# MSCI ANNUAL CONFERENCE ON **GLOBAL INVESTING AND RISK MANAGEMENT 2017**

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Jumeirah Carlton Tower

London, UK

# DYNAMIC FACTOR ALLOCATION STRATEGIES

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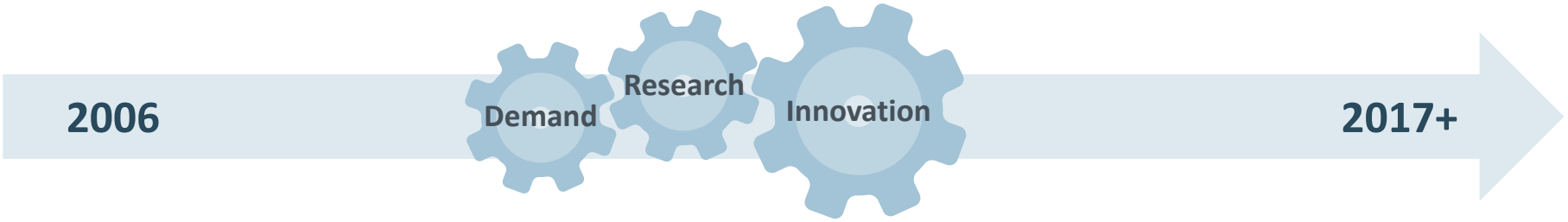
# INNOVATIONS IN FACTOR STRATEGIES




| Factors – Key Drivers of Risk/Return | How Much Active Risk ? | Multi-Factor 'Static Combinations' | Dynamic Factor Allocation Strategies |
|---|---|---|---|
| LOW VOLATILITY | Long / Short | Top-Down Index Mix | Trends |
| HIGH YIELD | Optimized | | Macro |
| QUALITY | High Exposure | Bottom-Up 'Integrated Approach' | Fundamentals |
| MOMENTUM | Moderate Tilts | | Risk |
| VALUE | | | |
| SIZE | | | |

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# DYNAMIC FACTOR ALLOCATION STRATEGIES

## GROUPING FACTORS BASED ON THEIR CHARACTERISTICS

| Macro Sensitivities | Trend | Fundamental | Risk |
|---|---|---|---|
| • Growth<br>• Inflation | • Cross-sectional<br>• Time-series | • Valuations<br>• Cross-sectional<br>• Time-series | • Correlations<br>• Volatility |

