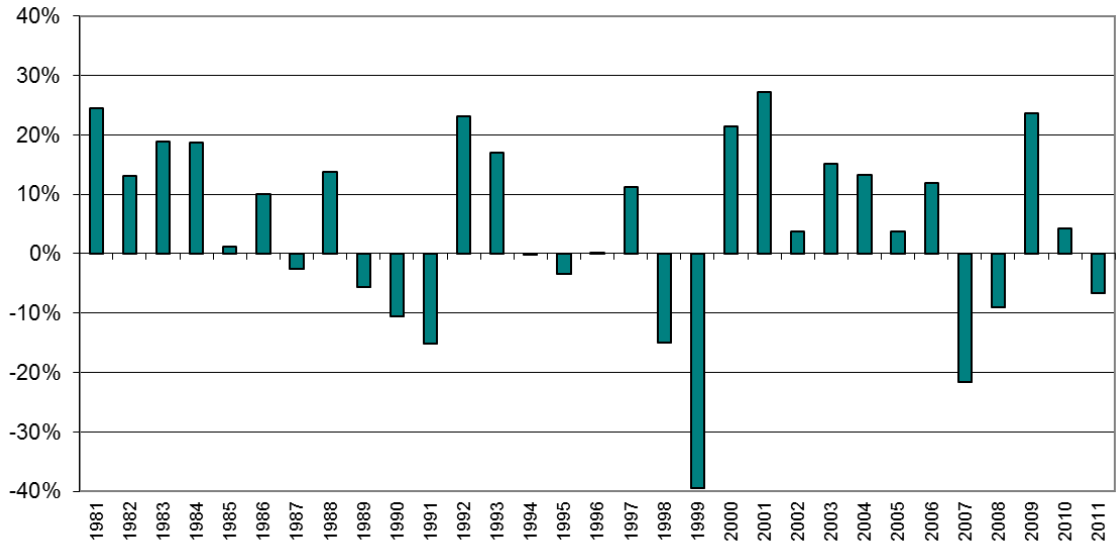
Figure 9: Historical Performance of Alternate Beta Strategies Relative to That of Cap-Weighted Portfolio



Source: S&P Dow Jones Indices, FTSE, AQR Capital Management LLC. Data from December 31, 1990 to October 31, 2011. The Fundamentally Weighted Strategy is represented by MSCI USA Value Weighted Index; the Equal Weighted Strategy is represented by S&P 500 Equal Weight Index; the Low Volatility Strategy is represented by S&P 500 Low Volatility Index; and the Momentum Strategy is represented by AQR US Large Cap Momentum Index. Some of the S&P 500 Equal Weight Index and S&P 500 Low Volatility Index data reflected in this chart may reflect hypothetical historical performance. Charts are provided for illustrative purposes. Past performance is not a guarantee of future results.

