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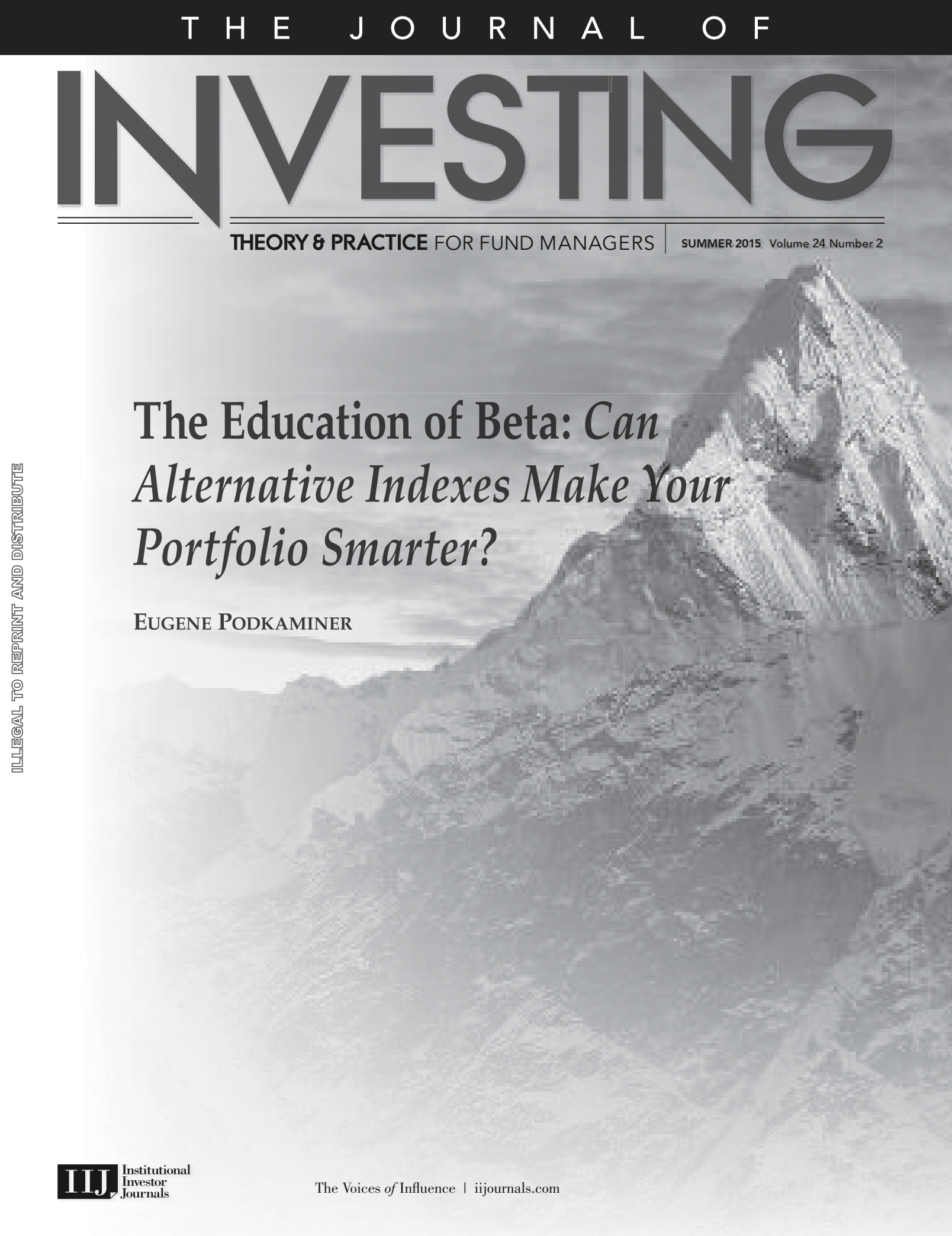

The Education of Beta: *Can Alternative Indexes Make Your Portfolio Smarter?*

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The Education of Beta: *Can Alternative Indexes Make Your Portfolio Smarter?*

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Implementing a strategic asset-allocation policy used to be straightforward: the investor chose between active and passive approaches. Passive index tracking provided broad exposure to a market, a fully diversified benchmark for performance measurement, and passive returns with low implementation fees. Active management was everything else, mainly the realization of manager skill by delivering performance above the passive benchmark. Passive beta has long been synonymous with capitalization-weighted indexes (CWI), where prices and shares outstanding determined a security's weight and rebalancing was nearly automatic. Those were the good old days.

Today so-called smart beta approaches aim to combine both passive and active elements to deliver the best of both worlds: transparent construction, the promise of diversification, and all at low cost. In this article, we explore how such strategies are put together, how they have performed over the past decade and how they can be used by investors. We also discuss observations about their future prospects.

Our research suggests that many forms of smart beta feature pronounced value and small cap tilts, which account for a significant amount of the risk and return differences when compared to CWI. If investors desire such tilts, they can be easily implemented using traditional passive and active strategies. The broader question remains: What is the economic justification for such tilts to outperform over the long term? Without a satisfactory answer, many smart beta strategies may not be a good fit for institutional portfolios.

THE DEMAND FOR SMARTER INDEXES

Though widely used, CWI have their shortcomings. Securities with inflated prices can balloon to take up a larger and larger share of an index, like technology stocks during the dot-com bubble or financials prior to the 2008 crisis. Investors who like to avoid bubbles (wouldn't we all) have loudly, and often correctly, criticized traditional indexes for promoting stocks with poor fundamentals only to see values come crashing down after the bubble has popped.

An increasing number of investors have been calling for different ways of constructing indexes, with weights determined by approaches as diverse as simple averages, quality of cash flows, or risk. These investors see CWI as inefficient and have conviction that they can be smarter about index construction. Some of these alternative indexes have been around for decades, others are newer and seek to make traditional beta smarter.

First a brief comment on naming: many new strategies in this area are called smart

beta, a name we dislike because it tells you nothing about how it is smarter than plain-old dumb beta. The same goes for the terms strategic, scientific, advanced, engineered, and even better beta. We refer to strategies that do not use capitalization weights as alternative indexes because they represent an alternate approach to the norm. Many styles fall under the broad umbrella of alternative indexes, including low volatility indexes, equally weighted indexes, and fundamental indexes. The category seems to be better defined by what it is *not*, rather than by what it is: alternative indexes are *not* capitalization weighted. They are also more expensive than traditional index strategies, but cheaper than traditional active management.

WHAT WAS OLD IS NEW AGAIN

Like many financial innovations, alternative indexes became popular in the wake of a crisis. Investor reaction to major drawdowns, increased focus on diversification, and bubble avoidance set the stage for strategies that would have done better through the turmoil of 2008. Though the monikers *smart beta* and *alternative index* are relatively new, the design has been around for decades. Take the Dow Jones Industrial Average (DJIA), first started in 1896. It is composed of a concentrated sampling of economically significant large companies. These securities are then weighted using a lightly modified cap-weighted formula with some constraints. In effect the DJIA is a "smart" index, though rarely referred to as such. Many more examples dot the landscape, including simple GDP- and equal-weighted equity indexes. The difference today, however, is not just the marketing. Novel construction can lead to strategies with unique traits. Similar to the dot-com boom, when placing a lower case *i* or *e* in front of a company's name nearly guaranteed a higher earnings multiple, it would seem that calling your strategy smart beta instantly makes it more interesting and relevant, and promises higher returns.

THE GENESIS OF BETA AND ALPHA

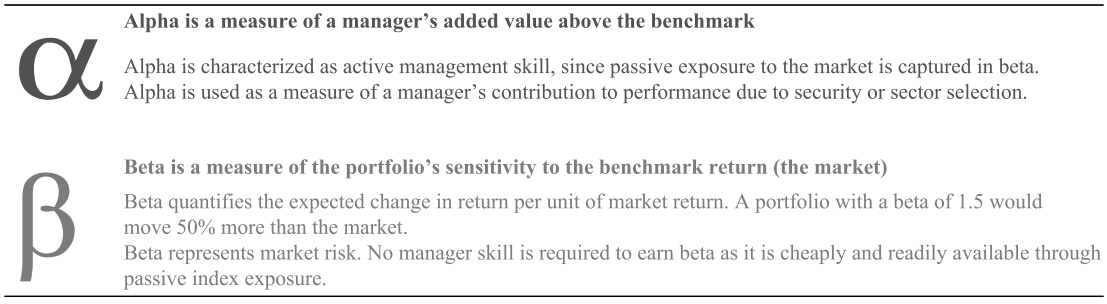
Beta and alpha are at the core of the alternative index discussion. Sharpe et al. popularized the concepts of beta and alpha through the capital asset pricing model (CAPM), introduced in 1964 (Sharpe [1963, 1964]). By streamlining the tenets of Markowitz's earlier modern portfolio theory (MPT) into a compact and tractable framework (Markowitz [1952]), CAPM introduced the market as a factor through a simple yet powerful relationship:

$$r_p - r_f = \alpha_p + \beta_p (r_m - r_f) + e_p$$

Translation: a portfolio's return is comprised of alpha (the portion of return not explained by the market), plus the return of the market multiplied by a beta term.[1] Under this construct the market has been traditionally defined as a capitalization-weighted index. Over time, the word "beta" has come to be synonymous with the return of the market.

Sharpe's CAPM approach describes the traditional difference between beta and alpha that, until recently, was the norm for many asset owners (Exhibit 1).

EXHIBIT 1
Defining Alpha and Beta



Source: Callan.

THE IMPORTANT DIFFERENCE BETWEEN BETA AND ALPHA

Beta, based on the CAPM definition, is compensated unconditionally, regardless of manager skill. This point is important because it means that investors are inherently compensated for taking on market risk, or beta, which can be accessed relatively cheaply and reliably through index funds. Active management, on the other hand, aims to access elusive alpha, which—as Sharpe succinctly points out in "The Arithmetic of Active Management"—is a zero-sum game across all market participants (Sharpe [1991]). An active investor that engages in security selection, market timing, sector rotation, and so on, in pursuit of excess return is only compensated conditionally on their skill. Since skill that generates alpha (or specifically, positive alpha) is difficult to come by, it commands a higher price in the marketplace.

THE EVOLUTION OF BETA

During the late 1970s and early 1980s, the CAPM framework was adopted as the standard tool for measuring the efficacy of active management—revealing just how scarce positive alpha was. Meanwhile, the evolution of portfolio management tools and trading techniques made the implementation of passive CWI ever cheaper and more reliable. The combination of these two trends led to the widespread adoption of passive management.

Beginning in the late 1980s, Sharpe (and many others) began to recognize that for many active strategies a sizeable portion of the alpha attributed to manager skill by the CAPM could be reproduced using simple rules-based approaches (Exhibit 2). The CAPM framework was extended by using the arbitrage pricing theorem (APT), which expands beta from a single market measure to include any number of factors (Roll and Ross [1980]). APT enables us to think in terms of multiple betas (or factors), including style (growth and value), capitalization (large, mid, small), and momentum (persistence among winners). This led to the development of rules-based style indexes such as the Russell 1000 Growth Index or the S&P 600 Small Cap Value Index. These indexes represented both a more accurate way to measure the true alpha being generated by a strategy, and a cheaper way to passively access the persistent factor exposures inherent in a strategy.

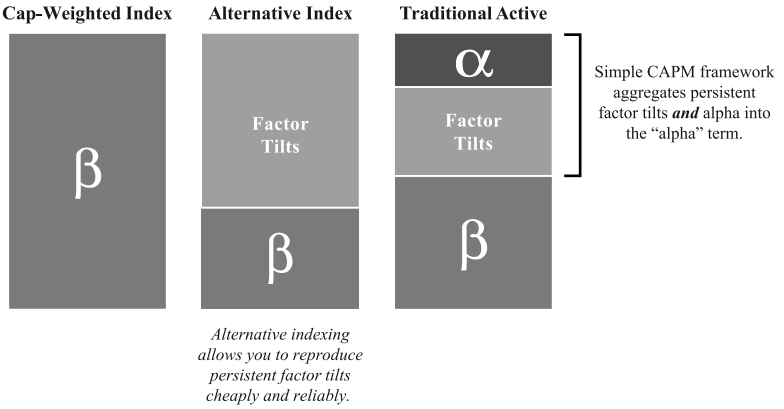
Conceptually, many smart beta strategies are really no different from the original style indexes. Though each of these newer strategies may emphasize a different set of market exposures, they all use fairly transparent rules-based approaches to efficiently and cheaply implement a combination of factors. The challenge for investors is in deciding which factors to emphasize (if any), and to implement them consistently across a complex multi-asset class portfolio.

BUILDING BETA: THREE DECISIONS FOR INDEX CONSTRUCTION

Building an index, whether smart, cap-weighted, or otherwise, relies on three important decisions: 1) defining the investable universe (for example, emerging market small cap or U.S. broad cap); 2) determining the weighting scheme; and 3) specifying constraints (for example, maximum position sizes or liquidity parameters). Alternative indexes tend to differ from traditional CWI on all three levels (Amenc et al. [2012]). Exhibit 3 presents a hierarchy for index construction and separates the weighting decision into three schemes:

a. Simple reweighting includes equal weightings across securities, countries, or regions/geographies; equal contribution to risk; and GDP weighting.

EXHIBIT 2
The Evolution of Alpha and Beta



Source: Callan.

EXHIBIT 3
Build an Index in Three Easy Steps

Source: Callan.

b. Risk-aware weighting focuses on the contribution to portfolio risk and can result in risk-weighted, minimum/low volatility/variance, as well as maximum Sharpe ratio portfolios (which use both risk and return).
c. Return-aware weighting focuses on some combination of fundamental factors such as value, dividend, momentum, and quality, which are presumed to have a persistent positive influence on return.

