MSCI

Research Insight

Deploying Multi-Factor Index Allocations in Institutional Portfolios

Jennifer Bender

Remy Briand

Dimitris Melas

Raman Aylur Subramanian

Madhu Subramanian

December 2013

Executive Summary

This paper is the second in a three-paper series focusing on factor investing. In the first paper, "Foundations of Factor Investing", we discussed six factors— **Value, Low Size, Low Volatility, High Yield, Quality and Momentum** —that historically have earned a premium over long periods, represent exposure to systematic sources of risk, and have strong theoretical foundations. We also discussed how they could be captured through indexation. In this paper, we turn to the question of how institutional investors interested in factor investing may allocate to and across factors.

In particular, we introduce a new framework for how institutional investors might consider implementing factor allocations through a passive mandate replicating a single multi-factor index. We call this type of allocation a multi-factor index allocation. Multi-factor indexes combine select factor indexes into single mixes created and controlled by the investor. Multi-factor indexes historically have demonstrated four key benefits: diversification, transparency, cost-efficiency via reduced turnover, and flexibility.

Most importantly, regarding diversification, combining factors historically could have helped offset the cyclicality in single factor performance. When multiple factor indexes are combined into a single multi-factor index, diversification across factors has historically lead to:

- Lower volatility and higher Sharpe Ratio
- Higher information ratios and lower tracking errors
- Less regime dependency over business cycles

Next, we look at how factor allocations fit in the traditional institutional portfolio setting. Factor allocations have the potential to change the landscape of mandate structures by offering a new way to achieve exposure to systematic factors that formerly could only be captured through active mandates. Factor index-based investing can be viewed as active decisions implemented through passive replication. As such, factor allocations should be tailored to each institution.

The first step is to assess the role of factor investing in the institution's portfolio. The two main dimensions that drive factor investing are the institution's objectives and constraints (governance structure, horizon, risk budget, etc.). For example, those seeking to enhance risk-adjusted returns may be looking for a dynamic allocation (higher return and higher risk), a defensive allocation (moderate return and lower risk), or a balanced allocation (something in between).

Once the institution has established its investment objectives and identified factors that might contribute to these objectives, it must also decide how to structure and implement the factor allocation. The main criteria for deciding which combination of indexes to deploy depend on the institution's assessment of the tradeoff between investability and factor exposure (which is tied to performance). Indexes with greater investability generally have lower factor exposure and vice versa. In this implementation phase there can also be significant turnover reduction benefits to combining multiple factors in a multi-factor index. In particular, "natural crossing" effects may reduce turnover, provided that the allocation is structured around a single passive mandate (or multiple mandates structured to replicate passively the same index) with synchronized rebalancing dates. Since there are different index alternatives with varying levels of exposure versus investability, the appropriate index implementation depends on the institution's objectives and constraints.

I. Implementing Factors through Multi-Factor Index Allocations

Multi-Factor Indexes: A New Approach for Institutional Mandates

In a previous paper, "Foundations of Factor Investing", we discussed why some institutional investors seek exposure to systematic factors and introduced the notion of factor indexes that represent factor returns. We focused on six factors (Value, Low Size, Low Volatility, High Yield, Quality and Momentum) that historically have earned a premium over long periods and have strong theoretical foundations. In this paper, we now discuss a new framework for how institutional investors might consider implementing factor allocations through a passive mandate replicating a single multi-factor index. We call this type of allocation a multi-factor index allocation. Multi-factor indexes combine select factor indexes into single mixes created and controlled by the investor.

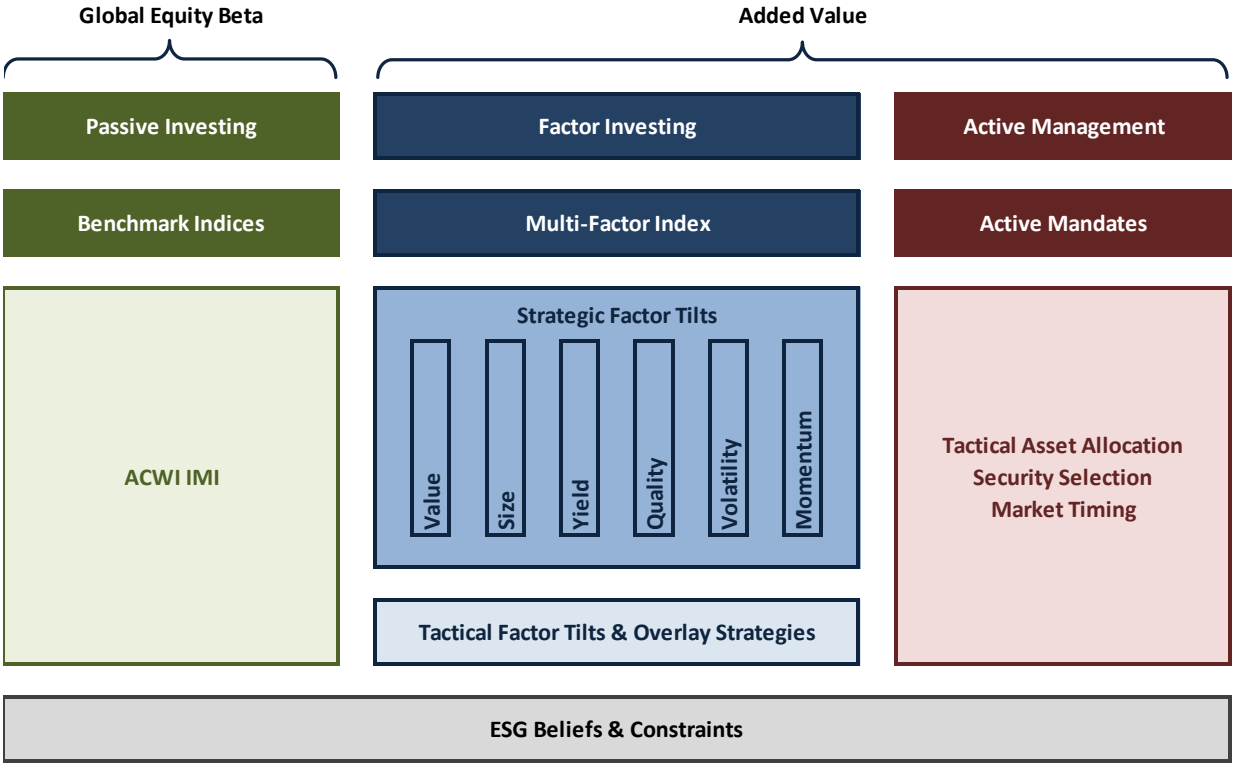
Traditionally, institutional investors structured their allocations around two main sources of return:

- ***(Passive) Beta:*** Based on modern portfolio theory, beta is the return the institution gets from broad exposure to the market, or the full equity investment opportunity set. It is achievable through a portfolio that passively tracks the market, represented typically by a market capitalization weighted index. For instance, in a global portfolio, global equity beta is represented by a broad market capitalization weighted index such as the MSCI ACWI Investable Market Index (IMI).
- ***(Active) Alpha:*** Alpha is the additional return that active management can provide. It is excess return (or value-added) over the market capitalization weighted index. Traditionally, active managers have sought to identify and capture two types of alpha: market inefficiencies and systematic factors associated with excess risk-adjusted returns.

Factor allocations have the potential to change the landscape of mandate structures by offering a new way to achieve exposure to systematic factors that formerly could only be captured through active mandates. Exhibit 1 shows how we can view these allocations as part of a new category in between traditional passive mandates, which replicate market cap weighted portfolios, and active mandates. Factor index-based investing can be viewed as active decisions implemented through passive replication.[1]

[1] Note that in Exhibit 1, and throughout the paper, we generally refer to factor index allocations through a multi-factor index but a factor index allocation could also consist of only one single factor index. In this case, the benefits of indexation (transparency and simplicity) would apply but not the diversification and natural crossing effects.