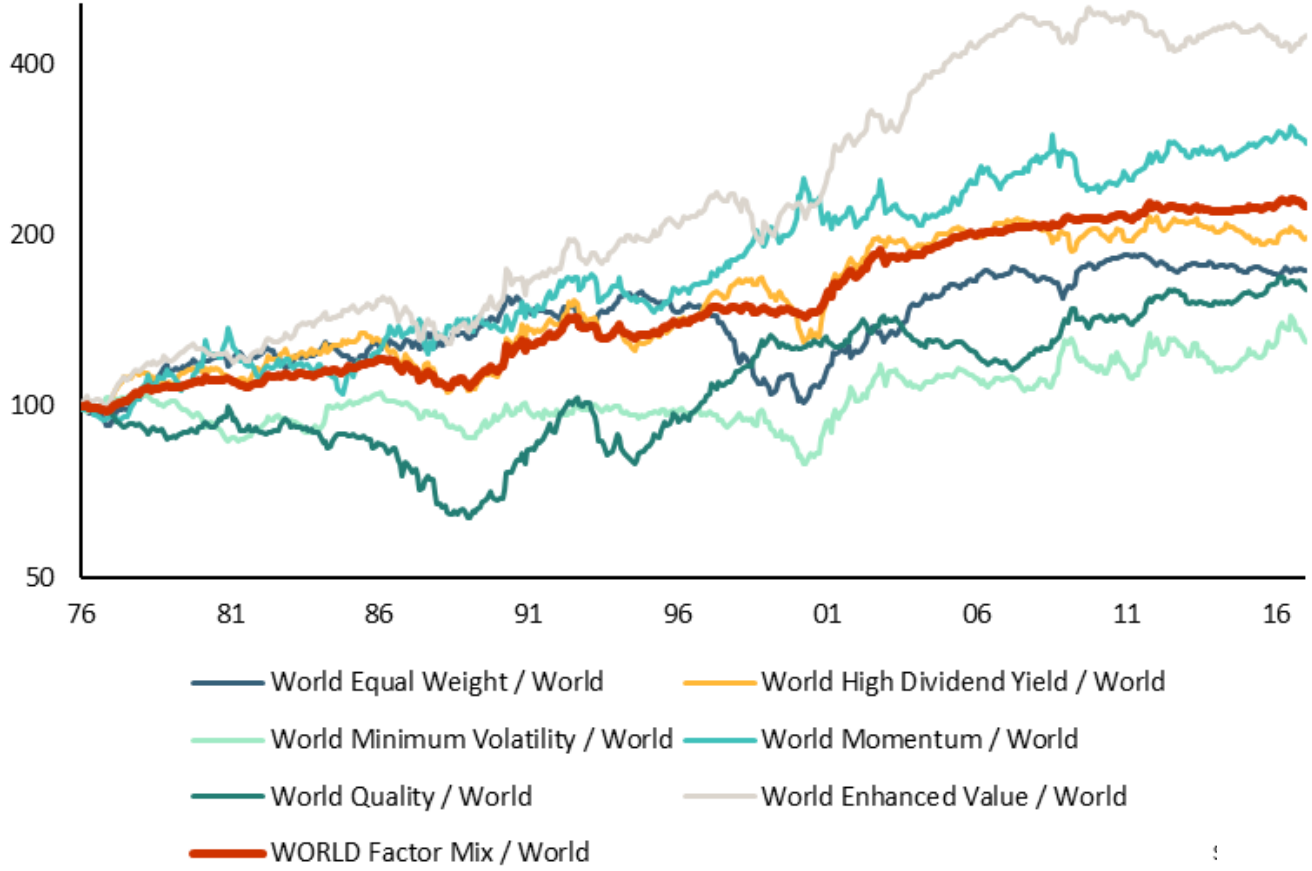
# MSCI 'HIGH EXPOSURE' FACTOR INDEXES

- The following MSCI World indexes are used throughout this presentation as a representation of the target factor.

| Target Factor | MSCI World Factor Index |
|---|---|
| LOW VOLATILITY | Minimum Volatility |
| HIGH YIELD | High Dividend Yield |
| QUALITY | Quality |
| MOMENTUM | Momentum |
| VALUE | Enhanced Value |
| SIZE | Equal-Weighted |