Before proceeding to alternative indexes, we briefly explore how three common cap-weighted equity indiexes are constructed: the S&P 500, Russell 3000, and MSCI EAFE.

- The S&P 500's universe selection includes "500 of the top companies in leading industries of the U.S. economy" with market capitalizations of more than $4.6 billion (as of March 31, 2014), and with at least 50% of the shares outstanding available for trading. The inclusion criteria are carefully managed by committee and therefore do not simply represent the largest 500 companies. Constituent stocks are weighted based on market capitalization and constraints, including positive earnings over recent periods and adequate liquidity.[2]
- The Russell 3000 is more transparent in construction, as the universe selection consists of all U.S. common stocks. These are ranked annually from largest to smallest market capitalization, and the top 3,000 stocks form the Russell 3000 Index. Constraints exclude stocks that trade for less than $1.00, stocks with market capitalizations under $30 million, and foreign stocks.[3]
- The MSCI EAFE (Europe, Australasia, and Far East) selects the largest 85% of stocks from each of 21 developed market countries, weighted by free-

float adjusted market capitalization (which includes only shares readily available in the market), with typical liquidity and investability constraints applied.[4]

Build Your Own Index

In the cap-weighted examples above, the universe selection alone can provide a portfolio bias toward some characteristics (as in the S&P 500), whereas the weighting scheme determines how individual securities are combined. Some alternative indexes are specified entirely at the universe selection level. For instance, the allowable universe can be defined as low volatility stocks (those with lower historical standard deviations), but the weighting scheme may be cap weights. Typically alternative indexes both redefine the universe and employ an alternative weighting scheme. A low volatility index may use the same starting point as the example above, but can weight those low volatility securities in a risk-minimizing manner to create a minimum variance portfolio. Multiple approaches can be combined, and the process can be applied to equity or fixed income securities.

The Limits of Diversification

Many alternative index approaches introduce tilts when compared to traditional CWI, such as overweighting value or small cap stocks. These factor tilts seem incidental at first. They are rarely obvious when learning about how a particular strategy is built, but they are crucial to our understanding of how alternative indexes differ from CWI. Just like traditional CWI, alternative indexes focus on a single asset class, equities most often, and are long only (no shorting is allowed). Although alternative indexes can be found in several asset classes, we focus our analysis exclusively on U.S. equity strategies.

Exhibit 4 illustrates the distinction between alternative indexes and multi-asset class strategies, such as risk factor, risk premia, or risk parity, many of which use shorting. This distinction is important because if you desire to isolate a particular factor (for example, value), then doing so across several asset classes with the ability to short is surely more efficient than limiting a strategy to a single asset class and prohibiting short selling (Grinold and Kahn [2000]).

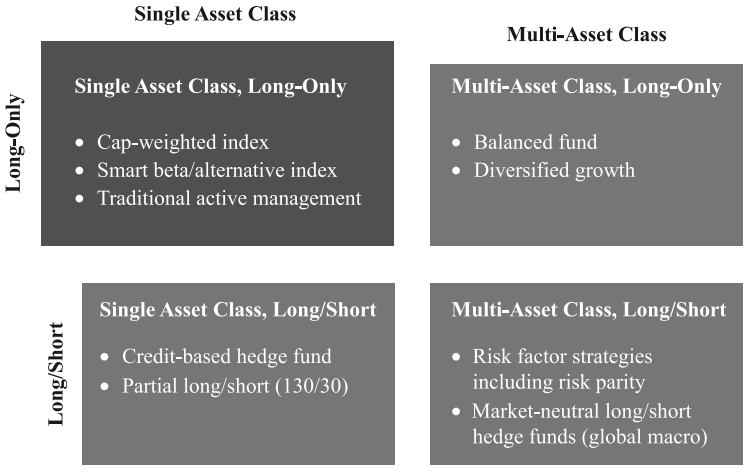
And therein lies the rub. Smart beta strategies are often marketed as good diversifiers or volatility reducers. But if the index is composed of the same securities as a CWI (for example, large cap U.S. stocks), then no matter how much you reweight the names, a very high degree of correlation remains. The same goes for volatility. Certainly, some low volatility strategies have lower risk, but there is no reason to expect that a different weighting scheme will magically result in an overall public equity portfolio that is appreciably less risky.

The three most popular types of alternative indexes are low volatility, fundamental, and equally weighted. We take a closer look at each to better understand what benefits these strategies deliver, how they can be used within a portfolio, and the assumptions on which they are based.

Low Volatility Indexes

The promise of low volatility strategies is to reduce the total risk (as measured by standard deviation)—as opposed to active risk—of the index by carefully selecting less risky stocks. This, in aggregate, is designed to result in a more efficient portfolio with returns similar to the overall market. Low volatility stocks can have a value bias because dull companies that do not grab headlines

EXHIBIT 4
Examples of Alternative Indexes and Other Strategies



Source: Callan.

tend to be less volatile than the hot technology firm that just released the new must-have mobile device or the pharmaceutical company that just obtained FDA approval for a drug. We often hear behavioral finance arguments put forth for why low volatility strategies will continue to outperform CWI: irrational investors shun lower-risk stocks (and overpay for higher-risk stocks), classic return-chasing behavior by emotional investors, and asset managers focusing on information ratios rather than Sharpe ratios. Not all market participants believe that these behaviors will persist.

Low volatility strategies represent a number of approaches that include minimum volatility, minimum variance, and maximum Sharpe ratio (MSR). Though these terms sound somewhat similar, there are big differences in the way each strategy is assembled. There are three main approaches to putting together such an index. The first involves just picking from a set of low volatility stocks and using capitalization weights. The second expands on this by using optimization tools to weight the low volatility stocks into a low volatility portfolio. The third approach is to select from low and high volatility stocks and optimize them into a portfolio with the best return/risk ratio (as represented by the Sharpe ratio). The subtleties are important because each approach leads to a unique portfolio.

The MSCI USA Minimum Volatility Index uses the MSCI USA as a starting point and optimizes the stocks for the lowest absolute volatility (subject to constraints which help maintain investability). On the surface, the strategy seems to meet the stated goals: over the past 10 years ending December 31, 2013, performance has exceeded the S&P 500 by 0.85% whereas realized standard deviation has been lower (11.66% versus 14.69%). However, over the past five years ending December 31, 2013, performance has lagged the CWI S&P 500 by 1.56%. Tracking error, when compared to the S&P 500, has been similar to many traditional active managers, in the 5% to 7% range—a far cry from the 0% expected of cap-weighted index-tracking funds.

We use a Sharpe returns-based style analysis to plot the footprints of the strategy over the past 10 years (using rolling three-year periods) in Exhibit 5 (Sharpe [1992]). For comparison and reference, we include the standard MSCI USA Index. We observe two biases: an overweight to smaller cap stocks (especially between 2003 and 2008) and a pronounced value tilt (darker-shaded bars). The choppiness observed in the low volatility analysis is due to frequent required rebalancing, a hallmark of all alternative index strategies. The MSCI USA Minimum Volatility Index annual turnover is constrained to a maximum of 20% as compared to a realized turnover of 2.5% for the cap-weighted MSCI USA.[5]

The R^2 measure, which can range from 0 to 1, indicates the proportion of variation in the returns that is explained by the characterization in the style analysis. The minimum volatility index's R^2 is nearly 0.75, which implies a moderately strong relationship: something other than simply reweighting slices of CWI is responsible for the return pattern. For reference, the MSCI USA Index R^2 is 0.99.

In Exhibit 6, we use a style map to offer another perspective on the difference that index construction choices make between the minimum volatility index (in orange) and the MSCI USA Index (in teal). The ovals for each index represent roughly 80% of the observations and provide an indication of drift. Whereas the MSCI USA Index is very close to the S&P 500 (both are large cap and style neutral), the minimum volatility index is skewed to value and lower capitalization stocks. These two factor tilts (small cap and value) are observed in other low volatility indexes as well.

But what about diversification? Does adding a minimum volatility strategy reduce the overall equity portfolio's risk? Over the past 10 years ending December 31, 2013, this strategy has exhibited a 0.93 correlation with the S&P 500. Despite lower risk than cap-weighted indexes, it is still highly correlated with them. (See Appendix A for correlations with a range of standard indexes and excess correlations against other alternative index strategies.)

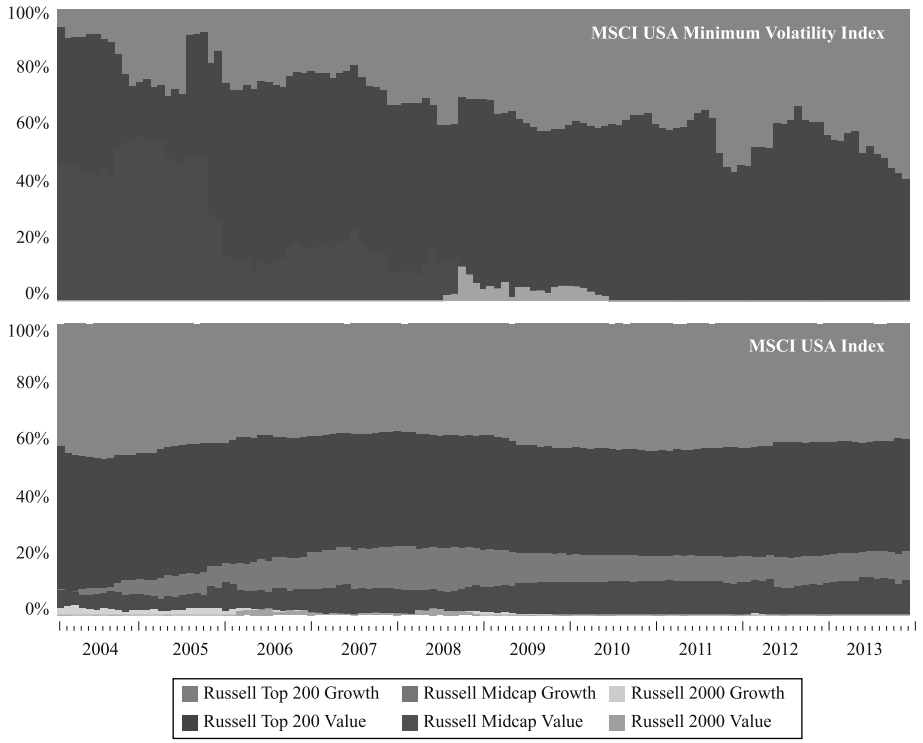
FUNDAMENTAL INDEXES

Fundamental indexes shun market capitalization as the appropriate measure of economic size, and instead focus on various alternative measures including sales revenue, cash flow, dividends, and stock buybacks. The Russell Fundamental U.S. Index uses all three of these alternative measures (Russell partners with Research Affiliates to develop the Index). Using sales figures adjusted for leverage minimizes heavily leveraged companies; operating cash flow is a proxy for balance sheet health; and dividends plus stock buybacks reflects on overall enterprise health and management confidence. The goal of such strategies is to take advantage of the

EXHIBIT 5

MSCI USA Minimum Volatility and MSCI USA Style Analyses

(monthly data for 10 years ending 12/31/2013, rolling 36-month periods)

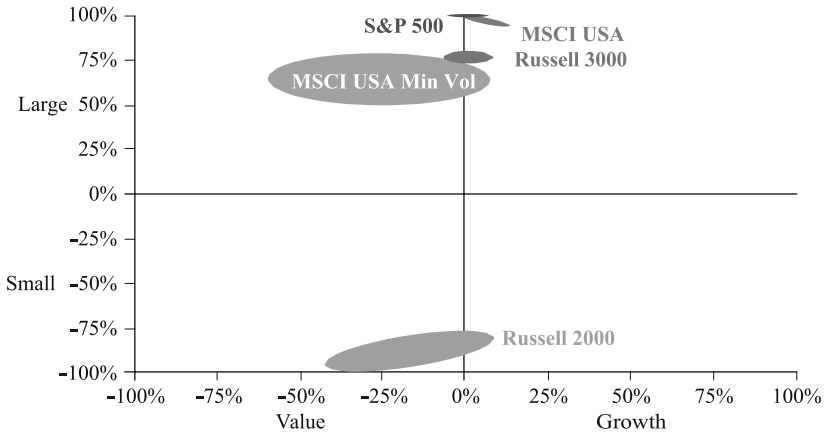


Sources: Callan, MSCI.

EXHIBIT 6

MSCI USA Minimum Volatility Index Style Map

(monthly data for 10 years ending 12/31/2013, rolling 36-month periods)



Sources: Callan, MSCI, Russell, Standard & Poor's.

disconnections between share prices and other fundamental metrics of company success.

The style analysis footprints of the fundamental index point out a strong value bias (nearly all of the bars are darker shades) and a tilt toward smaller cap stocks, as seen in Exhibit 7. Unlike the previous low volatility example, the style analysis R^2 is high (0.9896), which implies that we could recreate this index by using a combination of cap-weighted passive (or active) portfolios. The Russell Fundamental U.S. Index's annual turnover is expected to be between 10% and 12% (Hsu and Campollo [2006]). For reference we include the standard Russell 3000 Index style analysis.