Exhibit 1: Factor Allocations within Institutional Mandates



Multi-factor index allocations offer a new approach for institutional investors to seek factor returns[2]. Their four key potential benefits are:[3]

- ***Flexibility:*** Institutions have full control over the selection and the weights of individual factor indexes within a multi-factor index and can adjust the strategic factor allocation dynamically through time. The most appropriate combination of individual factor indexes can be customized to account for institutional constraints (e.g., ESG policies, plan rules, etc.). Operationally, the multi-factor approach provides flexibility as it can be created and managed easily within the passive mandate and without having to change the structure or the terms of the mandate. Because the multi-factor allocation relies on standardized indexes, it allows for the flexibility of employing existing passive instruments such as ETFs for tactical overlays. We view this as a "building block" approach.
- ***Transparency:*** Multi-factor index allocations provide full transparency regarding the strategy's underlying building blocks. They allow for easy and consistent analysis not only of the aggregate positions, exposures, and risks of the portfolio but also of the individual indexes, all with the same level of granularity.
- ***Cost efficiency:*** Because multi-factor indexes can be replicated passively, multi-factor index allocations can provide a potentially cost-effective alternative to active funds. Moreover, blending multiple factor indexes in a multi-factor index may create natural crossing

[2] Historically, active managers would have provided institutions with exposure to multiple factors. For instance, quantitative active funds can use optimizers to create portfolios with targeted factor exposures. But there are significant potential benefits to an index-based approach (transparency, cost-effectiveness, and flexibility).

[3] Note that the benefits of "Transparency" and "Cost Efficiency" would be potentially applicable for single factor index allocations as well.

opportunities, which can reduce turnover and hence potentially reduce transaction costs at rebalancing.

- ***Diversification:*** Factor returns have been highly cyclical historically, with sensitivity to macro-economic and market forces. They also have underperformed the overall market for long periods of time. However, they do not all react to the same drivers and, hence, can have low correlations between each other. Consequently, multi-factor index allocations historically have demonstrated similar premiums over the long run to the individual factors but with milder fluctuations.

In Exhibit 1, the category "Factor Investing" contains both "Strategic Factor Tilts" and "Tactical Factor Tilts and Overlay Strategies". The former refer to strategic static tilts deployed as a long term strategy while the latter refers to dynamic allocations in which investors overweight/underweight factor allocations based on their forward looking expectations.

Also in Exhibit 1, "Pure Alpha" can still be provided by active management, which comprises value-adding activities that are not captured by passive factor allocations to indexes. "Pure Alpha" includes stock selection and sector rotation strategies, as well as top down asset allocation strategies where factor tilts are not driving excess return.

Deploying Factor Allocations

Many institutions have struggled to determine the appropriateness of factors for their own plan, what role these allocations might play, which factors should be adopted, and how factor indexes can be used.[4]

There are generally three main parts to the process for an institution deploying factor allocations:

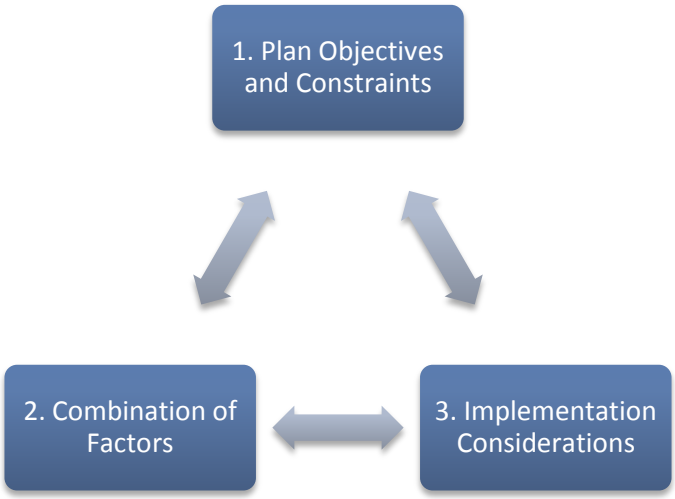
- Assess the Institution's Objectives and Constraints
- Select Candidate Factors
- Decide How to Structure the Implementation

In this framework, the institution must first assess the role of factor investing and what it hopes to achieve. This includes setting the investment objectives, assessing the internal governance structure, and establishing key constraints such as the risk tolerance. Once the role of factor investing has been established, the institution can then evaluate candidate factors. As discussed in "Foundations of Factor Investing", certain factors have strong theoretical foundations and have earned a persistent premium over long periods. The institution must form a belief about whether a factor's long-term historical premium will persist as part of this step.

The third part of the deployment decision process in this framework is the implementation. Among the available options for implementation (including via active managers) we focus here on passive implementation based on indexes. Exhibit 2 illustrates the process for an institution to evaluate its objectives, the relevant candidate factors, and the implementation structure. The plan's objectives and constraints inform the combination of the factors chosen and the degree of investability required in the factor allocation. For instance, very large allocations may not be capable of implementation for certain highly concentrated or long short strategies.

[4] To add to the difficulty, there has been a rapid proliferation of factor indexes and investment products. Even the breadth of names alone—factor indexes, strategy indexes, smart beta, alternative beta, to name just a few—have challenged even the most sophisticated investors.

Exhibit 2: Dimensions for Implementing Multi-Factor Index Allocations



Note that the institution's objectives and constraints drive the factor allocation decision, not the indexes themselves, a point that is often lost in the arguments about why one index might be superior to another. Simply focusing on a particular index's rules and construction process leads to the slippery slope of data-mining. There are thousands of options for generating indexes by varying the weights or criteria for selecting stocks. Any given set of index construction rules can lead to outperformance of the market through statistical sampling alone.[5]

Before evaluating any factor indexes, the institution should identify its goals for factor investing and evaluate potential candidate factors based on criteria that follow from their objectives and constraints. Choosing a factor index is an implementation decision that turns the objectives, goals, and factor beliefs into actual allocations. Next, in Section II, we discuss how an institution's objectives and constraints motivate the appropriate choice and blend of factors and factor indexes. In Section III, we look at investability, which is key in determining how to structure the factor index allocation. There are different index alternatives with varying levels of exposure versus investability. Therefore the appropriate index implementation depends on how the institution prioritizes exposure versus investability, which in turn is based on the institution's objectives and constraints.

[5] In fact, a recent paper by Arnott, Hsu, Kalesnik, and Tindall (2013) argues that any non-price-weighted portfolio will outperform a cap-weighted portfolio because of size and value effects. In our framework, we start with the pure factors first -- Value and Size -- and choose the most appropriate index based on key metrics such as factor exposure, investability, tracking error, and concentration.

II. Selecting the Right Blend of Factors

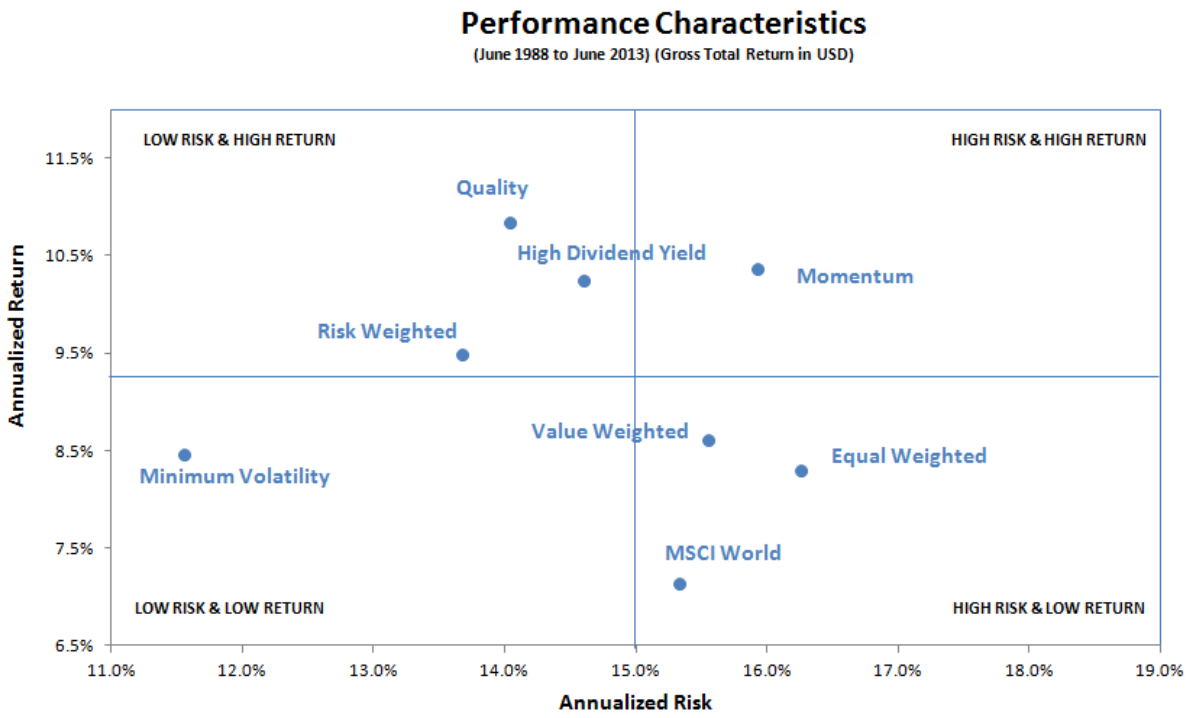
As an institution seeks the right blend of factors, the starting point is the institution's own profile. Factor allocations should be driven first and foremost by the institution's investment objectives and constraints (governance structure, horizon, risk budget, etc.).