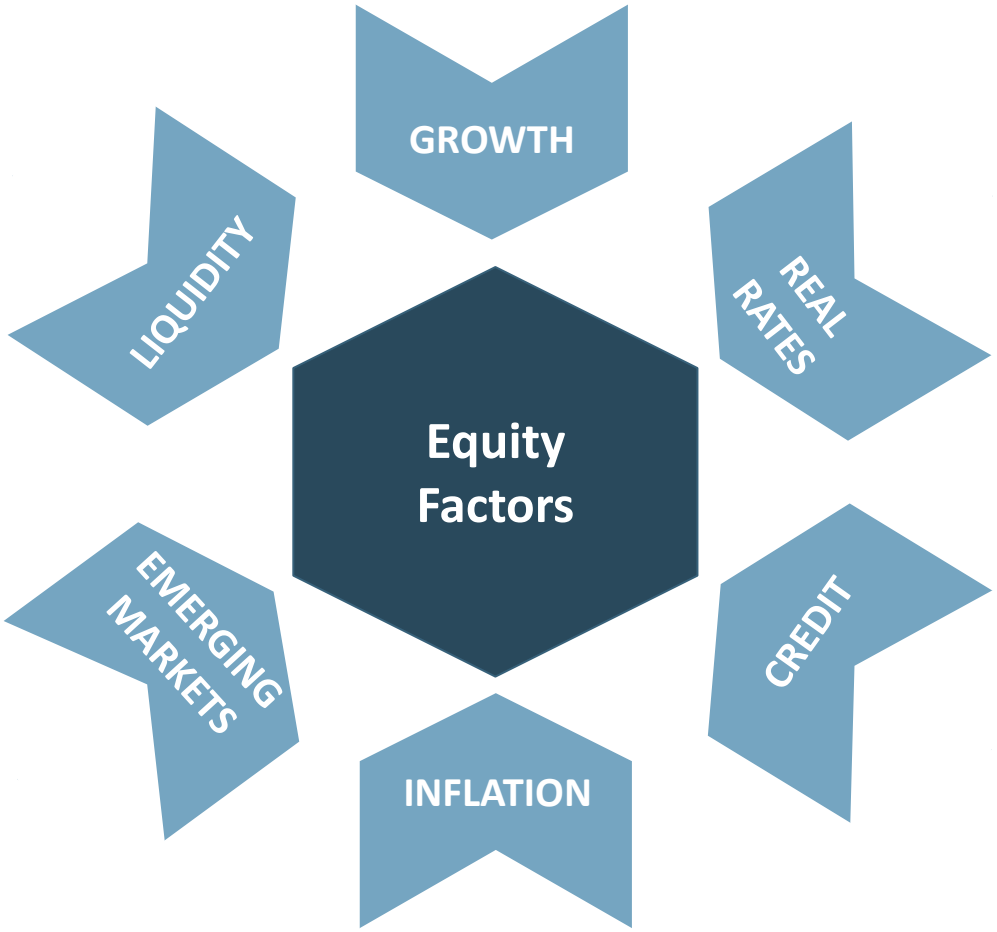
# CAN WE DO BETTER THAN EQUAL-WEIGHT FACTORS?