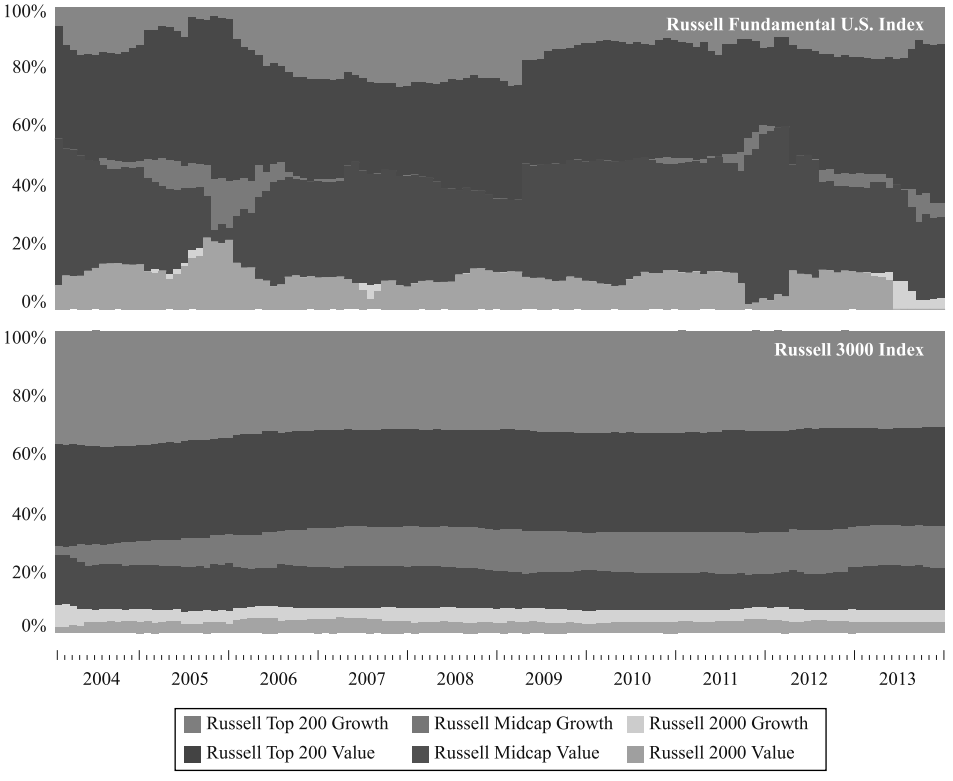
This fundamental index has outperformed the S&P 500 by 2.65% over 10 years ending December 31, 2013, but with moderately more volatility (15.98% versus 14.69%). Tracking error is nearly 3% over this period. Over the past five years, we find that performance, total risk, and tracking error are each higher. Tracking error for the fundamental index is lower than the minimum volatility index because the strategy hews closer to the cap-weighted benchmark, as seen by the higher R^2 and somewhat smoother style analysis. In the total risk dimension (as opposed to tracking error), the minimum volatility index is lower than the fundamental index (11.66% versus 15.98% for 10 years ending December 31, 2013).

Exhibit 8 illustrates characteristics of the Russell Fundamental U.S. Index using a style map. The pronounced value bias and small capitalization tilt are readily apparent. Similar to the low volatility index, the correlation with the S&P 500 is very high (0.9860), limiting the benefit of diversification.

EXHIBIT 7

Russell Fundamental U.S. and Russell 3000 Style Analyses

(monthly data for 10 years ending 12/31/2013, rolling 36-month periods)

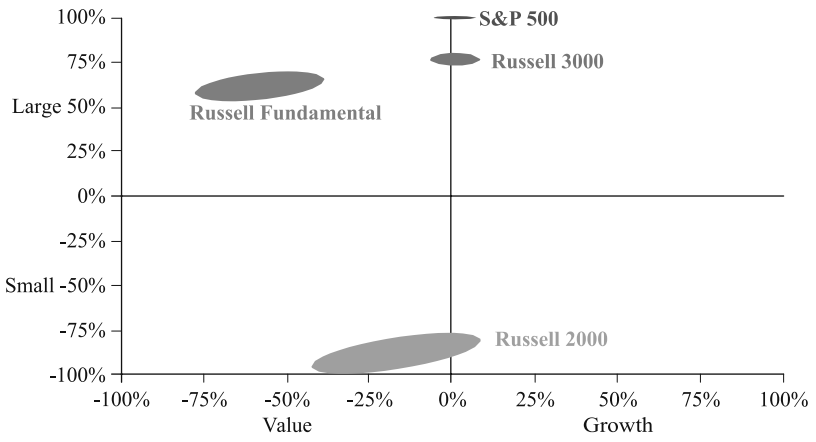


Sources: Callan, Russell.

EXHIBIT 8

Russell Fundamental U.S. Index Style Map

(monthly data for 10 years ending 12/31/2013, rolling 36-month periods)



Sources: Callan, Russell, Standard & Poor's.

EQUALLY WEIGHTED INDEXES

Equal weighting is the simplest form of index construction. In light of the more complex approaches discussed earlier, averaging an entire universe eliminates many complicated choices. One well-known example is the S&P 500 Equal Weight Index, which consists of the same constituents as the widely tracked S&P 500, but with each company allocated a fixed 0.2% weight. Intuitively, we know that such a weighting scheme will introduce a significant small cap bias because the stocks that have a lower market capitalization are now held at the same weight as major multinational corporations. We expect that the portfolio will likely also have a value tilt because equal weighting will expand the presence of value stocks, which tend to trade at lower multiples. Equal weighting is widely used in active management, where, for instance, a fundamental manager will equally weight 30 high-conviction stocks to form her portfolio.

The style analysis in Exhibit 9 confirms both of these exposures. Notice the scarcity of large cap (green bars) and the prevalence of value (dark shading). The R^2 of the equally weighted index is 0.9827, which means that the vast majority of the variation in returns is explained by the style analysis characterization. For 10 years ending in 2012, the average annual turnover for the equal-weight index was 24.7%, much higher than the S&P 500's turnover of 6.3% (Zeng and Luo [2013]). For comparison we include the standard S&P 500 Index style analysis.

The style map in Exhibit 10 illustrates the relative magnitude of the value and small cap tilts, both of which are pronounced.

As with the two previous examples, performance relative to the S&P 500 has been strong over the past 10 years ending December 31, 2013, with the equal-weight index beating the cap-weighted benchmark by 2.38%. However, historical risk over this period was much higher, 17.61% versus 14.69% for the S&P 500. Similarly, tracking error is near 5%. This index relies on the same stocks as in the S&P 500, so we expect a very high correlation with the cap-weighted index. Over the 10-year period ending December 31, 2013, the correlation is 0.9743. Looking forward, we have a hard time developing an economic justification for why equal weighting a portfolio should deliver outsized returns.

All three alternative index strategies seem to exhibit positive performance versus cap-weighted benchmarks. This could be for a variety of reasons, including the use of data mining in the development of these strategies. Value and small cap were rewarded over the past 10 years; the amount of readily available data does not include many periods where these strategies underperform. Factor tilts are prevalent in alternative indexes and have certainly paid off recently—but is it reasonable to assume that they will do so going forward? (Amenc and Martellini [2014]).

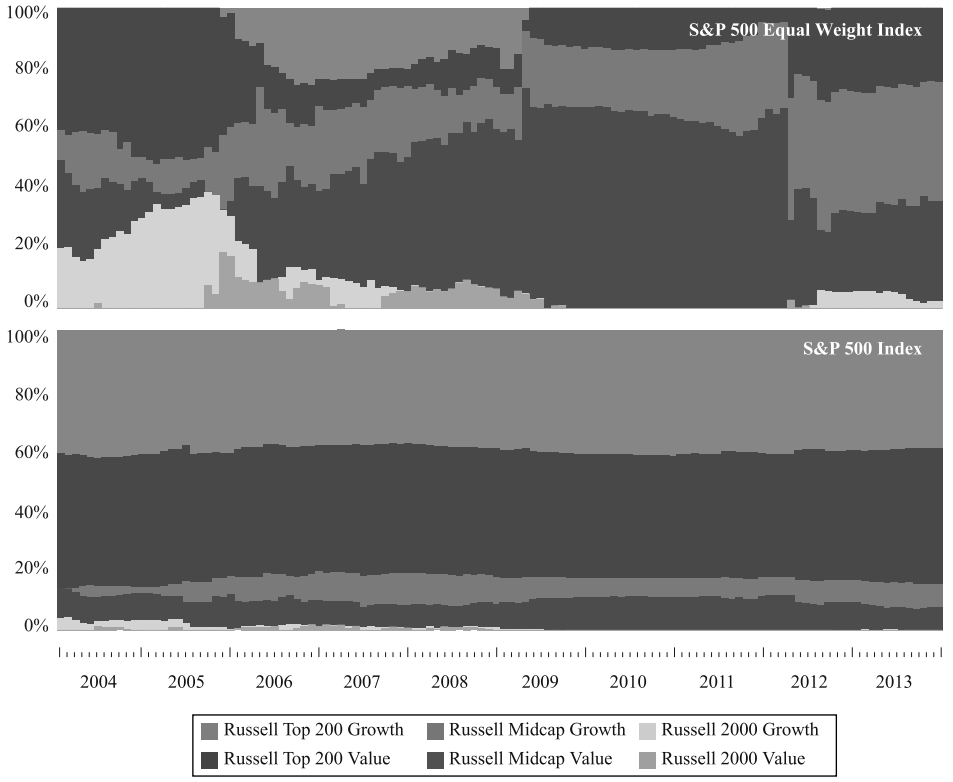
Interested readers can examine findings from eight additional alternative indexes covering U.S. and non-U.S. equity in Appendix A. Results are broadly similar across all strategy types.

ALTERNATIVE INDEXES: ACTIVE OR PASSIVE?

Does a mechanical, rules-based strategy meet the definition of active management? A strong argument can be made that any weighting scheme or security-selection process other than cap-weighted is active. For a real world illustration we turn to low-risk active or

EXHIBIT 9
S&P 500 Equal Weight and S&P 500 Style Analyses

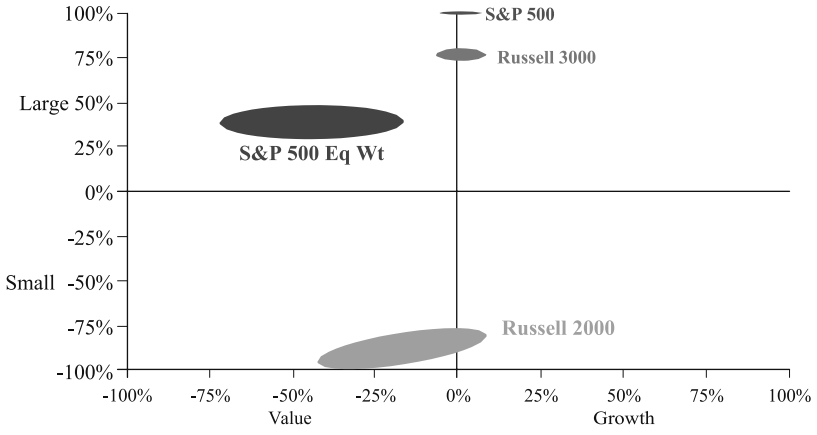
(monthly data for 10 years ending 12/31/2013, rolling 36-month periods)



Sources: Callan, Standard & Poor's.

EXHIBIT 10
S&P 500 Equal Weight Index Style Map

(monthly data for 10 years ending 12/31/2013, rolling 36-month periods)



Sources: Callan, Russell, Standard & Poor's.

enhanced indexing strategies popularized in the 1990s by quantitatively oriented asset managers. These strategies start with a CWI, and then carefully reweight the component stocks or bonds within tightly defined parameters while adhering to industry and sector neutrality.

Enhanced index strategies were presented to investors as lower-fee, quasi-passive products, but were then typically categorized as active strategies because the portfolio manager's judgment could effectively override model weights. The primary difference between alternative and enhanced index strategies has to do with where decisions are made in the hierarchy of portfolio management events—in universe selection and weighting schemes for alternative index

strategies, and in security selection for enhanced index products (given that the universe selection is the same as the underlying benchmark and differences between benchmark capitalization weighting and enhanced portfolios are relatively small). Another big difference is that enhanced index strategies are tuned to minimize tracking error relative to a traditional CWI, whereas alternative indexes are constructed without tracking error in mind. Selecting a *tilt* is itself an act of judgment, and renders the resulting alternative index strategy active. The decision to include an alternative index strategy in a portfolio is an active one, even if the implementation of the strategy is mainly passive. The investor is making an active choice, akin to the decision that an asset manager makes when tilting a portfolio toward a certain factor, security, sector, or region.

Like active management, if all market participants adopted alternative index strategies, the average of their investments would still aggregate to traditional CWI definitions. This process feeds back into setting prices and informs CWI weights. Alternative indexes aggregate to a zero-sum game.

WHERE DO ALTERNATIVE INDEX STRATEGIES FIT IN THE PORTFOLIO?

Alternative index strategies are typically single asset class and long only, and are relatively easy to place within the corresponding equity or fixed income sleeve. Some investors may want to include alternative index strategies in their hedge fund or alternatives allocations. However, should capital for alternative index strategies be sourced from existing active or passive CWI allocations? The answer may depend on how skeptical the investor is of traditional active management. Allocating to lower-fee, transparent, and mechanical alternative index strategies may make sense for investors who grudgingly engage in active management. On the other hand, investors who are convinced of the merit of active management may wish to exchange traditional index holdings for alternative index strategies (resulting in additional tracking error). We have observed alternative index strategies used in the following ways:

- Low/minimum volatility strategies coupled with liability-driven investing (LDI) portfolios promise low surplus risk[6] for investors who are hedging liabilities.
- Low/minimum volatility strategies, used when an investor is required to hold a high equity allocation, aim to reduce overall portfolio risk.
- Fundamental index strategies can be a substitute for CWI if the investor believes they are more representative of the market, or as a substitute for active managers for active-management nonbelievers.
- Equally weighted approaches intentionally lower portfolio capitalization, which offers liquidity to the small cap market.