- ***Objectives:*** Different investors have different objectives for factor investing, or said another way, different problems for which factor investing is meant to address. One institution may seek to enhance risk-adjusted returns, limit downside risk, or improve returns by holding the current level (or market level) of risk or beta constant. Another institution might be trying to replicate the performance of certain style managers, for instance, existing value and small cap managers. Different investors will also have different beliefs regarding the persistence of factors.
- ***Constraints:*** Constraints can also vary among investors. Key constraints are associated with the institution's governance structure which is tied to its investment horizon and risk tolerance. Often, the stronger the governance structure an institution has, the longer the horizon and the higher the risk tolerance it has. Institutions with very strong governance structures and long horizons are better able to withstand long periods of underperformance, and perhaps be compensated for bearing this risk. Funding ratios and the size of assets managed can also affect investability constraints.

Before selecting factors, the institution should begin by screening out any candidate factors which it does not expect to persist in the future. In other words, ***all candidate factors should be those the institution believe will*** persist in the future. Thus, the ***institution's objectives and constraints together drive the choice of factors*** among these candidates. For example, an institution seeking to enhance risk-adjusted returns may be looking for a somewhat more aggressive allocation (higher return and higher risk), a defensive allocation (moderate return and lower risk), or a balanced allocation (something in between).

Exhibit 3 shows the historical return and risk characteristics (June 1988 to June 2013) of seven MSCI Factor Indexes capturing "risk premia" factors introduced in "Foundations of Factor Investing". These are factors that have earned a premium over long periods and which have solid theoretical foundations. (Factor indexes based on the MSCI World Index are shown.) The Low Volatility factor, represented by the MSCI World Minimum Volatility and World Risk Weighted Indexes, and the Quality factor, represented by the MSCI World Quality Index, both have lower risk than the MSCI World Index. The Value and Yield factors represented by the MSCI World Value Weighted and MSCI High Dividend Yield Indexes had risk levels close to the market. The Low Size factor and Momentum factors, represented by the MSCI World Equal Weighted, and MSCI Momentum Indexes, respectively, have had higher returns. All seven indexes have historically shown higher Sharpe Ratios than the MSCI World Index. Determining the appropriate factors to allocate to might depend on the institution's return, risk, or Sharpe Ratio objectives.

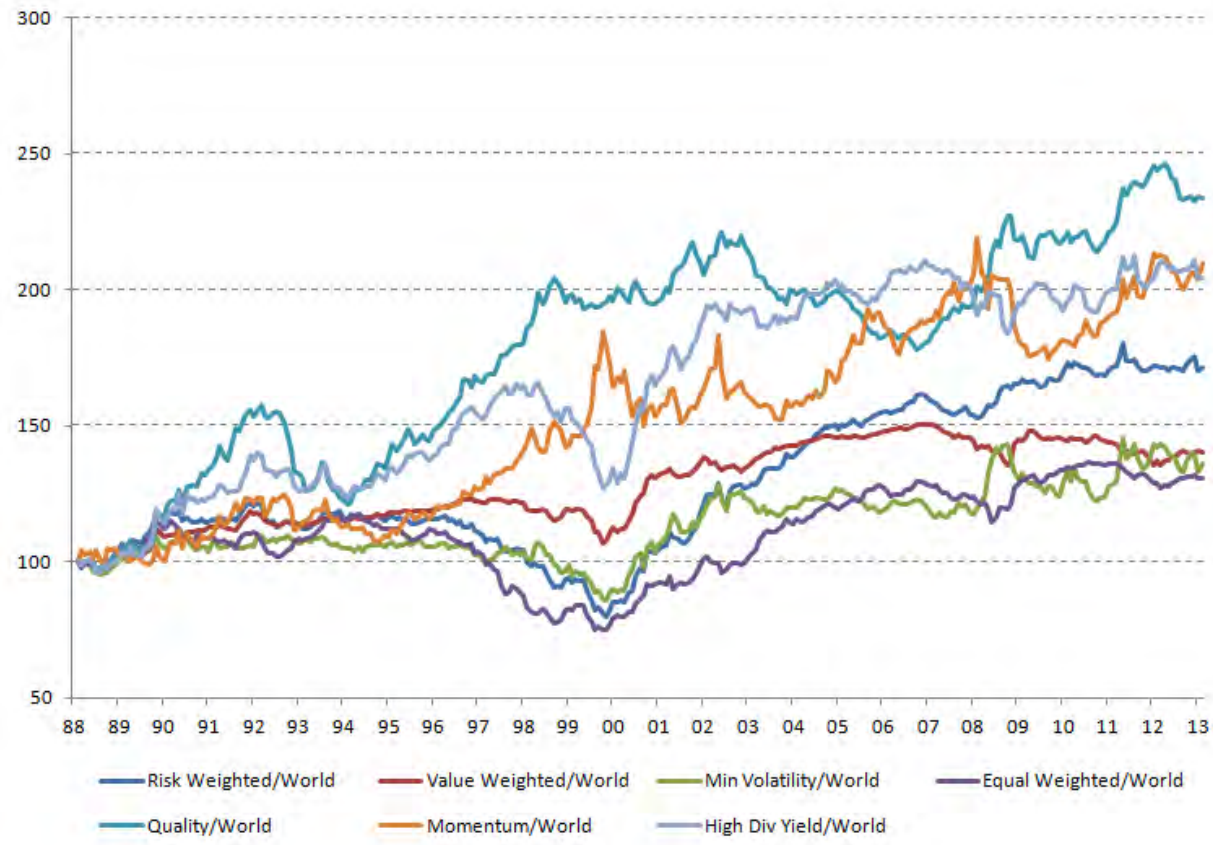
Exhibit 3: Factors Have Historically Exhibited Different Performance Characteristics



Correlations Matter When Selecting Factors: The Diversification Effects of Multi-Factor Index Allocations

Factor selection should also take into account the correlations between factors, which affects portfolio-level risk. Factor returns have historically been highly cyclical. Exhibit 4 shows the cumulative returns relative to the market cap weighted index (MSCI World Index). Each of the factor indexes shown has undergone at a minimum two-to-three consecutive year periods of underperformance. Some factors historically underwent even longer periods; the Small Cap or Low Size factor (captured by the MSCI World Equal Weighted Index in the exhibit) went through a six-year period of underperformance in the 1990s.

Exhibit 4: All Systematic Factors are Cyclical (Cumulative Relative Returns, June 1988 to June 2013)



But while individual factor returns have all been cyclical, their periods of underperformance have not been identical. Systematic factors have historically been sensitive to macro-economic and market forces but not in the same way. For instance, during the period between 2001 and 2007, the Momentum, Value, Low Volatility, and Low Size factors experienced positive excess returns over the market, but the Quality factor experienced negative returns. In contrast, from 2007-on, Quality fared well while Momentum and Value did not. Combining Quality with Momentum and Value for instance historically achieved smoother returns over time and diversified across multi-year cycles.