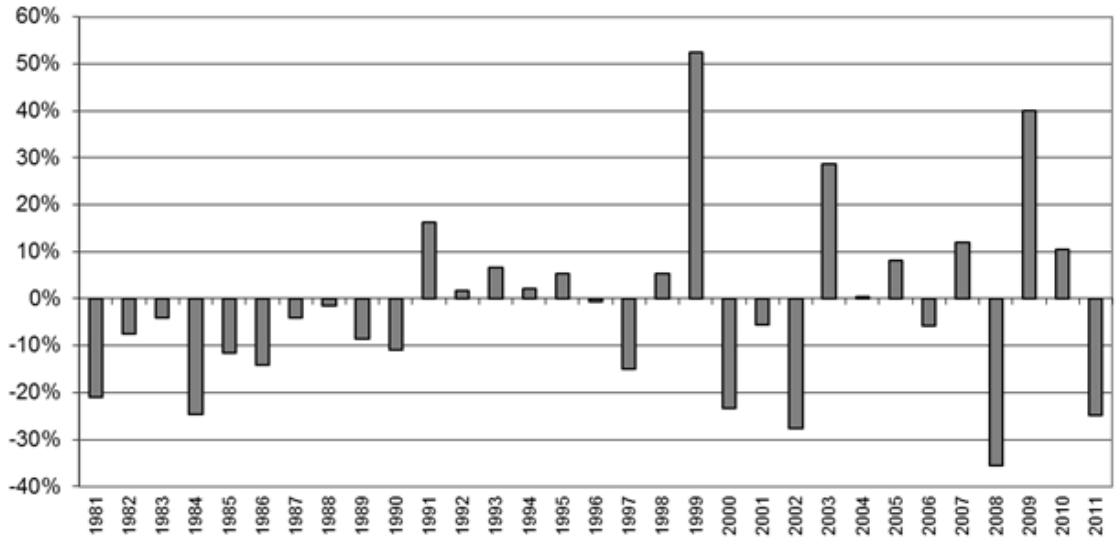
The active risks in alternate beta strategies are often primarily the direct results of those strategies' factor exposures. As factor returns can be volatile over time and difficult to predict, a strategy's active exposures to common factors such as value, small-cap, momentum and volatility can have significant implications for the strategy's performance relative to the overall market. For instance, we have shown in Figure 1 that, over the last 30 years, the value factor was associated with an annualized return of 3.6%, while the volatility factor was associated with an annualized return of -1.9%. However, Figure 10a and 10b demonstrate that both value and volatility factor returns varied greatly during this period. Notably, the value factor was associated with substantial negative returns in 1998-1999 during the IT bubble, as well as in 2007-2008 during the credit crisis. Not surprisingly, Figure 9 shows that the fundamentally weighted strategy significantly underperformed the market during these two periods, as this strategy has significant value exposure. Another observation is that the volatility factor returned over 50% in 1999 and about 40% in 2009, as high-volatility/high-beta stocks outperformed the market in these two years. Correspondingly, low-volatility strategies significantly underperformed the cap-weighted portfolio in 1999 and 2009 (see Figure 9). The implication of these observations is that, despite the potential of alternate beta strategies to deliver better risk-adjusted performance than the market over the long term, investors may need to be prepared for periods of significant underperformance.

Figure 10a: Historical Value Factor Return



Source: Kenneth French's website, Analytic Investors LLC, S&P Dow Jones Indices. Data from January 1, 1981 to October 31, 2011. The returns of the value factor are from Kenneth French's website. The returns of the volatility factor are from Analytic Investors LLC.

Figure 10b: Historical Volatility Factor Return



Source: Kenneth French's website, Analytic Investors LLC, S&P Dow Jones Indices. Data from January 1, 1981 to October 31, 2011. The returns of the value factor are from Kenneth French's website. The returns of the volatility factor are from Analytic Investors LLC.

3.3: Potential Benefits of Combining Alternate Beta Strategies

Another important observation from Figure 9 is that individual alternate beta strategies' periods of underperformance do not always coincide with each other. For example, when the fundamentally weighted, equal-weighted and low-volatility strategies all underperformed during the 1998-1999 IT bubble, the momentum strategy outperformed. When the fundamentally weighted and equal-weighted strategies underperformed in 2008 amid the credit crisis, the low-volatility strategy outperformed during that same period.

After all, as we noted earlier, the active risks of value strategies, low-volatility strategies, diversification strategies and momentum strategies may be driven by different risk factors. As the common equity risk factors may not be highly correlated, combining alternate beta strategies may potentially reduce active risks. Figure 11 provides the

correlations between the common risk factors, and shows that some factors are in fact negatively correlated with each other. In short, the observations from Figure 9 and Figure 11 indicate the potential to diversify active risk by combining alternate beta strategies that are driven by different sets of risk factors.

Figure 11: Correlation Matrix of Common Equity Risk Factors

	Market Factor	Small-Cap Factor	Value Factor	Momentum Factor	Volatility Factor
Market Factor	1	0.25	-0.16	-0.16	0.65
Small-Cap Factor	-	1	-0.20	-0.06	0.66
Value Factor	-	-	1	-0.59	-0.38
Momentum Factor	-	-	-	1	-0.11
Volatility Factor	-	-	-	-	1

Source: Kenneth French's website, Analytic Investors LLC, S&P Dow Jones Indices. Data from January 1, 1981 to October 31, 2011. The correlations are calculated based on monthly returns of the market, small cap, value and momentum factors from Kenneth French's website, and monthly returns of the volatility factor are from Analytic Investors LLC.