All alternative index strategies strive to deliver a return stream different from traditional strategies, but as previously noted, their diversification has limits.

Characteristics When Added to a Portfolio

To see how alternative indexes interact with the other portfolio components, we show the risk-and-return effects of adding a 15% allocation to each of the three alternative indexes analyzed in detail; this allocation is carved out of the U.S. equity cap-weighted Russell 3000 Index in Exhibit 11. We begin with a reference portfolio made up of 30% U.S. equity (Russell 3000), 30% developed ex-U.S. equity (MSCI EAFE), and 40% U.S. investment-grade bonds (Barclays Aggregate). For the 10 years ending December 31, 2013, the reference mix returned 6.65% (with 9.95% standard deviation).

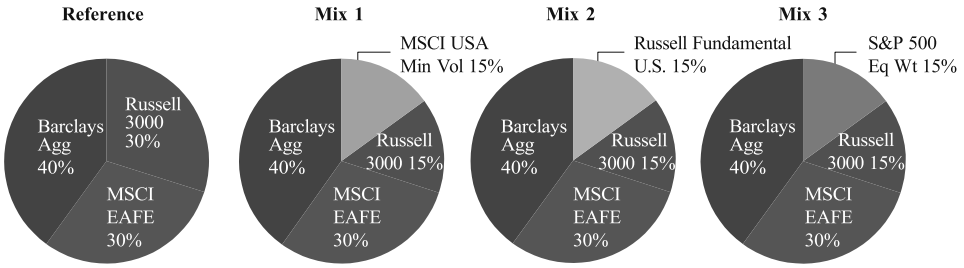
Mixes 1, 2, and 3 each add 15% to a single alternative index strategy (MSCI USA Minimum Volatility Index, Russell Fundamental U.S. Index, and S&P 500 Equal Weight Index, respectively). All three mixes achieved higher return than the reference portfolio, but Mix 2 and Mix 3 did so by assuming more risk, whereas Mix 1 (with the minimum volatility index) somewhat lowered portfolio risk. Detailed characteristics for each strategy can be found in Appendix A.

This backward-looking analysis suggests that adding moderate amounts of alternative index strategies to a standard-reference portfolio slightly improves risk-adjusted return characteristics. Whether these relationships persist going forward is the obvious question for asset owners. To assert a return premium or risk advantage over CWI, we must believe that the universe-selection and weighting-scheme decisions offer an economic or behavioral rationale for better returns.

As a counterpoint to the first three mixes, we construct Mix 4 by excluding all alternative indexes

EXHIBIT 11
Adding Alternative Indexes to the Portfolio

(data for 10 years ending 12/31/2013)



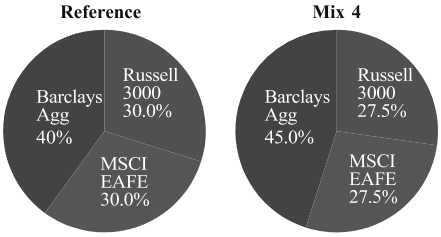
	Reference	Mix 1	Mix 2	Mix 3
10-Year Annualized Total Return	6.65%	6.69%	6.98%	6.96%
10-Year Annualized Std. Dev.	9.95%	9.34%	10.02%	10.25%
10-Year Sharpe Ratio	0.500	0.537	0.530	0.515
10-Year Beta	0.648	0.603	0.654	0.668

Source: Callan.

and instead adding 5% to fixed income sourced from global equity (Exhibit 12). Intuitively, we expect the total portfolio's historical return to decrease, and it does so by 0.14% (from the reference mix's 6.65% to 6.51% over the past 10 years). However, 10-year historical risk falls by more than 0.76% (from 9.95% to 9.18%). If the investor's objective is to reduce risk and increase the return/risk ratio, then adding bonds to an equity-heavy portfolio historically provides more powerful results than changing the mix of equity strategies to include alternative indexes. Note that fixed income may offer a different forward-looking risk-adjusted return profile than we have historically observed. This point bears repeating: The market consensus points to weak fixed income returns over the next several years. Forward-looking asset allocation decisions require appropriate forward-looking views.

EXHIBIT 12
Changing the Asset Allocation

(data for 10 years ending 12/31/2013)



	Reference	Mix 4
10-Year Annualized Total Return	6.65%	6.51%
10-Year Annualized Std. Dev.	9.95%	9.18%
10-Year Sharpe Ratio	0.500	0.527
10-Year Beta	0.648	0.596

Source: Callan.

ASSET OWNERS AS ASSET MANAGERS

Many institutional asset owners already engage in a big-picture form of smart beta by biasing portfolios toward small cap, value, their home country, and emerging markets. Using traditional active managers, the investor typically specifies the universe (for example, emerging-market debt or global developed equity) and the manager is responsible for security selection or weighting (Exhibit 3). By contrast, with an alternative index strategy, these decisions are shifted to the asset owner. This shift on a policy level, from CWI to alternative indexes, moves some of the asset-management burden to the asset owner because they are now responsible for security selection and other basic strategy definitions. Those investors allocating to alternative index strategies should have appropriate governance and benchmarking policies in place.

CONCLUSION

This article explores the origins of alternative indexes, how their construction reveals specific factor tilts, and their impact when paired with traditional cap-weighted indexes in a portfolio. Examining three alternative index strategies in detail, we found that they feature significant exposure to value and small cap, which may not be rewarded in the future, though historical performance has been favorable. The various tilts found in alternative index strategies are obscured by naming conventions and marketing, but are readily apparent upon empirical examination. Interested readers can find additional analysis (including a Fama–French–Carhart regression) on 11 alternative indexes in Appendix A.

Alternative indexes are one way to express a belief in value and small cap factor tilts. Investors already use traditional value and small cap strategies (active and passive) to tilt portfolios toward these factors. For an investor who *really* believes in value and small cap (or other factors), the most efficient way to implement is by adopting a risk-premia strategy that can invest across multiple asset classes and permits short selling, which is far more compelling than a single-asset-class, long-only alternative index strategy (Podkaminer [2013]). Additionally, alternative indexes appear to offer minimal diversification benefits versus traditional cap-weighted indexes: Rearranging stocks picked from the same pool still leads to very high correlations.

Investors who are skeptical of active management can use alternative indexes to extend a passive core to obtain exposure to desirable factors in a transparent manner. On the other hand, investors who believe in the value of active management can use alternative indexes to obtain low-cost, semipassive exposure in a portfolio dominated by traditional active strategies. Regardless of your perspective, the availability of a middle-ground option located between active and passive enables greater control in constructing portfolios of managers when implementing a strategic asset allocation.

APPENDIX A

We expand on the three alternative index analyses presented earlier to include an additional eight strategies.

Empirical analysis provides intuition about the performance and risk differences between cap-weighted and alternative indexes. However, the time period examined substantially impacts the results. Data for many alternative indexes are available only in back-test form, and even then the history tends to be brief by statistical standards. The dearth of data coupled with the unusual period suggests placing less emphasis on historical empirical results versus forward-looking expectations. Additionally, the wide-scale adoption of factors and tilts is a relatively new phenomenon, which is not captured in the back-test period.

Our analysis includes 11 alternative equity indexes (six U.S. shaded in green and five developed ex-U.S. shaded in orange). Each index is picked for its unique construction, which is based on various choices for universe selection, weighting scheme, and constraints (Exhibit A1).

MSCI: The minimum volatility indexes strive to reflect the performance characteristics of a minimum variance strategy by optimizing the parent index (MSCI USA and MSCI EAFE in this analysis) for the lowest absolute volatility for a given covariance matrix of stock returns within a set of constraints that maintain index replicability and investability. Constraints include turnover limits along with minimum and maximum constituent allocations and sector and country weights relative to the parent index. The index is rebalanced (or reoptimized) semiannually.

S&P: The equal-weight index consists of the same constituents as the widely tracked S&P 500, but each company is allocated a fixed weight (0.2%) and is rebalanced quarterly.

Russell/Research Affiliates: The index starts with the Russell Global Index universe with a liquidity screen applied that captures 95% of liquidity based on average daily dollar-traded volume to facilitate investability. Three measures of economic size are selected: adjusted sales, retained operating cash flow, and dividend plus buybacks, all averaged over five years. Securities representing the bottom 2% of the fundamental weight are removed to enhance investability.

FTSE RAFI: The index comprises 1,000 companies with the largest RAFI fundamental scores selected from the corresponding FTSE parent indexes. The scores are based on four fundamental factors: dividends, cash flows, sales, and book value. Screens are applied for liquidity, and the index is reviewed annually.

ERI: The maximum deconcentration strategy aims to maximize the effective number of stocks, which is equivalent to minimizing the concentration as measured by the Herfindahl Index. This strategy aims to get as close as possible to equal weights while respecting practical investment constraints, including turnover and liquidity concerns. The maximum decorrelation strategies combine securities specifically to exploit the risk-reduction effect stemming from low correlations (instead of reducing portfolio risk by concentrating in low volatility stocks). For high-liquidity indexes, only the most liquid constituents are selected (those with a score

EXHIBIT A1
Alternative Index Characteristics

Strategy	1) Universe Selection	2) Weighting Scheme	3) Constraints
MSCI USA Minimum Volatility	MSCI USA	Minimum Variance	Replicability, Investability, and others
MSCI EAFE Minimum Volatility	MSCI EAFE	Minimum Variance	Replicability, Investability, and others
MSCI EAFE GDP Weighted	MSCI EAFE	Simple – GDP	None
S&P 500 Equal Weight	S&P 500	Simple – 1/N	None
Russell Fundamental U.S.	Russell 3000	Fundamental	Liquidity, Investability
Russell Fundamental Developed Large Cap	Russell Developed LC	Fundamental	Liquidity, Investability
FTSE RAFI U.S. 1000	FTSE USA All Cap	Fundamental	Liquidity
FTSE RAFI Developed 1000	FTSE Developed All Cap	Fundamental	Liquidity
ERI SB U.S. High Liquidity Maximum Decorrelation	U.S. High Liquidity Stocks	Max Decorrelation	Liquidity, turnover
ERI SB U.S. Low Volatility Maximum Deconcentration	U.S. Low Volatility Stocks	Max Deconcentration	Liquidity, turnover
ERI SB Euro High Dividend Maximum Deconcentration	European High Dividend Stocks	Max Deconcentration	Liquidity, turnover

☐ U.S. Strategies ☐ Non-U.S. Developed Strategies

Sources: Callan, ERI, FTSE, MSCI, Russell, Standard & Poor's.

above the 60th percentile). Index turnover is constrained and liquidity adjustments are made. The indexes are reviewed in full annually and are reoptimized at least biannually.

Our analysis shows that alternative index weighting schemes can lead to significant exposure to equity risk factors, even in those cases where the strategy objective does not specify a factor tilt. We calculate empirical results using two methods: (1) returns-based style analysis with index-based factors and (2) Fama–French–Carhart four-factor regression for U.S.-based strategies and four-ratio regression for developed ex-U.S. strategies (Fama and French [1993] and Carhart [1997]).

Index-Based Factor Analysis

Exhibit A2 shows the performance of six style indexes for the past 20 years in a periodic table format. We segment the U.S. market universe by capitalization and style with the Russell Top 200 (green), Mid Cap 800 (blue), and Small Cap 2000 (yellow), Growth (lighter shades) and Value (darker shades) indexes. These six components enable us to explore the various size and capitalization characteristics of alternative index portfolios. There is little persistence in the ranking of each component over time, which acknowledges that skill is necessary to select top-performing components: a systematic tilt to a particular component does not guarantee superior long-term returns.

In Exhibit A3, we look at the six U.S. alternative indexes in a Sharpe returns-based style analysis (simply a regression constrained to sum to 100%) to effectively model capitalization and style loadings. Each analysis covers 13 years of monthly data, starting January 1, 2000, and uses rolling three-year periods (ERI Index inception is mid-2002, so 11.5 years of data are available for the style analysis). The plots represent the performance footprints of each strategy and illustrate the relatively active nature of the alternative index strategies versus a traditional CWI and uncover portfolio tilts.