There is also strong empirical evidence that factors performed differently over various parts of the business cycle. Some factors such as Value, Momentum, and Size have historically been pro-cyclical, performing well when economy growth, inflation and interest rates are rising. Other factors such as Quality and Low Volatility have historically been defensive, performing well when the macro environment was falling or weak. Similar to macro business cycles, investors may seek factors that perform well under different types of market cycles such as high/low market volatility. Measuring the sensitivity of factors to macro economic cycles is an area that still requires further research. For recent research in this area, see Winkelmann et al. (2013).

The historical diversification effects can further be seen in the correlations between monthly active returns shown in Exhibit 5. Notably, the active returns of the MSCI World Quality and MSCI Momentum Indexes have been very low or negatively correlated with the other factor indexes shown. However, the majority of the correlations range from about 0.30 to -0.30.

Exhibit 5: Correlations of Relative Monthly Returns (June 1988 to June 2013, USD Gross Returns)

	MSCI World Risk Weighted	MSCI World Value Weighted	MSCI World Minimum Volatility	MSCI World Equal Weighted	MSCI World Quality	MSCI World Momentum	MSCI World High Div. Yield
MSCI World Risk Weighted	1.00						
MSCI World Value Weighted	0.61	1.00					
MSCI World Minimum Volatility	0.65	0.14	1.00				
MSCI World Equal Weighted	0.75	0.63	0.12	1.00			
MSCI World Quality	0.07	0.00	0.24	-0.26	1.00		
MSCI World Momentum	0.04	-0.26	0.16	-0.20	0.38	1.00	
MSCI World High Div. Yield	0.62	0.71	0.51	0.26	0.35	0.04	1.00

When multiple factor indexes are combined into a single multi-factor index, diversification across factors has historically lead to:

- Lower volatility and higher Sharpe Ratio
- Higher information ratios and lower tracking errors
- Less regime dependency over business cycles

For illustration, Exhibit 6 shows a multi-factor index where four individual indexes are combined: the MSCI World Quality Index, MSCI World Value Weighted Index, and MSCI World Momentum Index, and MSCI World Risk Weighted Index. [6] While the returns are a linear combination of the individual indexes, the risk metrics are not. The high Information Ratio of 0.83, substantially higher than the four individual indexes, reflects how well they diversified each other during this period.

Exhibit 6: Combining Multiple Factors Offers Substantial Diversification Effects (May 1999 to September 2013)

	World Standard	MSCI World Quality Index	MSCI World Risk Weighted Index	MSCI World Value Weighted Index	MSCI World Momentum Index	**Multi Factor Index**
Total Return* (%)	4.2	5.3	8.6	5.5	6.9	**6.7**
Total Risk* (%)	16.3	14.3	14.6	17.2	16.7	**14.9**
Sharpe Ratio	0.18	0.26	0.47	0.25	0.33	**0.34**
Annualized Active Return (bps)		110	440	120	270	**250**
Tracking Error* (%)		4.5	5.6	3.6	9.0	**3.0**
Information Ratio		0.25	0.79	0.35	0.30	**0.83**
Max Rel. Drawdown (Active Returns) (%)		20.5	16.0	10.7	21.6	**5.7**
Max Rel. Drawdown Period (Active Returns) (in Months)		52	10	9	19	**2**

* Annualized in USD for the 05/31/1999 to 09/30/2013 period
** Annualized one-way index turnover for the 05/31/1999 to 09/30/2013 period

Exhibit 6 also includes maximum drawdown, relative to the MSCI World Index, and the maximum relative drawdown period in months. Both measures capture prolonged periods of underperformance. This measure of risk is equally if not more important than traditional measures of risk like standard deviation of returns because it arguably captures "career risk." Even for institutions with long stated

[6] The multiple-index combination is rebalanced semi-annually at the same time as the underlying indexes in May and November.

horizons, the investment staff will often be forced to reassess allocations if the portfolio underperforms for too long. The multi-factor index historically has significantly lower drawdown measures than the individual indexes.

In sum, historically there are important diversification effects in combining multiple factors. Multi-factor indexes achieved the same historical premium over the long run as the individual factors but with milder fluctuations. Actual use cases include a Canadian pension plan which adopted a combination of MSCI Risk Weighted, MSCI Quality, and MSCI Value Weighted Indexes, and a US pension plan which chose a combination of MSCI High Dividend Yield, MSCI Quality, and MSCI Value Weighted Indexes. These and other use cases presented later in Section III further illustrate the benefits of multi-factor indexes.

Considerations for Combining Factor Indexes

Tying all this together, we arrive at the main considerations for selecting the right blend of factors. It starts with the institution's objectives and constraints, its beliefs regarding which factors are likely to persist, and in some cases, return expectations for the factors. When choosing an appropriate factor combination, the key criteria are risk, correlations with other factors, and performance in different business cycles, as shown in Exhibit 7.

Exhibit 7: Considerations for Combining Factor Indexes

Factor	Historical Risk	Historical Correlation	Historical Business Cycle
Value	Comparable to market	Low with Momentum and Quality	Pro-cyclical
Momentum	Comparable to market	Low with Value, Yield, and Quality	Pro-cyclical
Low Size	Higher than market	Low with Min Volatility, Yield, and Quality	Pro-cyclical
Quality	Lower than market	Low with Value, Size, Yield and Momentum	Defensive
Low Volatility	Lower than market	Low with Value and Momentum	Defensive
Yield	Lower than market	Low with Size, Quality and Momentum	Defensive

Other criteria that can affect factor selection include sources of return as well as return patterns. For example, an institution may prefer income to capital appreciation or prefer factors which imply higher yields. In addition, an institution may be particularly sensitive to the possibility of a prolonged drawdown and seek factors that are less likely to go through multi year periods of underperformance or, as illustrated earlier in Exhibit 6, blends of factors that minimize prolonged underperformance. Thus, the criteria for choosing factors and combinations of factors could include a variety of characteristics such as ***return (including forward looking expectations), risk, Sharpe Ratio, diversification effects, yield levels, beta, general liquidity characteristics, downside risk, and risk of prolonged periods of underperformance***.

Exhibit 8 provides examples of how factor allocations can be tailored by the institution to its objectives.[7]

Exhibit 8: Factor Allocations Are Based on the Institution's Objectives and Constraints

Sample Objective	Example Allocation (Pure Factors)	Example Index Allocation
Diversified Balanced Mix	➢ Value, Low Volatility, Momentum, Quality	➢ MSCI Multi-Factor Index: Value Weighted, Risk Weighted, Momentum, and Quality
Diversified Dynamic Mix	➢ Low Size, Momentum, and Value	➢ MSCI Multi-Factor Index: Equal Weighted, Momentum, and Value Weighted
Diversified Defensive Mix	➢ Low Volatility, Value, and Quality	➢ MSCI Multi-Factor Index (MSCI Quality Mix): Minimum Volatility, Value, and Quality
De-Risking with Yield-Enhancement	➢ Low Volatility and High Dividend Yield	➢ MSCI Multi-Factor Index: Minimum Volatility, and High Dividend Yield

In sum, there is no universal factor solution, either in the form of a single factor or a combination of factors, that is right for all institutions. Actual use cases are helpful in understanding different types of allocations. Several examples are shown in Section III.

[7] Some institutions may not have explicit performance goals. Rather, they may be seeking ways to make explicit the tilts that the plan's active managers already take.