Figure 12 shows the historical risk and return profiles of fundamentally weighted, equal-weighted, low-volatility and momentum strategies over the last 20 years. We tested the idea of combining alternate beta strategies by constructing a composite strategy that equally weights all four strategies. The composite strategy achieved a higher return than the S&P 500 with slightly lower volatility (14.2% versus 15.1%). This indicates that diversifying via different alternate beta strategies has limited potential to reduce the total risk of the equity portfolio (a more effective way to reduce portfolio volatility is via low-volatility strategies). However, the more important observation is that the active risk of the composite strategy is significantly reduced to 3.4%, compared with an average of 7.2% for individual strategies. This also results in an information ratio that is significantly higher than that of any one individual strategy, confirming the potential to manage active risks and partially reduce the possibility of significant underperformance by combining alternate beta strategies.

Figure 12: Combining Alternate Beta Strategies

Alternate Beta Strategy	Total Return (%)	Total Risk (%)	Sharpe Ratio	Active Return (%)	Active Risk (%)	Information Ratio
S&P 500	8.8	15.1	0.35			
Fundamentally Weighted	9.6	15.6	0.40	0.8	4.0	0.20
Equal-Weighted	11.3	16.9	0.47	2.5	5.7	0.44
Low-Volatility Strategy	10.2	11.4	0.60	0.014	0.099	0.143
Momentum Strategy	10.6	18.2	0.39	0.017	0.091	0.191
Alternate Beta Composite	10.7	14.2	0.51	0.019	0.034	0.547

Source: S&P Dow Jones Indices, FTSE, AQR Capital Management LLC. Data from December 31, 1990 to October 31, 2011. The Fundamentally Weighted Strategy is represented by MSCI USA Value Weighted Index; the Equal-Weighted Strategy is represented by S&P 500 Equal Weight Index, the Low-Volatility Strategy is represented by S&P 500 Low Volatility Index, and the Momentum Strategy is represented by AQR US Large Cap Momentum Index. The Alternate Beta Composite Strategy is simulated by equally weighting the four alternate beta strategies on a monthly basis. Some of the S&P 500 Equal Weight Index and S&P 500 Low Volatility Index data reflected in this chart may reflect hypothetical historical performance.

4: Conclusions

Although alternate beta strategies aim to achieve better risk-adjusted performance than the cap-weighted portfolio, they are often constructed with more specific objectives in mind. These objectives include achieving a systematic value tilt, lowering portfolio volatility and reducing stock-specific risks. While the risk and return profiles of the alternate beta strategies examined in this paper are to a large degree driven by the well-known equity risk factors (market, value, small-cap, momentum and volatility), the primary factor drivers of individual strategies are often distinct, and in turn may define the essence of the strategy. When evaluating an alternate beta strategy, a starting point for investors may therefore be to examine its objective and risk drivers, in the context of those investors' own investment objectives and preferences for risk-taking.

When it comes to implementation, our analysis suggests that portfolio construction methodologies can have significant implications for the risk and return profiles of alternate beta strategies, and should therefore be examined carefully. Our findings suggest that implementation costs, as well as simplicity and transparency, may also be considered important evaluation criteria.

We caution that alternate beta strategies often take substantial active risks, which are largely driven by their factor exposures. As factor returns can be volatile over time, all alternate beta strategies may experience periods of significant underperformance relative to the cap-weighted market portfolio. However, as common equity risk factors may not be correlated, combining alternate beta strategies that are driven by distinct sets of risk factors may help to reduce the active risk and improve the information ratio.

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Performance Disclosures

The S&P 500 Low Volatility Index (the "Index") was launched on April 20, 2011. All information presented prior to the launch date is back-tested. Back-tested performance is not actual performance, but is hypothetical. The back-test calculations are based on the same methodology that was in effect when the index was officially launched. Complete index methodology details are available at www.spdji.com. It is not possible to invest directly in an index.

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Past performance of the Index is not an indication of future results. Prospective application of the methodology used to construct the Index may not result in performance commensurate with the back-test returns shown. The back-test period does not necessarily correspond to the entire available history of the Index. Please refer to the methodology paper for the Index, available at www.spdji.com for more details about the index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations.

Another limitation of using back-tested information is that the back-tested calculation is generally prepared with the benefit of hindsight. Back-tested information reflects the application of the index methodology and selection of index constituents in hindsight. No hypothetical record can completely account for the impact of financial risk in actual trading. For example, there are numerous factors related to the equities, fixed income, or commodities markets in general which cannot be, and have not been accounted for in the preparation of the index information set forth, all of which can affect actual performance.

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