Exhibit A2

U.S. Equity Capitalization and Style Index Performance

(20 years ending 12/31/2013)

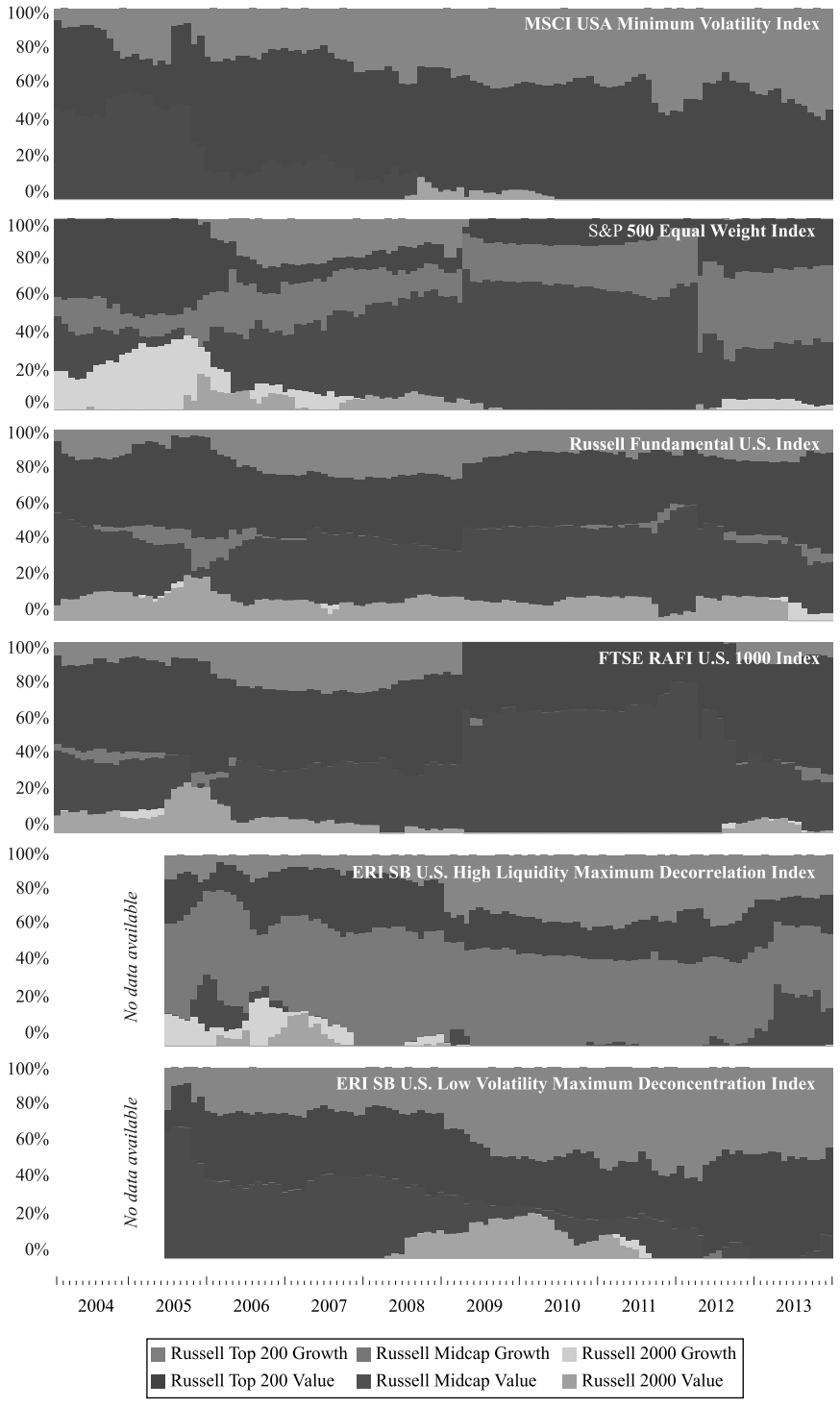
1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Russell Top 200 Growth 4.9%	Russell Top 200 Value 40.0%	Russell Top 200 Growth 25.6%	Russell Top 200 Value 35.5%	Russell Top 200 Growth 45.1%	Russell Midcap Growth 51.3%	Russell 2000 Value 22.8%	Russell 2000 Value 14.0%	Russell Midcap Value -9.6%	Russell 2000 Growth 48.5%	Russell Midcap Value 23.7%	Russell Midcap Value 12.6%	Russell 2000 Value 23.5%	Russell Top 200 Growth 12.2%	Russell 2000 Value -28.9%	Russell Midcap Growth 46.3%	Russell 2000 Growth 29.1%	Russell Top 200 Growth 4.6%	Russell Midcap Value 18.5%	Russell 2000 Growth 43.3%
Russell 2000 Value -1.5%	Russell Top 200 Growth 38.7%	Russell Top 200 Value 22.3%	Russell Midcap Value 34.4%	Russell Top 200 Value 21.2%	Russell 2000 Growth 43.1%	Russell Midcap Value 19.2%	Russell Midcap Value 2.3%	Russell 2000 Value -11.4%	Russell 2000 Value 46.0%	Russell 2000 Value 22.2%	Russell Midcap Growth 12.1%	Russell Top 200 Value 23.0%	Russell Midcap Growth 11.4%	Russell Top 200 Growth -36.1%	Russell 2000 Growth 34.5%	Russell Midcap Growth 26.4%	Russell Top 200 Value 1.1%	Russell 2000 Value 18.1%	Russell Midcap Growth 35.7%
Russell Top 200 Value -1.9%	Russell Midcap Value 34.9%	Russell 2000 Value 21.4%	Russell Top 200 Growth 33.7%	Russell Midcap Growth 17.9%	Russell Top 200 Growth 29.7%	Russell Top 200 Value 2.3%	Russell Top 200 Value -8.8%	Russell Top 200 Value -18.0%	Russell Midcap Growth 42.7%	Russell Midcap Growth 15.5%	Russell 2000 Value 4.7%	Russell Midcap Value 20.2%	Russell 2000 Growth 7.0%	Russell Top 200 Value -36.1%	Russell Midcap Value 34.2%	Russell Midcap Value 24.8%	Russell Midcap Value -1.4%	Russell Top 200 Value 17.0%	Russell 2000 Value 34.5%
Russell Midcap Value -2.1%	Russell Midcap Growth 34.0%	Russell Midcap Value 20.3%	Russell 2000 Value 31.8%	Russell Midcap Value 5.1%	Russell Top 200 Value 10.9%	Russell Midcap Growth -11.7%	Russell 2000 Growth -9.2%	Russell Midcap Growth -11.7%	Russell Midcap Growth 38.1%	Russell 2000 Growth 14.3%	Russell Top 200 Value 4.6%	Russell 2000 Growth 13.3%	Russell Top 200 Value 0.2%	Russell Midcap Value -38.4%	Russell Top 200 Growth 34.0%	Russell 2000 Value 24.5%	Russell Midcap Growth -1.7%	Russell Midcap Growth 15.8%	Russell Midcap Value 33.5%
Russell Midcap Growth -2.2%	Russell 2000 Growth 31.0%	Russell Midcap Growth 17.5%	Russell Midcap Growth 22.5%	Russell 2000 Growth 1.2%	Russell Midcap Value -0.1%	Russell 2000 Growth -22.4%	Russell Midcap Growth -20.2%	Russell Top 200 Growth -28.0%	Russell Top 200 Value 26.8%	Russell Top 200 Value 13.3%	Russell 2000 Growth 4.2%	Russell Midcap Growth 10.7%	Russell Midcap Value -1.4%	Russell 2000 Growth -38.5%	Russell 2000 Value 20.6%	Russell Top 200 Growth 13.2%	Russell 2000 Growth -2.9%	Russell Top 200 Growth 15.1%	Russell Top 200 Growth 32.7%
Russell 2000 Growth -2.4%	Russell 2000 Value 25.7%	Russell 2000 Growth 11.3%	Russell 2000 Growth 12.9%	Russell 2000 Value -6.5%	Russell 2000 Value -1.5%	Russell Top 200 Growth -24.5%	Russell Top 200 Growth -20.5%	Russell 2000 Growth -30.3%	Russell Top 200 Growth 26.6%	Russell Top 200 Growth 3.7%	Russell Top 200 Growth 2.9%	Russell Top 200 Growth 8.6%	Russell 2000 Value -9.8%	Russell Midcap Growth -44.3%	Russell Top 200 Value 14.6%	Russell Top 200 Value 11.7%	Russell 2000 Value -5.5%	Russell 2000 Growth 14.6%	Russell Top 200 Value 32.1%

Sources: Callan, Russell.

EXHIBIT A3

U.S. Alternative Index Style Analyses

(monthly data for 10 years ending 12/31/2013, rolling 36-month periods)

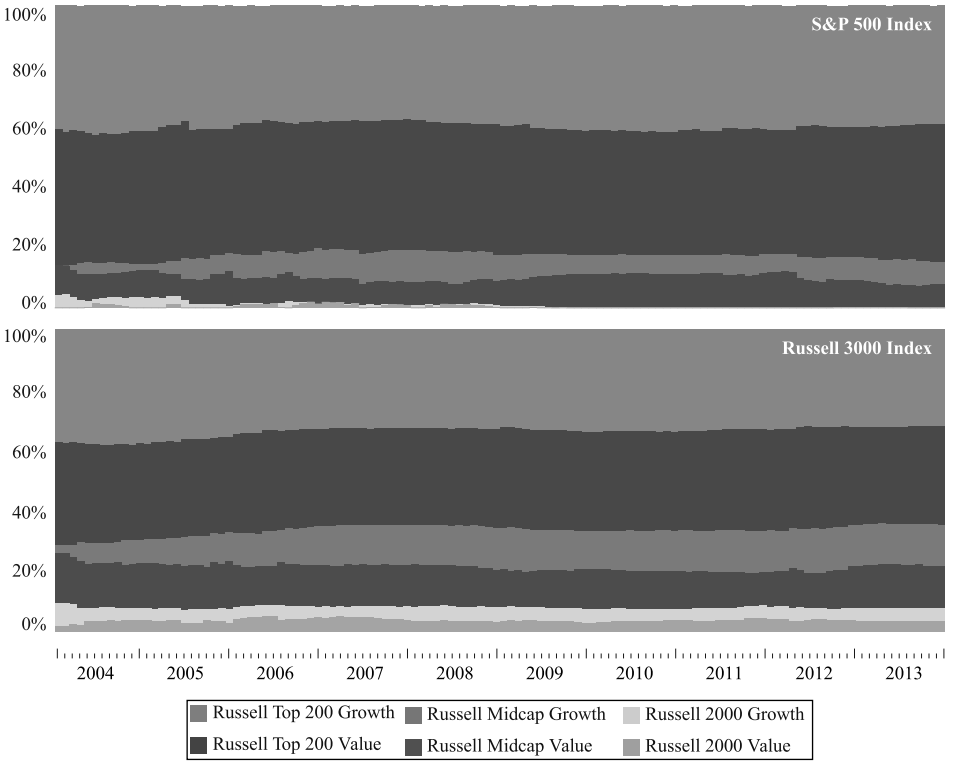


Sources: Callan, ERI, FTSE, MSCI, Russell, Standard & Poor's.

EXHIBIT A4

U.S. Reference Index Style Analyses

(monthly data for 10 years ending 12/31/2013, rolling 36-month periods)

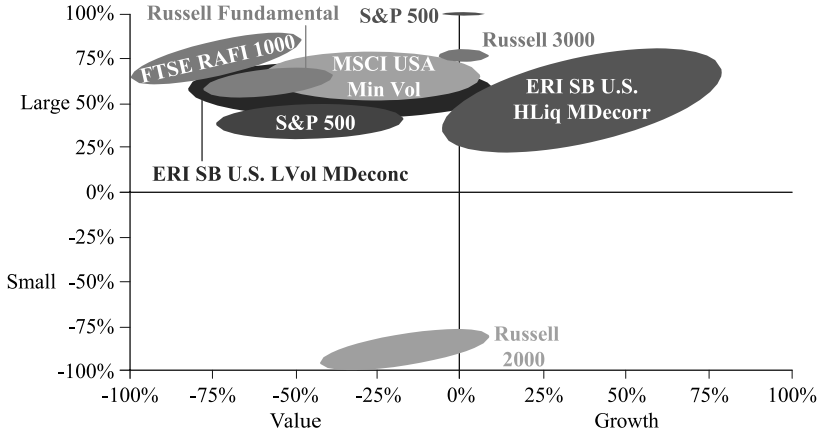


Sources: Callan, Russell, Standard & Poor's.

EXHIBIT A5

U.S. Style Map

(monthly data for 10 years ending 12/31/2013, rolling 36-month periods)



Sources: Callan, ERI, FTSE, MSCI, Russell, Standard & Poor's.

Exhibit A6

Non-U.S. Equity Style Index Performance

(20 years ending 12/31/2013)

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
MSCI Pacific Value 17.9%	MSCI Europe Growth 25.2%	MSCI Europe Growth 21.4%	MSCI Europe Value 28.4%	MSCI Europe Growth 32.7%	MSCI Pacific Growth 71.1%	MSCI Europe Value -0.3%	MSCI Europe Value -15.8%	MSCI Pacific Value -9.1%	MSCI Europe Value 45.8%
MSCI Pacific Growth 7.7%	MSCI Europe Value 18.5%	MSCI Europe Value 20.6%	MSCI Europe Growth 19.9%	MSCI Europe Value 24.3%	MSCI Pacific Value 44.9%	MSCI Pacific Value -9.2%	MSCI Europe Growth -24.2%	MSCI Pacific Growth -9.4%	MSCI Pacific Value 43.0%
MSCI Europe Value 3.5%	MSCI Pacific Value 5.4%	MSCI Pacific Value -2.4%	MSCI Pacific Growth -21.7%	MSCI Pacific Value 4.4%	MSCI Europe Value 16.2%	MSCI Europe Growth 16.6%	MSCI Pacific Growth -25.4%	MSCI Europe Value -18.3%	MSCI Pacific Growth 34.0%
MSCI Europe Growth 1.1%	MSCI Pacific Growth 0.1%	MSCI Pacific Growth -14.2%	MSCI Pacific Value -29.3%	MSCI Pacific Growth 0.5%	MSCI Europe Growth 15.1%	MSCI Pacific Growth -40.0%	MSCI Pacific Value -25.6%	MSCI Europe Growth -18.5%	MSCI Europe Growth 31.4%

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
MSCI Europe Value 24.7%	MSCI Pacific Growth 25.6%	MSCI Europe Value 36.8%	MSCI Europe Growth 19.5%	MSCI Pacific Value -32.3%	MSCI Europe Value 37.7%	MSCI Europe Growth 16.8%	MSCI Europe Growth -9.7%	MSCI Europe Growth 19.7%	MSCI Europe Value 26.8%
MSCI Pacific Value 23.6%	MSCI Pacific Value 19.7%	MSCI Europe Growth 30.7%	MSCI Pacific Growth 9.5%	MSCI Pacific Growth -40.6%	MSCI Europe Growth 33.9%	MSCI Pacific Value 15.1%	MSCI Pacific Value -11.3%	MSCI Europe Value 18.2%	MSCI Europe Growth 23.5%
MSCI Europe Growth 17.0%	MSCI Europe Value 11.3%	MSCI Pacific Value 18.0%	MSCI Europe Value 8.2%	MSCI Europe Growth -43.7%	MSCI Pacific Value 27.4%	MSCI Europe Growth 10.3%	MSCI Europe Value -12.4%	MSCI Pacific Value 16.7%	MSCI Pacific Growth 20.8%
MSCI Pacific Growth 14.3%	MSCI Europe Growth 7.5%	MSCI Pacific Growth 6.6%	MSCI Pacific Value 1.1%	MSCI Europe Value -49.2%	MSCI Pacific Growth 21.0%	MSCI Europe Value -2.6%	MSCI Pacific Growth -16.2%	MSCI Pacific Growth 12.2%	MSCI Pacific Value 15.7%

Sources: Callan, MSCI.