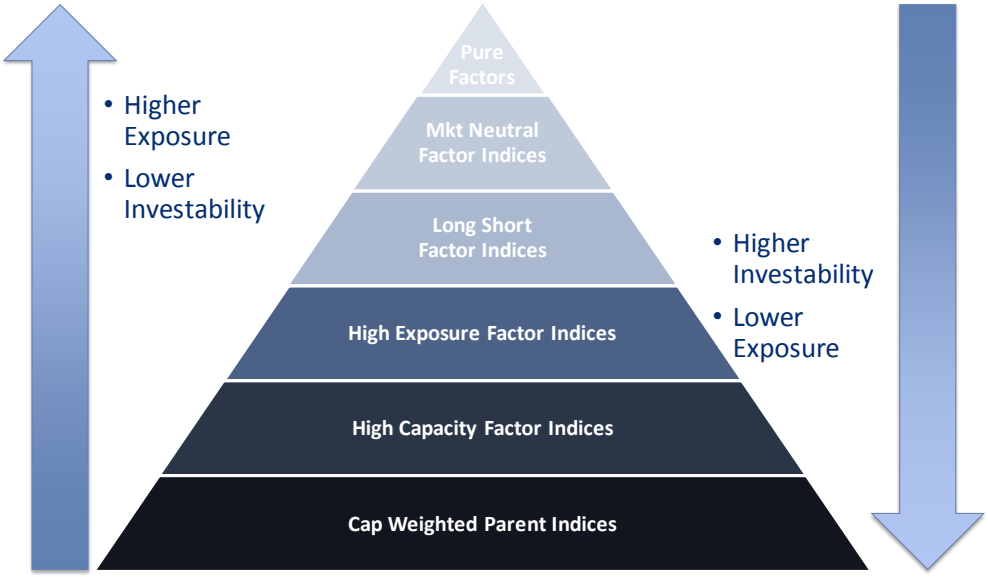
III. Implementation Considerations

In this section, we discuss in more detail critical aspects of implementation. We focus, in particular, on a potential framework for how to incorporate the investability dimension in the selection of the individual factor indexes. We also discuss how factor indexes can be combined in a multi-factor index to reduce trading cost by benefitting from potential natural crossing. This last element requires the allocation to be structured around a single passive mandate (or multiple mandates structured to replicate passively the same index) with synchronized rebalancing dates.

Understanding the Exposure vs. Investability Trade Off

In selecting the individual factor indexes that make up a multi-factor index or in selecting a single factor index, the most critical point we stress here is that there is a tradeoff between the strength of the exposure to a factor and the investability of the strategy that reflects it. There is a range of index alternatives that have varying levels of investability and exposure to a specific factor. Exhibit 9 shows a general framework which visually displays the different index options.

Exhibit 9: Capturing Factors Through Indexation



The most investable index, by definition, is the one whose weights are proportional to free float adjusted market capitalization, the bottom part of the pyramid. The factors at the top (e.g., the Fama-French or Barra factors) are the theoretical or pure factors that the institution may wish to capture, but that are research rather than investability oriented. The closest factor indexes to market capitalization weighted indexes are High Capacity Factor Indexes. These are indexes that hold all the stocks in the parent index but tilt the market cap weights toward the desired factor. As we move up, High Exposure Indexes hold a subset of names in the parent index and can employ more aggressive weighting mechanisms. The investor who seeks to control active country or industry weights or exposures to other style factors, or who desires to limit turnover, tracking error, or concentration, can use High Exposure Indexes that employ optimization or systematic stock screening. Next, Long/Short Factor Indexes add leverage (e.g., 150/50, 130/30) primarily to hedge out residual exposure to other factors, and lastly

Market-Neutral Factor Indexes are pure long/short Indexes that have zero market exposure.[8] The leveraged index categories typically employ optimization.

Moving up the pyramid yields lower investability and greater exposure to the pure factor.

Factor Exposure

What do we mean by "factor exposure"? Factor exposure captures the degree to which the index captures the pure non-investable factor. To assess the strength of the factor exposure of a particular index, one can use a factor model (which can be used to calculate any portfolio or index's exposure to the factors in that model). Factor exposure is typically expressed as standard deviations away from the cap-weighted average of the market.[9] Note that for most factor models, which typically employ linear exposures and regressions, the exposure of an index to an underlying factor is just the weighted exposure of the individual stocks' exposures to the factor in question. (Factor exposure is also often called signal strength in the language of quantitative equity managers.)

As one moves up the pyramid, typically higher levels of factor exposure are achieved which translates into higher returns if factor returns scale with exposure and as long as incidental bets are controlled for.[10] This last point is important because more concentrated portfolios often have larger sector and country active weights, or even unintended exposures to factors other than the factor of interest. If these are not controlled, they can incidentally negatively affect returns, detracting from the intended factor return.

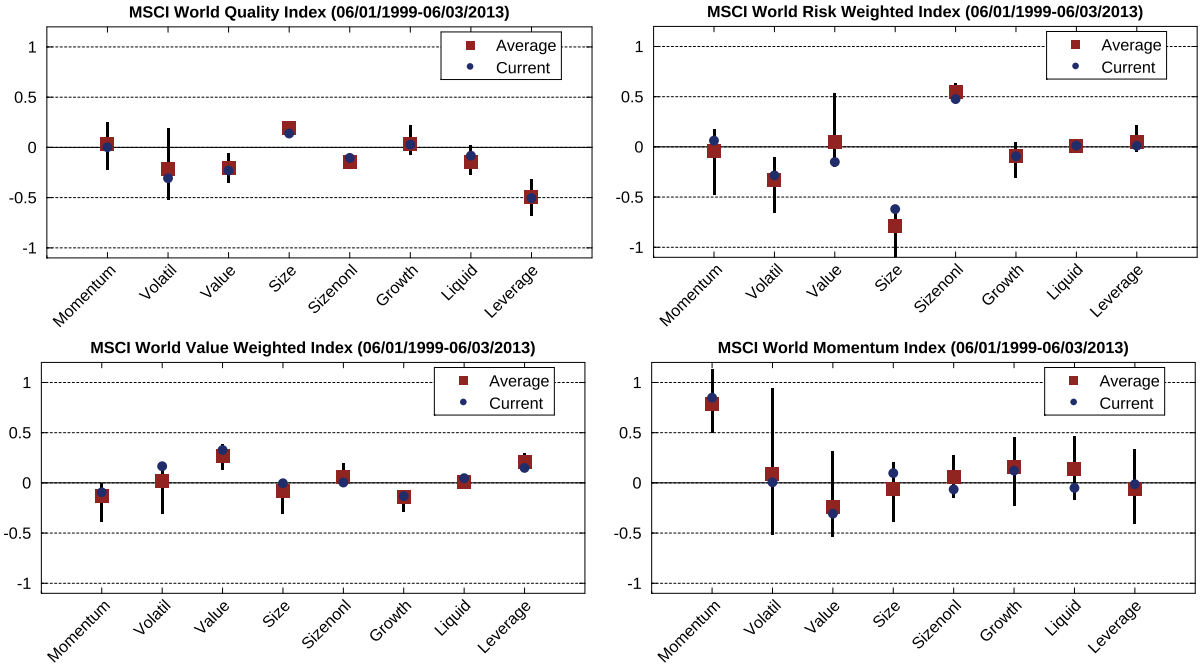
In Exhibit 10, we illustrate factor exposures using the Barra multi-factor models which estimate factor portfolios using multivariate regressions and have the advantage of specifying factors with little co-linearity. As an example, Exhibit 10 shows the active exposures (relative to the MSCI World Index) of four of the factor indexes. In all cases, the indexes have significant exposure, with the expected sign, to the most relevant pure factors. The MSCI World Value Weighted Index has an exposure of 0.28 to the Barra GEM2 Value Factor, which is above the usual 0.20-0.25 rule of thumb for statistically significant exposures. In some cases, an index may have significant exposure to factors other than the intended factor. For instance, the MSCI World Risk Weighted Index has a significant small cap bias as seen by the large negative exposure to the GEM2 Size factor. In this case, the small cap bias contributes to the excess return of the World Risk Weighted Index. Institutional investors should be aware of these potential secondary exposures and understand/manage them appropriately.

[8] Active country and sector weights will be zero and exposures to all other style factors will be zero.

[9] An active/relative exposure of 0.25 to the Barra Value factor can be interpreted as the portfolio or stock's Value characteristics being 0.25 standard deviations higher than the market cap weighted benchmark.