Of note are the capitalization differences between the alternative index strategies and the cap-weighted S&P 500 and Russell 3000 reference indexes shown in Exhibit A3. The MSCI USA Minimum Volatility strategy appears to have loaded up almost exclusively on mega cap stocks since 2008 and has a value bias. The ERI SB U.S. Low Volatility Maximum Deconcentration strategy exhibits similar behavior but demonstrates more mid cap value loading. The S&P Equal Weight Index features a high allocation to mid cap, particularly mid cap value, with large cap value rounding out the mix. Both the Russell Fundamental U.S. and the FTSE RAFI U.S. 1000 Indexes are heavily value tilted, with significant exposure to both large and mid cap value. The ERI SB U.S. High Liquidity Maximum Decorrelation strategy is growth biased and overweight to mid cap versus the cap-weighted market indexes. Each of these tilts will help inform the risk and return characteristics examined in the next section.

With the exception of the MSCI USA Minimum Volatility strategy, the R^2 (a measure of the goodness of fit) for these constrained regressions is very high (0.98 or higher), with 0.9896 for the Russell Fundamental U.S. Index. The vast majority of factor tilts appear to be captured by style.

For comparison, we analyze the CWI benchmarks in Exhibit A4, revealing relatively static exposure to capitalization and style when compared to the alternative index strategies. As expected, the R^2 for the S&P 500 and Russell 3000 are 0.9992 and 0.9999, respectively.

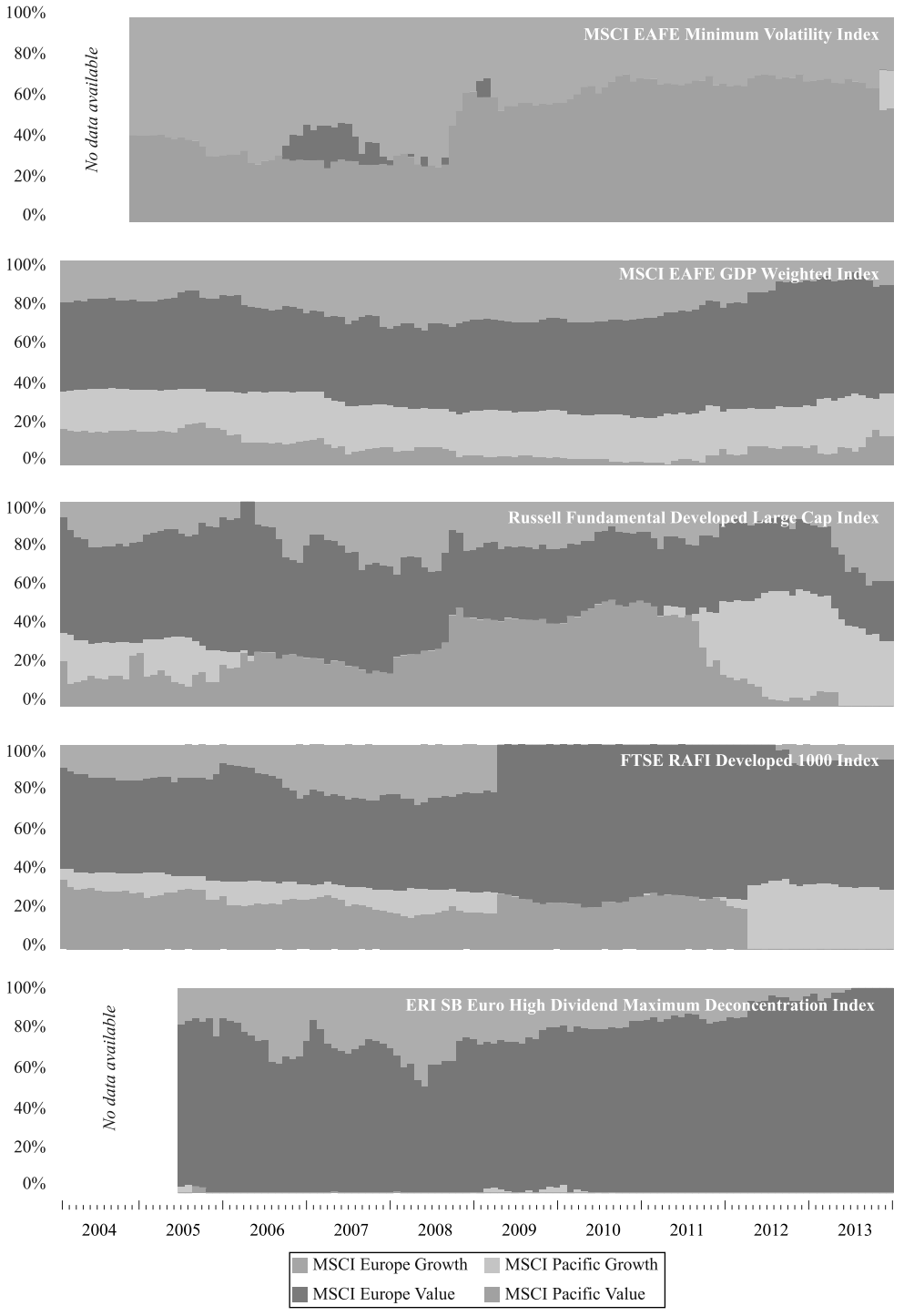
These characteristics are summarized in the style map in Exhibit A5, which plots each alternative index strategy and reference CWI on capitalization and style axes. The ellipses cover 80% of the data and provide an idea of dispersion over time. Not surprisingly, given the significant value and size tilts observed earlier, most of the alternative index strategies tend to skew toward value and exhibit markedly smaller capitalizations than the S&P 500 or Russell 3000. The most heavily value-oriented strategy of the six is the FTSE RAFI U.S. 1000, whereas the ERI SB U.S. High Liquidity Maximum Decorrelation is skewed to growth.

We run a similar analysis for the developed ex-U.S. market as defined by the MSCI EAFE Index. The universe is broken up into four segments based on style and region: Europe growth and value (teal), and Pacific growth and value (orange). Exhibit A6 shows the performance of these four

EXHIBIT A7

Non-U.S. Alternative Index Style Analyses

(monthly data for 10 years ending 12/31/2013, rolling 36-month periods)

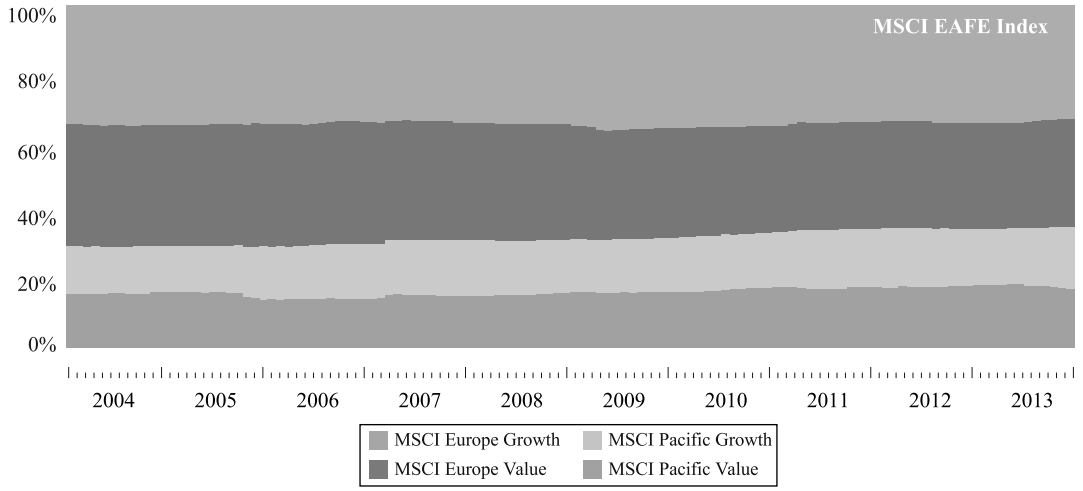


Sources: Callan, ERI, FTSE, MSCI, Russell.

EXHIBIT A8

MSCI EAFE Reference Index Style Analysis

(monthly data for 10 years ending 12/31/2013, rolling 36-month periods)



Sources: Callan, MSCI.

EXHIBIT A9

U.S. Fama–French–Carhart Regression

(monthly data for 10 years ending 12/31/2013)

	MSCI USA Min Vol		S&P 500 Equal Weight		Russell Fundamental U.S.		FTSE RAFI U.S. 1000		ERI SB HLiq MDecorr		ERI SB LVol MDeconc	
	Coefficient	t-*Stat*	*Coefficient*	t-*Stat*	*Coefficient*	t-*Stat*	*Coefficient*	t-*Stat*	*Coefficient*	t-*Stat*	*Coefficient*	t-*Stat*
Multiple R	0.81		0.99		0.99		0.99		0.98		0.97	
R Square	0.66		0.99		0.99		0.98		0.96		0.94	
Intercept	0.28	1.38	0.09	1.67	**0.14**	**3.73**	0.09	1.46	0.07	0.78	**0.21**	**2.40**
Mkt-RF	**0.75**	**13.13**	**1.04**	**67.45**	**0.97**	**94.88**	**1.00**	**57.73**	**1.06**	**46.17**	**0.83**	**33.98**
SMB	**-0.35**	**-3.32**	**0.19**	**6.63**	**0.04**	**2.13**	-0.04	-1.28	0.05	1.16	-0.03	-0.71
HML	0.05	0.53	**0.06**	**2.29**	**0.21**	**12.39**	**0.30**	**10.44**	**-0.13**	**-3.35**	**0.08**	**2.07**
MOM	-0.01	-0.25	**-0.14**	**-11.20**	**-0.06**	**-7.41**	**-0.15**	**-10.49**	0.01	0.39	-0.03	-1.59

Sources: Callan, ERI, FTSE, MSCI, Russell, Standard & Poor's, Kenneth French Data Library, http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

components for the past 20 years. As with the U.S. analysis, there is little persistence in the ranking of each component over time.

Exhibit A7 shows the Sharpe returns-based style analysis approach used to model regional and style loadings for the five developed ex-U.S. alternative index strategies. Correspondingly, each analysis covers 13 years of monthly data, starting January 1, 2000, and uses rolling three-year periods (MSCI EAFE Minimum Volatility inception is December 2001, so just over 12 years of data are available for this analysis; ERI index inception is mid-2002, so 11.5 years of data are available for this analysis).

The style analyses feature high R^2 figures, most above 0.92, which indicate very robust explanatory power. Analogous to the U.S. analysis, the MSCI EAFE Minimum Volatility R^2 is lower than the rest of the group, at 0.78. Many of the plots feature a high allocation to value factors, consistent with the strategy-construction methodology. For reference, the MSCI EAFE Index is shown in Exhibit A8; the R^2 is 0.9999.

EXHIBIT A10

Non-U.S. Four-Factor Regression

(monthly data for 10 years ending 12/31/2013)

	MSCI EAFE Min Vol		MSCI EAFE GDP Weighted		Russell Fundamental Dev. LC		FTSE RAFI Developed 1000		ERI SB Euro HDiv MDeconc	
	Coefficient	t-*Stat*	*Coefficient*	t-*Stat*	*Coefficient*	t-*Stat*	*Coefficient*	t-*Stat*	*Coefficient*	t-*Stat*
Multiple R	0.97		0.99		0.98		0.99		0.97	
R Square	0.95		0.99		0.95		0.99		0.94	
Intercept	**0.20**	**2.27**	**-0.18**	**-3.12**	0.11	1.09	-0.10	-1.52	-0.07	-0.45
B/M Mkt	**0.95**	**2.54**	**1.62**	**6.64**	0.67	1.54	**0.57**	**2.11**	**1.98**	**2.87**
B/M High	-0.19	-1.49	0.13	1.57	**0.41**	**2.76**	**0.22**	**2.34**	**0.50**	**2.13**
B/M Low	0.34	1.77	0.01	0.05	-0.07	-0.32	-0.24	-1.77	-0.46	-1.29
E/P High	**-0.45**	**-2.50**	-0.21	-1.81	0.07	0.32	-0.06	-0.45	-0.45	-1.34
E/P Low	0.17	0.78	-0.06	-0.42	0.17	0.65	0.00	0.02	-0.18	-0.42
CE/P High	-0.09	-0.65	0.13	1.39	-0.07	-0.38	**0.26**	**2.48**	0.04	0.16
CE/P Low	0.18	0.91	-0.07	-0.53	-0.21	-0.91	0.00	-0.01	0.16	0.43
Yld High	**0.62**	**4.67**	-0.17	-1.94	-0.08	-0.48	**0.22**	**2.29**	-0.23	-0.95
Yld Low	**-0.58**	**-3.89**	**-0.25**	**-2.53**	0.12	0.67	0.13	1.16	-0.13	-0.47
Yld Zero	**-0.11**	**-2.01**	-0.05	-1.32	**-0.17**	**-2.67**	-0.04	-1.08	-0.04	-0.38

Sources: Callan, ERI, FTSE, MSCI, Russell, Standard & Poor's, Kenneth French Data Library, http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

Regression-Based Factor Analysis

To corroborate the style analysis above, we also perform linear regression on the U.S.-based strategies using the well-known Fama–French–Carhart factor model constructed using six value-weighted portfolios based on size, book-to-market, and momentum. Factors include:

- excess market return (Mkt-Rf): value-weighted return of all CRSP firms incorporated in the U.S. and listed on the NYSE, AMEX, or NASDAQ that have good data minus the Treasury-bill rate from Ibbotson Associates
- small minus big (SMB): the average return on the three small cap portfolios minus the average return on the three large cap portfolios
- high minus low (HML): the average return on the two value portfolios minus the average return on the two growth portfolios
- momentum (MOM): the intersection of two portfolios formed on size and three portfolios formed on prior return: ½ (small high + big high) – ½ (small low + big low).

For the developed ex-U.S. market, we use four factor families grouped into several buckets, each with countries represented by the MSCI EAFE universe. These factors include:

- book-to-market (B/M)
- earnings-to-price (E/P)
- cash earnings-to-price (CE/P)
- dividend yield (D/P).

Within each factor the stratification is as follows:

- value portfolio high contains firms in the top 30% of a ratio
- growth portfolio low contains firms in the bottom 30% of a ratio.

The factor-based analysis is largely consistent with our previous index-based analysis. Exhibits A9 and A10 present a summary of regression results. We find that the R^2 terms are proportionally similar to the earlier analysis, with the MSCI EAFE Minimum Volatility Index generating the lowest R^2 (at 0.66), and all the remaining strategies' R^2 above 0.94. Factor loadings with *t*-statistics greater than a ±2 threshold are shaded. Note that all six strategies load significantly on the excess market return (Mkt – Rf) with *t*-statistics above 13. This result will also be corroborated in the subsequent correlation analysis.

Three of the U.S. alternative index strategies exhibit a pronounced small cap bias (MSCI USA Minimum Volatility, S&P 500 Equal Weight, and Russell Fundamental U.S.). This should come as no surprise, since the equal-weighted index construction criteria and the Russell Fundamental U.S. Index style analysis also support this finding.

EXHIBIT A11

Periodic Tables of U.S. and Non-U.S. Alternative Indexes and Cap-Weighted Benchmarks

(nine years ending 12/31/2013)

2005	2006	2007	2008	2009	2010	2011	2012	2013
ERI SB U.S. HLiq MDecorr 10.0%	ERI SB U.S. LVol MDeconc 19.7%	ERI SB U.S. HLiq MDecorr 9.4%	MSCI USA Minimum Volatility -27.5%	S&P 500 Equal Weight 46.3%	S&P 500 Equal Weight 21.9%	MSCI USA Minimum Volatility 12.9%	S&P 500 Equal Weight 17.7%	ERI SB U.S. HLiq MDecorr 38.2%
ERI SB U.S. LVol MDeconc 8.1%	FTSE RAFI U.S. 1000 19.7%	S&P 500 5.5%	ERI SB U.S. LVol MDeconc -31.1%	FTSE RAFI U.S. 1000 42.0%	FTSE RAFI U.S. 1000 20.0%	ERI SB U.S. LVol MDeconc 8.4%	FTSE RAFI U.S. 1000 17.2%	S&P 500 Equal Weight 36.2%
S&P 500 Equal Weight 8.1%	Russell Fundamental U.S. 19.2%	MSCI USA Minimum Volatility 5.4%	Russell Fundamental U.S. -34.7%	ERI SB U.S. HLiq MDecorr 37.8%	Russell Fundamental U.S. 19.3%	Russell Fundamental U.S. 2.3%	Russell Fundamental U.S. 16.9%	FTSE RAFI U.S. 1000 35.7%
Russell Fundamental U.S. 7.0%	S&P 500 Equal Weight 15.8%	Russell Fundamental U.S. 3.2%	S&P 500 -37.0%	Russell Fundamental U.S. 34.9%	ERI SB U.S. LVol MDeconc 18.7%	S&P 500 2.1%	S&P 500 16.0%	Russell Fundamental U.S. 35.3%
FTSE RAFI U.S. 1000 6.1%	S&P 500 15.8%	FTSE RAFI U.S. 1000 3.0%	ERI SB U.S. HLiq MDecorr -38.3%	S&P 500 26.5%	ERI SB U.S. HLiq MDecorr 17.4%	FTSE RAFI U.S. 1000 0.1%	ERI SB U.S. HLiq MDecorr 15.8%	S&P 500 32.4%
MSCI USA Minimum Volatility 5.8%	MSCI USA Minimum Volatility 12.4%	S&P 500 Equal Weight 1.5%	S&P 500 Equal Weight -39.7%	ERI SB U.S. LVol MDeconc 23.6%	S&P 500 15.1%	S&P 500 Equal Weight -0.1%	ERI SB U.S. LVol MDeconc 14.7%	ERI SB U.S. LVol MDeconc 30.1%
S&P 500 4.9%	ERI SB U.S. HLiq MDecorr 10.9%	ERI SB U.S. LVol MDeconc 0.9%	FTSE RAFI U.S. 1000 -40.0%	MSCI USA Minimum Volatility 18.4%	MSCI USA Minimum Volatility 14.7%	ERI SB U.S. HLiq MDecorr -2.5%	MSCI USA Minimum Volatility 11.2%	MSCI USA Minimum Volatility 25.3%

2005	2006	2007	2008	2009	2010	2011	2012	2013
FTSE RAFI Developed 1000 15.7%	ERI SB Euro High Dividend Max Deconc 43.5%	ERI SB Euro High Dividend Max Deconc 15.6%	MSCI EAFE Minimum Volatility -27.7%	FTSE RAFI Developed 1000 44.0%	Russell Fundamental Developed LC 12.8%	MSCI EAFE Minimum Volatility -0.7%	MSCI EAFE GDP Weighted 18.1%	ERI SB Euro High Dividend Max Deconc 33.1%
MSCI EAFE GDP Weighted 13.7%	MSCI EAFE Minimum Volatility 31.5%	FTSE RAFI Developed 1000 14.5%	Russell Fundamental Developed LC -37.4%	ERI SB Euro High Dividend Max Deconc 36.2%	MSCI EAFE Minimum Volatility 9.3%	Russell Fundamental Developed LC -5.7%	MSCI EAFE 17.3%	Russell Fundamental Developed LC 29.9%
MSCI EAFE 13.5%	FTSE RAFI Developed 1000 29.2%	MSCI EAFE GDP Weighted 12.9%	MSCI EAFE -43.4%	Russell Fundamental Developed LC 33.1%	MSCI EAFE 7.8%	MSCI EAFE -12.1%	ERI SB Euro High Dividend Max Deconc 16.1%	FTSE RAFI Developed 1000 25.4%
ERI SB Euro High Dividend Max Deconc 11.2%	MSCI EAFE GDP Weighted 27.4%	MSCI EAFE 11.2%	FTSE RAFI Developed 1000 -43.9%	MSCI EAFE 31.8%	FTSE RAFI Developed 1000 7.5%	MSCI EAFE GDP Weighted -14.3%	FTSE RAFI Developed 1000 15.9%	MSCI EAFE 22.8%
Russell Fundamental Developed LC 10.3%	MSCI EAFE 26.3%	MSCI EAFE Minimum Volatility 10.1%	MSCI EAFE GDP Weighted -44.8%	MSCI EAFE GDP Weighted 30.4%	MSCI EAFE GDP Weighted 3.1%	FTSE RAFI Developed 1000 -14.3%	Russell Fundamental Developed LC 15.5%	MSCI EAFE GDP Weighted 20.6%
MSCI EAFE Minimum Volatility 8.3%	Russell Fundamental Developed LC 23.3%	Russell Fundamental Developed LC 9.3%	ERI SB Euro High Dividend Max Deconc -46.5%	MSCI EAFE Minimum Volatility 15.9%	ERI SB Euro High Dividend Max Deconc 2.2%	ERI SB Euro High Dividend Max Deconc -20.9%	MSCI EAFE Minimum Volatility 11.5%	MSCI EAFE Minimum Volatility 16.7%

Sources: Callan, ERI, FTSE, MSCI, Russell, Standard & Poor's.

EXHIBIT A12

Summary Performance and Risk Statistics

(monthly data for 10 years ending 12/31/2013)

Alternative Index	Return	St. Dev.	Sharpe	Beta	Excess R.	TE	ER/TE	Info. Ratio
MSCI USA Min Vol	8.26%	11.66%	0.57	0.74	0.85%	5.79%	0.15	0.49
Russell Fundamental U.S.	10.05%	15.98%	0.53	1.07	2.65%	2.86%	0.93	0.82
S&P 500 Equal Weight	9.78%	17.61%	0.46	1.17	2.38%	4.65%	0.51	0.40
FTSE RAFI U.S. 1000	9.35%	17.17%	0.45	1.13	1.95%	4.67%	0.42	0.31
ERI SB U.S. High Liquidity Max Decorr	9.81%	13.24%	0.62	0.87	2.40%	3.77%	0.64	0.88
ERI SB U.S. Low Vol Max Deconc	9.19%	16.20%	0.47	1.07	1.79%	3.94%	0.45	0.38
S&P 500	7.41%	14.69%	0.39					
S&P 500 Growth	7.69%	14.13%	0.43					
S&P 500 Value	7.05%	15.94%	0.34					
MSCI EAFE Min Vol	9.19%	12.94%	0.58	0.66	2.27%	7.67%	0.30	0.77
MSCI EAFE GDP Weighted	6.44%	19.49%	0.24	1.07	-0.47%	2.27%	-0.21	-0.34
Russell Fundamental Developed LC	8.91%	16.40%	0.44	0.88	2.00%	4.42%	0.45	0.62
FTSE RAFI Developed 1000	8.51%	20.21%	0.34	1.10	1.60%	3.81%	0.42	0.36
ERI SB Euro High Dividend Max Deconc	8.18%	23.14%	0.28	1.23	1.27%	7.40%	0.17	0.12
MSCI EAFE	6.91%	18.15%	0.29					
MSCI EAFE Growth	6.97%	17.48%	0.30					
MSCI EAFE Value	6.77%	19.24%	0.26					

Sources: Callan, ERI, FTSE, MSCI, Russell, Standard & Poor's.

Value orientations are apparent in nearly all U.S. portfolios (S&P 500 Equal Weight, Russell Fundamental U.S., FTSE RAFI U.S. 1000, and ERI SB U.S. Low Volatility Maximum Deconcentration), with *t*-statistics largely corroborating value exposure observed in the style analysis. The ERI SB U.S. High Liquidity Maximum Decorrelation portfolio has a negative weight to value because it is a growth-tilted portfolio by construction. Generally, the momentum factor is muted, likely as a result of rebalancing parameters, with statistically significant negative exposure for the S&P 500 Equal Weight, Russell Fundamental U.S., and FTSE RAFI U.S. 1000 strategies.

The developed ex-U.S. framework is somewhat different than the U.S.-based analysis but still provides useful insight. We observe that all of the R^2 terms are very high (over 0.94), providing some statistical comfort in the findings. With the exception of the Russell Fundamental Developed Large Cap strategy, all portfolios had statistically significant positive weights to the B/M factor (and three, including the Russell Fundamental Developed Large Cap, to the High B/M slice). Both the MSCI EAFE Minimum Volatility and FTSE RAFI Developed 1000 show positive weights to higher-yielding stocks.