[10] One can have higher exposure to the desired factor but the positive impact on returns may be negated by other exposures (either to other factors or countries or sectors). Controlling exposures to other factors is possible through optimization. For example, in a Value factor index, one might want to neutralize exposures to other factors such as Low Size and Momentum.

Exhibit 10: Factor Exposures (Factor Exposures for Select World Factor Indexes Using the Barra GEM2 Model, Average and Current Exposures, June 1999 to June 2013)

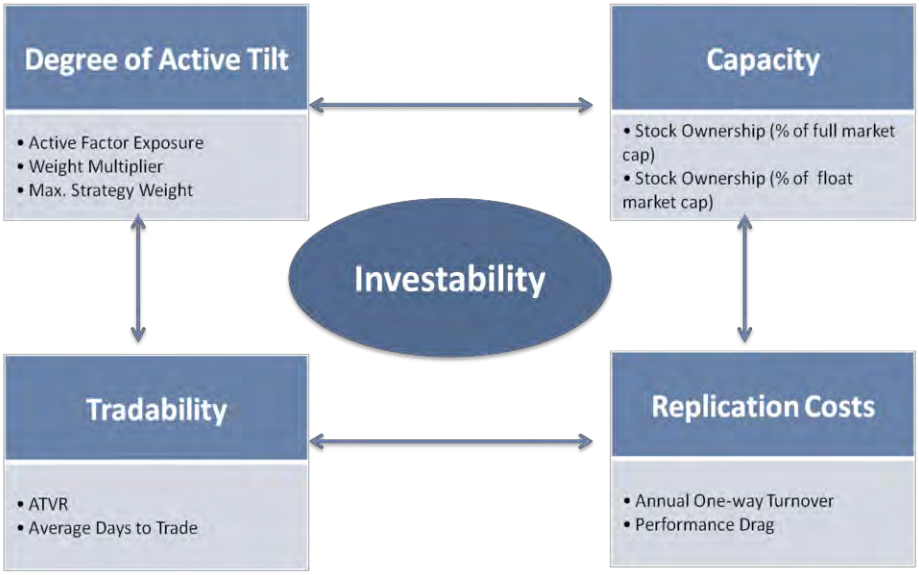


Investability

What do we mean by "investability"? Investability refers to how liquid and tradable the index is. It also refers to how scalable the allocation to an index replicating vehicle might be. There are multiple dimensions to investability. As shown in Exhibit 11, they include Tradability/Liquidity, Turnover/Cost of Replication and Capacity -- for a given degree of active tilt.[11] Tradability/Liquidity quantifies how liquid the stocks are in the index replicating portfolio and how tradable the portfolio is. Metrics include days to trade individual stocks at rebalancings and during the initial construction, and days to trade a certain portion of the portfolio (given a certain size portfolio and a set limit to the amount traded on a single day). Turnover/Cost of Replication measures the turnover of the index at rebalancing which scales with trading costs. The higher the turnover, generally the higher the cost of trading. Capacity quantifies (for a given size portfolio) the percentage of a stock's free float or full market capitalization the portfolio would own. The degree to which a portfolio is "active" relative to the index has been traditionally used by many active asset managers to characterize their active strategies' performance. Metrics like active share and maximum strategy weight capture this.

[11] These dimensions were first discussed in Bambaci et al. (2013).

Exhibit 11: Dimensions for Investability



Note that some indexes may score well on all four dimensions; the MSCI Value Weighted Indexes for instance historically have exhibited low turnover, high capacity, and good tradability. Others may have good capacity and tradability but incur high turnover (e.g., Momentum).

Investability vs. Exposure

Since, as we have seen, indexes nearer the top of the pyramid are less investable and less liquid but have greater factor exposure, there is an ***unavoidable tradeoff*** between the purity or exposure of a factor index and the investability of a factor index. One can generally only achieve purer factor exposure by sacrificing investability and being willing to take on greater amounts of active risk and complexity. The appropriate index thus depends on the institutional investor's own preferences for factor exposure and investability. Institutions must make a self-assessment of where they desire to be on the pyramid.

It is also important to note that institutions typically care about tracking error, or risk relative to the market cap weighted parent index. In particular, many plans have active risk budgets at the plan level.[12] As we move up the pyramid, tracking error generally increases. Plans with low tracking error targets may want to limit the discussion to the lower end of the pyramid while those with higher tracking error limits may consider options further up the pyramid.

Exhibit 12 shows characteristics of the MSCI Factor Indexes over the period June 1988 to June 2013. Higher capacity indexes typically hold a broad set of names (e.g., all the names in the broad market parent index) and are weighted with investability in mind. As previously discussed in Bambaci et al. (2013), the MSCI Value Weighted Indexes effectively employ a weighting scheme that combines a score based on value characteristics and market capitalization, and are an example of a high capacity index.

As illustrated in Exhibit 12, the MSCI World Value Weighted Index has the lowest active risk (tracking error) and very low turnover among the indexes shown. Other "Weighted" indexes (all of which hold all the names in the parent index) also exhibit relatively low tracking errors and turnover. The other indexes (the MSCI Momentum Indexes, MSCI Quality Indexes, and MSCI Minimum Volatility Indexes) are

[12] Many institutional investors have a maximum (or target) level of desired risk, usually in the form of return standard deviation, but sometimes gauged by downside measures such as maximum drawdown or expected shortfall.

more concentrated indexes, holding only a subset of the names in the parent index. These indexes exhibited higher tracking errors and lower levels of investability. (The MSCI Minimum Volatility Indexes are turnover constrained to 20% but other measures of investability are more similar to the MSCI Momentum and MSCI Quality Indexes.)

Exhibit 12: MSCI World Factor Indexes (Main Characteristics, June 1988 to June 2013)

Index	Factor Exposures*	Total Return	Total Risk	Active Return	Active Risk	Annual Turnover	Pairwise Correl-ation
MSCI World	--	7.1	15.4	0.0	0.0	3.9	NA
MSCI World Equal Weighted	Size	8.3	16.3	1.2	5.2	31.8	0.22
MSCI World Minimum Volatility	Volatility	8.5	11.6	1.4	6.7	20.0	0.30
MSCI World Value Weighted	Value	8.6	15.6	1.5	3.6	20.3	0.30
MSCI World Risk Weighted	Size, Volatility	9.5	13.7	2.4	5.3	27.2	0.46
MSCI World Quality	Growth, Leverage	10.9	14.0	3.8	5.9	27.6	0.13
MSCI World Momentum	Momentum	10.4	15.9	3.3	8.5	127.5	0.03
MSCI World HDY	--	10.3	14.6	3.2	6.5	22.0	0.41

* In the column "Factor Exposures" we show the Barra Global Equity Model (GEM2) factors which are statistically significant on average (>+/-0.20), with the expected sign, since December 1997. Note that there is no "Yield factor" in the GEM2 Model. Instead, Yield is a component (with a weight of 10%) in the GEM2 Value factor. Turnover reported is the average annual one-way turnover based on history from June 1988 – June 2013.

Reducing Trading Costs by Leveraging the Benefits of Natural Crossing

In addition to the investability dimensions we have discussed so far, investors should also consider the potential to reduce trading costs at each rebalancing through operational efficiency. As we discussed in Section II, historically there have been significant diversification effects when combining multiple factors. In the implementation phase there can also be significant investability benefits to combining multiple factors in a multi-factor index.

Combining factor indexes may reduce turnover from "natural crossing" effects. On the index rebalancing dates, the composite index would be rebalanced back to its target weights (e.g., 50/50) and turnover may be reduced as a company deleted from one factor index might be added as a constituent of another factor index. Take for example a stock whose price is falling over time. As the price falls, it

may drop out of a momentum index but the lower price could push the stock into a value index. Those shares which overlap the two indexes would be internally crossed. This "natural crossing" leads to lower index turnover and by implication, lower transaction costs in a portfolio replicating the index.

The historical effects of natural crossing are shown in Exhibit 13. In this example, we show a blend of the MSCI World Quality Index, MSCI World Risk Weighted Index, MSCI World Value Weighted Index, and MSCI World Momentum Index. The four indexes are equally weighted and rebalanced semi-annually at the same time the underlying indexes are reconstituted. (Note that the rebalancing for the individual indexes and the rebalancing across indexes needs to be synchronized for the natural crossing to take place.) The annual turnover for the individual indexes is 22.98%, 22.04%, 18.30%, and 89.62%, respectively. If these four indexes were replicated separately, their combined turnover would be 40.81%. When they are replicated as a single portfolio in a single mandate, the combined turnover is significantly lower at 31.91%. The turnover declines by 8.9 percentage points. What does this mean in terms of trading costs in index replicating portfolios? If trading costs are 50 basis points (a relatively conservative assumption for global developed market equities), the round-trip trading costs would be 41 basis points for the separately managed portfolio, and 32 basis points for the combined multi-factor index-based portfolio. The latter option saves the investor close to 9 bps in transaction costs.

Exhibit 13: Crossing Benefits Resulted in Lower Turnover and Lower Trading Costs (Simulated Turnover of Separate and Combined Equally Weighted Allocations to Select MSCI Factor Indexes)

	MSCI World Quality Index	MSCI World Risk Weighted Index	MSCI World Value Weighted Index	MSCI World Momentum Index	Separate Mandates (A)	Combined Mandates (B)	Reduction (A) - (B)
Turnover(%)	22.98	22.04	18.30	89.62	40.81	31.91	8.90
Performance Drag in bps (at 25 bps)*	11.49	11.02	9.15	44.81	20.40	15.95	4.45
Performance Drag in bps (at 50 bps)*	22.98	22.04	18.30	89.62	40.81	31.91	8.90
Performance Drag in bps (at 75 bps)*	34.47	33.06	27.45	134.42	61.21	47.86	13.35

Annualized for the 05/31/1999 to 9/30/2013 period

* Performance drag aims to represent the total two-way annualized index level transaction cost assuming various levels of security level transaction cost

Our conclusion here is that these natural crossing effects may often be overlooked and deserve consideration given the potential additional savings.

IV. Multi Factor Index Allocations: Examples

The right blend of factors will depend on the institution's preferences for various aspects of performance (return, risk, correlations, etc.), investability, and factor exposure, which in turn reflects the institution's objectives and constraints.

Actual use cases can be helpful in understanding how institutions have actually addressed these issues in adopting multi-factor index combinations.

Based on real use cases, in the first example, we show a strategic or long-term static allocation that is designed to be well diversified. Factor indexes in this example are the MSCI Value, MSCI Momentum, MSCI Risk Weighted, and MSCI Quality Indexes. The four factors are implemented as a single composite multi-factor index that is rebalanced semi-annually. The index allocation is executed as a passive internal mandate.

The second example focuses on an allocation that provides lower absolute volatility with higher yield. The desire to "de-risk" is driven by the institution's projections of a bearish, low growth market. At the same time, the institution seeks to achieve higher yields while de-risking. This allocation is implemented as a passive external mandate on a multi-factor index combining Low Volatility via the MSCI Minimum Volatility Indexes and Yield via the MSCI High Dividend Yield Indexes.

One additional use case is an extension of the second example. The "core portfolio" in the second use case (MSCI Minimum Volatility and MSCI High Dividend Yield Indexes) can also be augmented by tactical factor allocations to factor indexes such as MSCI Momentum, MSCI Quality, MSCI Value Weighted, and MSCI Equal Weighted Indexes. These exposures could be adjusted over time based on forward looking views and deployed via four exchange-traded funds tracking the MSCI indexes. An external consultant or active manager could play a role in advising on the tactical overlay decision.

How do institutions in practice arrive at allocations like these? Institutions must evaluate a number of key dimensions that we have discussed already in this paper-- Performance (Risk, Returns, etc.), Factor Exposure, Investability, and the Effects of Combining Multiple Indexes. Exhibit 14 summarizes a few of the key dimensions that might help the institution form a view on different combinations.

In order to help institutions understand whether their objectives are met given various combinations of factor indexes, MSCI has developed IndexMetrics, a structured framework for the analysis of multi-factor blends. The next paper in this series "Introducing MSCI IndexMetrics: An Analytical Tool for Factor Investing" describes this framework in greater detail.

Exhibit 14: Key Metrics for Evaluating Different Combinations of Factor Indexes in Structuring a Multi-Factor Index Allocation

Performance	Exposure	Investability	Combination
➢ Total Returns, Total Risk, Sharpe Ratio ➢ Active Returns, Tracking Error, Information Ratio ➢ VaR, Expected Shortfall ➢ Maximum Drawdown (percentage, length) ➢ Relative Maximum Drawdown ➢ Years of Consecutive Underperformance	➢ Active Factor, Sector, Region Exposures ➢ Relative Valuation and Fundamental Ratios	➢ Liquidity ➢ Cost of Replication (Turnover) ➢ Capacity ➢ Concentration	➢ Diversification of Returns ➢ Turnover Reduction

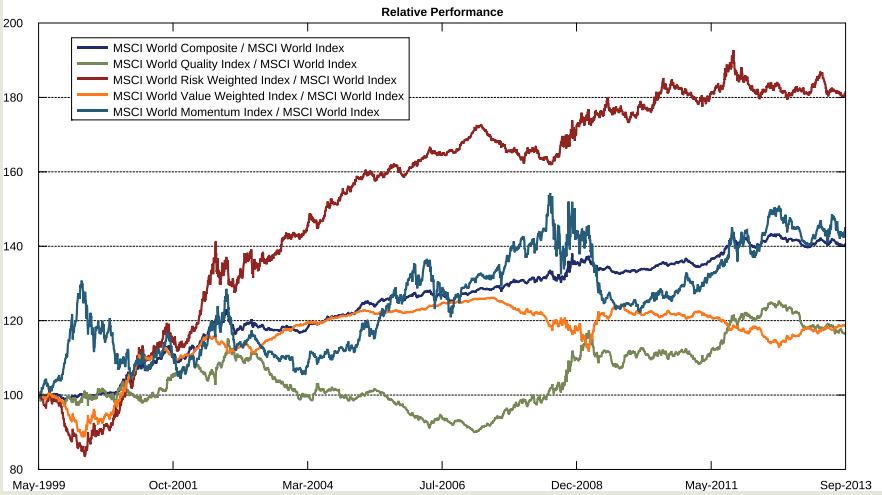
Example #1: Strategic Long-Term Risk-Adjusted Return

Strategic Allocation:

- MSCI World Value Weighted Index 25%
- MSCI World Risk Weighted Index 25%
- MSCI World Quality Index 25%
- MSCI World Momentum Index 25%

As shown in Exhibit 15, the four indexes exhibited significantly different returns over various sub periods. They historically provided high levels of diversification.

Exhibit 15: Performance Using Historical Returns (May 1999 to September 2013)



The result of combining the four indexes is a balanced portfolio which exhibited return enhancement at lower risk levels than the market historically.

Exhibit 16: Performance Using Historical Returns (May 1999 to September 2013)

Historical Gross Total Return, USD	MSCI World	MSCI World Quality Index	MSCI World Risk Weighted Index	MSCI World Value Weighted Index	MSCI World Momentum Index	Combined
Total Return Performance						
Total Return* (%)	4.2	5.3	8.6	5.5	6.9	6.7
Total Risk* (%)	16.3	14.3	14.6	17.2	16.7	14.9
Return/Risk	0.26	0.37	0.59	0.32	0.41	0.45
Sharpe Ratio	0.18	0.26	0.47	0.25	0.33	0.34
Active Return Performance						
Active Return* (%)	0.0	1.1	4.4	1.2	2.7	2.5
Tracking error* (%)	0.0	4.5	5.6	3.6	9.0	3.0
Information Ratio	N/A	0.25	0.79	0.35	0.30	0.83
Trading Costs / Investability						
Weighted Average Days to Trade***	0.01	0.04	0.04	0.01	0.18	0.03
Turnover** (%)	3.1	23.0	22.0	18.3	89.6	32.0
Performance Drag in bps (at 50 bps)	3.1	23.0	22.0	18.3	89.6	32.0