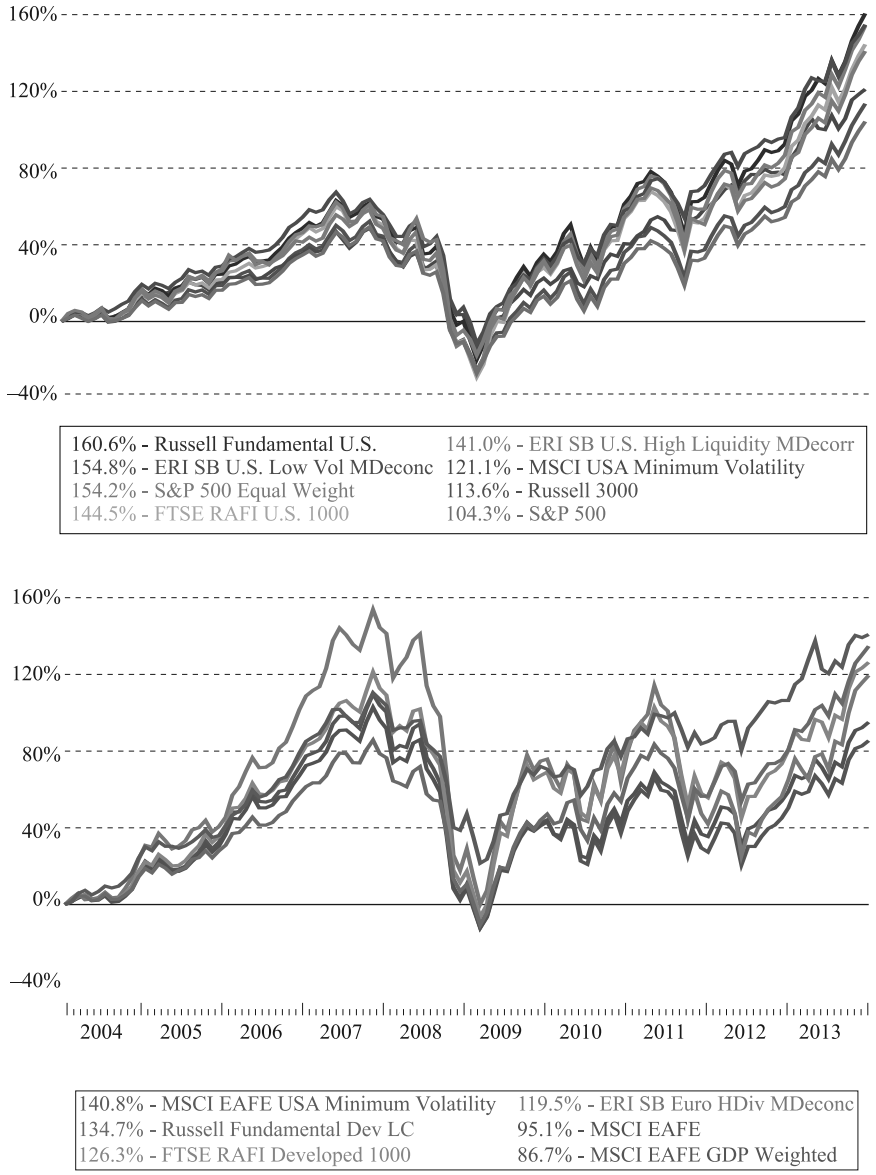
Overall, the high R^2 terms and significant factor weights provide compelling evidence that these alternative index portfolios are constructed with meaningful tilts that contribute to risk and return characteristics.

Return and Risk

Analysis of total returns show that many of the alternative index strategies outperformed their respective CWI counterparts over the past 10 years (through December 31, 2013). Exhibit A11 illustrates returns in a periodic table format for the past nine calendar years. Excess returns calculations versus the S&P 500 and MSCI EAFE benchmarks more clearly present each strategy's unique performance (see Exhibit A12).

EXHIBIT A13
Cumulative Performance

(monthly data for 10 years ending 12/31/2013)



Sources: Callan, ERI, FTSE, MSCI, Russell, Standard & Poor's

Turning to risk, we observe that some alternative index strategies had markedly higher annualized standard deviation than the S&P 500 over the same time period. Both low volatility strategies did indeed exhibit lower volatility. Tracking error for U.S. strategies versus the S&P 500 is in a similar range to many traditional active strategies, 3% to 5%. Tracking error for developed ex-U.S. alternative index strategies versus MSCI EAFE is higher than their U.S. counterparts, with some over 7%. Note that tracking error may not be as applicable to alternative index strategies as with traditional active strategies because these portfolios are constructed without reference to the cap-weighted benchmark, but nevertheless will be used by many investors for attribution and performance measurement purposes. Looking at overall standard deviation is likely a more relevant calculation. Information ratios do vary over time, but are robust over the 10-year sample (Exhibit A12).

Exhibit A14

Historical Total Return Correlations for Alternative and Cap-Weighted Indexes

(10 years ending 12/31/2013)

	MSCI USA Min Vol	S&P 500 Eq Wt	Russell Fund U.S.	FTSE RAFI U.S. 1000	ERI SB U.S. HLiq Max Decorr	ERI SB U.S. LVol Max Deconc	MSCI EAFE Min Vol	MSCI EAFE GDP Wt	Russell Fund Dev LC	FTSE RAFI Dev 1000	ERI SB Euro HDiv Max Deconc	S&P 500	MSCI EAFE	Barclays Agg
MSCI USA Min Vol	1.0000													
S&P 500 Equal Weight	0.8984	1.0000												
Russell Fundamental U.S. Index	0.9231	0.9878	1.0000											
FTSE RAFI U.S. 1000	0.9136	0.9787	0.9888	1.0000										
ERI SB U.S. High Liquidity Max Decorr	0.8862	0.9691	0.9569	0.9363	1.0000									
ERI SB U.S. Low Vol Max Deconc	0.9579	0.9637	0.9703	0.9518	0.9394	1.0000								
MSCI EAFE Min Vol	0.8067	0.7770	0.7841	0.7936	0.7934	0.8146	1.0000							
MSCI EAFE GDP Weighted	0.7918	0.8715	0.8672	0.8677	0.8876	0.8483	0.9217	1.0000						
Russell Fundamental Dev LC	0.8708	0.9533	0.8571	0.9542	0.9472	0.9251	0.8845	0.9702	1.0000					
FTSE RAFI Developed 1000	0.7917	0.8896	0.8834	0.8978	0.8830	0.8468	0.9049	0.9873	0.9763	1.0000				
ERI SB Euro High Div. Max Deconc	0.7635	0.8583	0.8544	0.8573	0.8634	0.8270	0.8851	0.9757	0.9515	0.9711	1.0000			
S&P 500	0.9280	0.9743	0.9860	0.9686	0.9719	0.9686	0.8027	0.8824	0.9587	0.8828	0.8614	1.0000		
MSCI EAFE	0.8057	0.8787	0.8732	0.8748	0.8960	0.8580	0.9324	0.9953	0.9724	0.9859	0.9644	0.8910	1.0000	
Barclays Aggregate	0.1429	0.0389	0.0350	0.0525	0.0329	0.1072	0.2696	0.1203	0.0689	0.1065	0.0998	0.0432	0.1251	1.0000

Sources: Callan, Barclays, ERI, FTSE, MSCI, Russell, Standard & Poor's

EXHIBIT A15
Historical Excess Return Correlations

(10 years ending 12/31/2013)

MSCI USA Min Vol	1.0000					
S&P 500 Equal Weight	-0.3968	1.0000				
Russell Fundamental U.S.	-0.1602	0.7665	1.0000			
FTSE RAFI U.S. 1000	-0.1701	0.7017	0.8425	1.0000		
ERI SB U.S. High Liquidity Max Decorr	-0.3067	0.4832	0.0683	0.0359	1.0000	
ERI SB U.S. Low Vol Max Deconcentration	0.7427	0.0003	0.1103	-0.0324	-0.1603	1.0000
	MSCI USA Min Vol	S&P 500 Eq Wt	Russell Fund U.S.	FTSE RAFI U.S. 1000	ERI SB U.S. HLiq Max Decorr	ERI SB U.S. LVol Max Deconc

MSCI EAFE Min Vol	1.0000				
MSCI EAFE GDP Weighted	-0.8067	1.0000			
Russell Fundamental Developed Large Cap	-0.0299	-0.1999	1.0000		
FTSE RAFI Developed 1000	-0.9261	0.8528	0.0898	1.0000	
ERI SB Euro High Dividend Max Deconcentration	-0.9494	0.8966	0.0029	0.9402	1.0000
	MSCI EAFE Min Vol	MSCI EAFE GDP Wtd	Russell Fund Dev LC	FTSE RAFI Dev 1000	ERI SB Euro HDiv Max Deconc

Sources: Callan, ERI, FTSE, MSCI, Russell, Standard & Poor's

Over 10 years, Sharpe ratios reflect stronger risk-adjusted performance for alternative index strategies (0.45 to 0.62 versus 0.39 and 0.43 for the S&P 500 and S&P 500 Growth, respectively). The developed ex-U.S. strategies have a wider distribution of Sharpe ratios, from 0.24 to 0.58 as compared to 0.29 for the MSCI EAFE. Though alternative indexes have performed well in the past (and especially over this 10-year sample), their historical performance is no indicator of future outperformance (Exhibit A13).

Correlation Analysis

Though alternative indexes promise diversification, our analysis concludes the opposite: correlation is very high with traditional cap-weighted indexes. We find that alternative index strategies are highly correlated with broad equity markets over multiple time periods. Because the universes are the same for alternative indexes and cap-weighted indexes (and both prohibit shorting), it is no surprise that most are greater than 0.96 correlated with the S&P 500. Of this group, both MSCI minimum volatility strategies have the lowest correlations, which have been trending downward since mid-2011. Exhibit A14 shows correlations over the 10-year period ending December 31, 2013. Interestingly, the alternative indexes are themselves highly correlated (0.9481 for U.S.-based strategies over 10 years and 0.9428 for developed ex-U.S. strategies, on average).

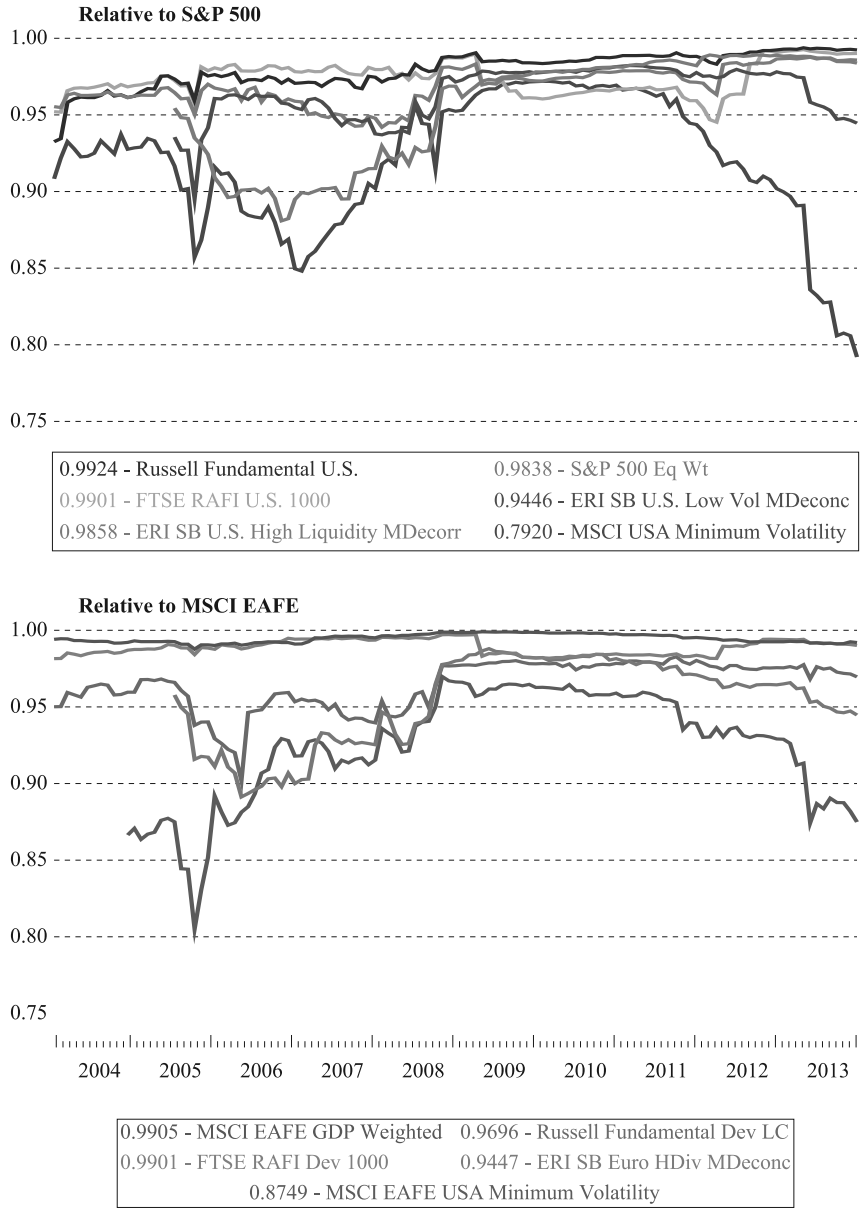
When we examine excess correlations (versus the S&P 500 and the MSCI EAFE, respectively), we can directly observe the relationship among the factor tilts (Exhibits A15 and A16). As expected, the MSCI USA Minimum Volatility is highly correlated (in excess terms) with the ERI SB U.S. Low Volatility Maximum Deconcentration portfolio, and the two fundamental indexes have also varied together over time.

These statistics imply that releasing the long-only constraint would lead to far more efficient harvesting of the factors targeted by these strategies. Evidence suggests that investment insights can generally be more effectively applied when both long and short positions are allowed. The way that we define alternative indexes, which mirrors the industry definition, explicitly precludes short selling. The result is the inclusion of a substantial amount of beta (market characteristics), which masks much of the portfolio tilt. The large difference between total and excess correlations displayed in Exhibits A15 and A16 underlines this point.

EXHIBIT A16

Historical Excess Return Correlations

(monthly data for 10 years ending 12/31/2013, rolling 36-month periods)



Sources: Callan, ERI, FTSE, MSCI, Russell, Standard & Poor's

ENDNOTES

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[1]Technically the CAPM model explains excess returns or returns above the risk-free rate (traditionally defined as the return on 90-day T-Bills). It also includes a residual term. This translation omits both of these components to simplify the definition in an effort to enhance readability.

[2]S&P Dow Jones Indexes.

[3]Russell.

[4]MSCI.

[5]MSCI.

[6]Surplus risk is the standard deviation of assets minus liabilities.

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