* Annualized in USD for the 05/31/1999 to 09/30/2013 period

** Annualized one-way index turnover for the 05/31/1999 to 09/30/2013 period

*** Average of last four index reviews ending 09/30/2013. Assuming a fund size of USD 10 bn and a maximum daily trading limit of 20%

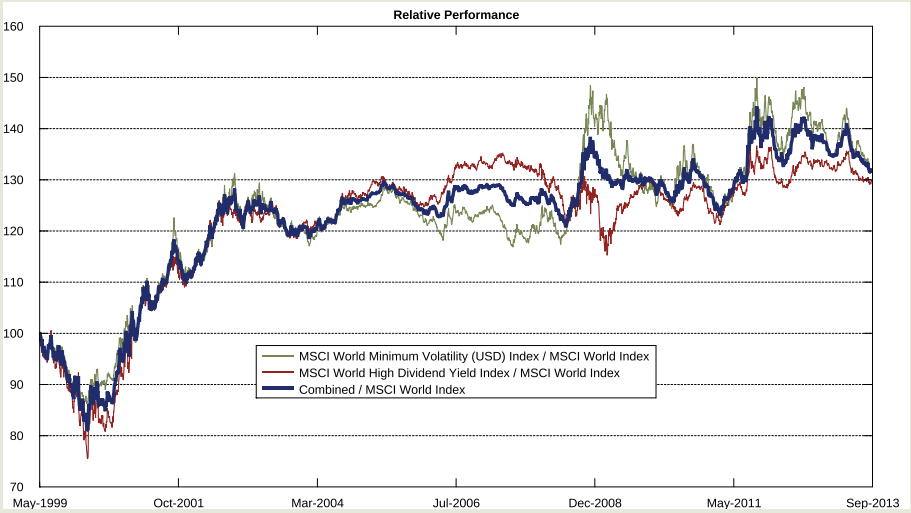
Example #2: De-Risking with Yield Enhancement

Strategic Allocation:

- MSCI World Minimum Volatility Index 50%
- MSCI World High Dividend Yield Index 50%

Some institutional investors have sought to enhance yield in recent years and at the same time reduce overall volatility. As shown in Exhibit 17, combining the MSCI World High Dividend Yield and MSCI World Minimum Volatility Indexes would have improved the historical performance of the portfolio over the May 1999 to June 2013 period significantly with overall lower volatility. Meanwhile, the average dividend yield for this period was 3.3% for the multi-factor index compared to 2.2% for the market cap weighted parent MSCI World Index.

Exhibit 17: Performance Using Historical Returns (May 1999 to September 2013)



The result of combining a high yield factor index with a low volatility index is a portfolio which historically exhibited substantial risk-adjusted return enhancement as seen below.

Exhibit 18: Performance Using Historical Returns (May 1999 to September 2013)

Historical Gross Total Return, USD	MSCI World Index	MSCI World High Dividend Yield Index	MSCI World Minimum Volatility (USD)	Combined
Total Return Performance				
Total Return* (%)	4.2	6.1	6.3	6.3
Total Risk* (%)	16.3	16.1	11.4	13.5
Return/Risk	0.26	0.38	0.55	0.46
Sharpe Ratio	0.18	0.30	0.37	0.33
Active Return Performance				
Active Return* (%)	0.0	1.9	2.0	2.0
Tracking error* (%)	0.0	6.1	7.9	6.2
Information Ratio	N/A	0.31	0.26	0.33
Trading Costs / Investability				
Weighted Average Days to Trade***	0.01	0.4	1.2	0.5
Turnover** (%)	3.1	20.4	27.1	23.1
Performance Drag in bps (at 50 bps)	3.1	20.4	27.1	23.1
Yield				
Dividend Yield (%)****	2.3	4.0	2.6	3.3

* Annualized in USD for the 05/31/1999 to 09/30/2013 period

** Annualized one-way index turnover for the 05/31/1999 to 09/30/2013 period

*** Average of last four index reviews ending 09/30/2013. Assuming a fund size of USD 10 bn and a maximum daily trading limit of 20%

**** Monthly averages for the 05/31/1999 to 09/30/2013 period

Conclusion

In this paper, we discussed a framework for how institutional investors might consider deploying factor allocations based on factor indexes. The framework comprises three key steps. In the first step, the institution assesses the role of factor investing in its portfolio. The second step identifies which factor(s) are appropriate for the institution's portfolio. Finally the third step implements the factor index allocation. This includes structuring the portfolio to take into account potential diversification effects between factors and the institution's preferences for investability and factor exposure. Factor allocations can play a variety of roles in the investment process, depending on the objectives and constraints of the investor.

Because they reflect systematic factors that respond to macroeconomic and macro market forces, factor indexes can underperform the overall market for periods of time that may exceed an investment committee's patience. However, many of these factors respond differently to macroeconomic and macro market forces, so they have historically low correlations which may yield strong diversification effects for combining multiple factors in an allocation. We demonstrated how combining factor indexes in a "Multi-Factor Index" captured these diversification effects as well as additional benefits such as lower turnover as a result of internal crossing.

In the next paper in this series, "Introducing MSCI IndexMetrics: An Analytical Tool for Factor Investing", we describe more precisely the concepts discussed here in this second paper. We define the metrics used in this paper as part of the overall criteria for identifying factors, selecting factor indexes, and selecting combinations of factor indexes. These metrics are all part of MSCI's new analytics engine -- "MSCI IndexMetrics" -- which turns the concepts into a set of actionable and concrete quantitative metrics.

References

Bambaci, Juliana, Jennifer Bender, Remy Briand, Abhishek Gupta, Brett Hammond, and Madhu Subramanian (2013), "Harvesting Risk Premia for Large Scale Portfolios: Analysis of Risk Premia Indices for the Ministry of Finance, Norway," MSCI Research Insight, March 2013.

Winkelmann, Kurt , Raghu Suryanarayanan, Ludger Hentschel, and Katalin Varga (2013), "Macro-Sensitive Portfolio Strategies: Macroeconomic Risk and Asset Cash-Flows", MSCI Market Insight, March 2013.

Client Service Information is Available 24 Hours a Day

clientservice@msci.com

Americas

Americas	1.888.588.4567 (toll free)
Atlanta	+ 1.404.551.3212
Boston	+ 1.617.532.0920
Chicago	+ 1.312.675.0545
Monterrey	+ 52.81.1253.4020
New York	+ 1.212.804.3901
San Francisco	+ 1.415.836.8800
Sao Paulo	+ 55.11.3706.1360
Toronto	+ 1.416.628.1007

Europe, Middle East & Africa

Cape Town	+ 27.21.673.0100
Frankfurt	+ 49.69.133.859.00
Geneva	+ 41.22.817.9777
London	+ 44.20.7618.2222
Milan	+ 39.02.5849.0415
Paris	0800.91.59.17 (toll free)

Asia Pacific

China North	10800.852.1032 (toll free)
China South	10800.152.1032 (toll free)
Hong Kong	+ 852.2844.9333
Seoul	00798.8521.3392 (toll free)
Singapore	800.852.3749 (toll free)
Sydney	+ 61.2.9033.9333
Taiwan	008.0112.7513 (toll free)
Tokyo	+ 81.3.5226.8222

Notice and Disclaimer

About MSCI

MSCI Inc. is a leading provider of investment decision support tools to investors globally, including asset managers, banks, hedge funds and pension funds. MSCI products and services include indices, portfolio risk and performance analytics, and governance tools.

The company's flagship product offerings are: the MSCI indices with approximately USD 7.5 trillion estimated to be benchmarked to them on a worldwide basis[1]; Barra multi-asset class factor models, portfolio risk and performance analytics; RiskMetrics multi-asset class market and credit risk analytics; IPD real estate information, indices and analytics; MSCI ESG (environmental, social and governance) Research screening, analysis and ratings; ISS corporate governance research, data and outsourced proxy voting and reporting services; and FEA valuation models and risk management software for the energy and commodities markets. MSCI is headquartered in New York, with research and commercial offices around the world.

[1] *As of March 31, 2013, as reported on July 31, 2013 by eVestment, Lipper and Bloomberg* *Oct 2013*