## LONG TERM PERFORMANCE VS MSCI WORLD (JAN '76–Dec'16)

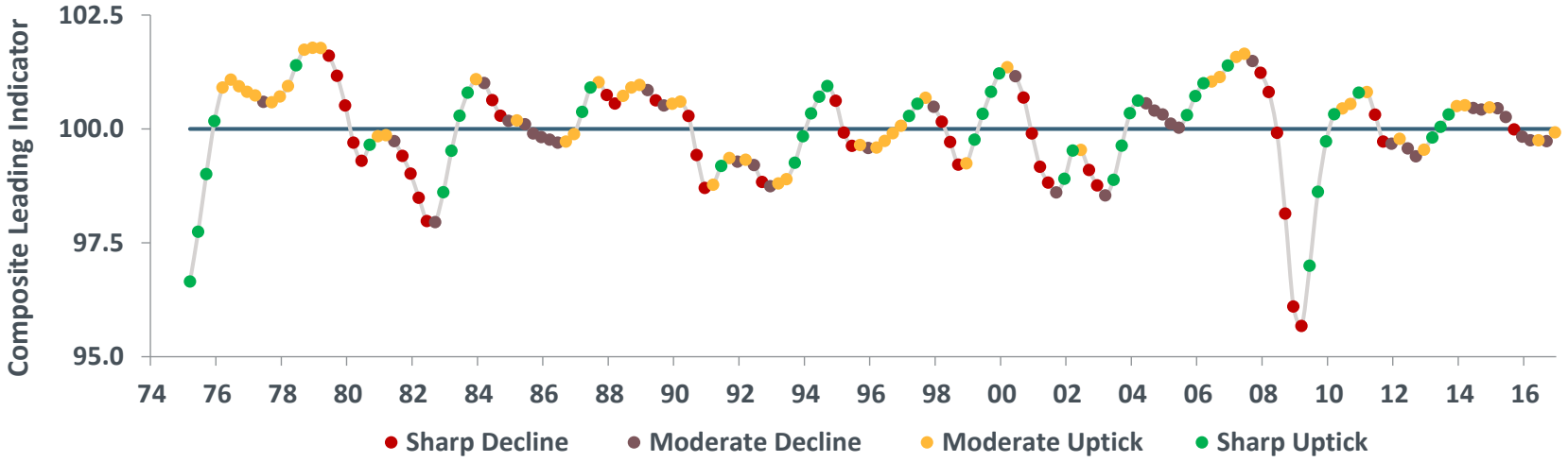



Source: MSCI

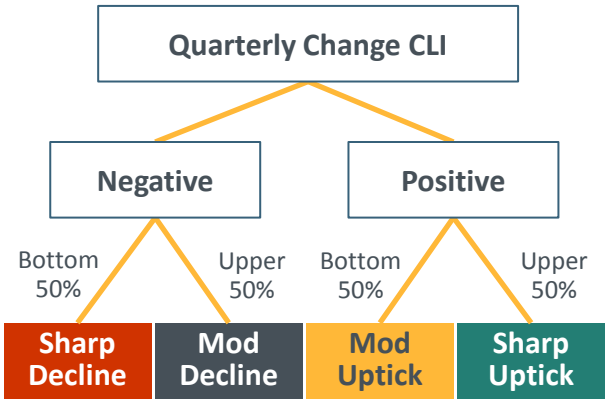
# MACRO EFFECTS ON FACTOR PERFORMANCE

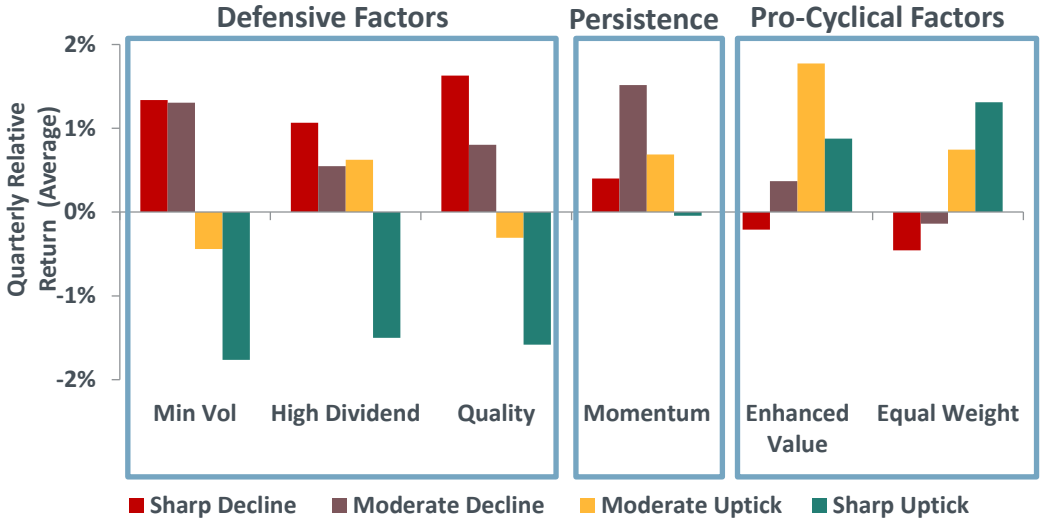


# GROUPING FACTORS BY MACRO SENSITIVITY




## HOW TO READ CHARTS

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Data: 28-Nov-1975 to 31-Dec-2016

# CORRELATION OF ACTIVE FACTOR RETURNS AND MACRO VARIABLES

| Correlation of Active Return and Change in Macro Variable | Minimum Volatility | Equal Weighted | Enhanced Value | High Dividend Yield | Momentum | Quality | Diversified Factor Mix |
|---|---|---|---|---|---|---|---|
| Growth | -0.25 | 0.14 | 0.16 | -0.04 | -0.03 | -0.21 | -0.07 |
| Inflation | -0.07 | -0.07 | -0.03 | -0.02 | 0.05 | 0.00 | -0.03 |
| Real Rates | -0.07 | 0.11 | 0.06 | -0.07 | 0.01 | -0.08 | -0.01 |
| Emerging Markets | -0.19 | 0.38 | 0.29 | 0.04 | 0.10 | -0.02 | 0.16 |
| Credit Spreads | 0.30 | -0.09 | -0.10 | -0.02 | 0.06 | 0.17 | 0.10 |

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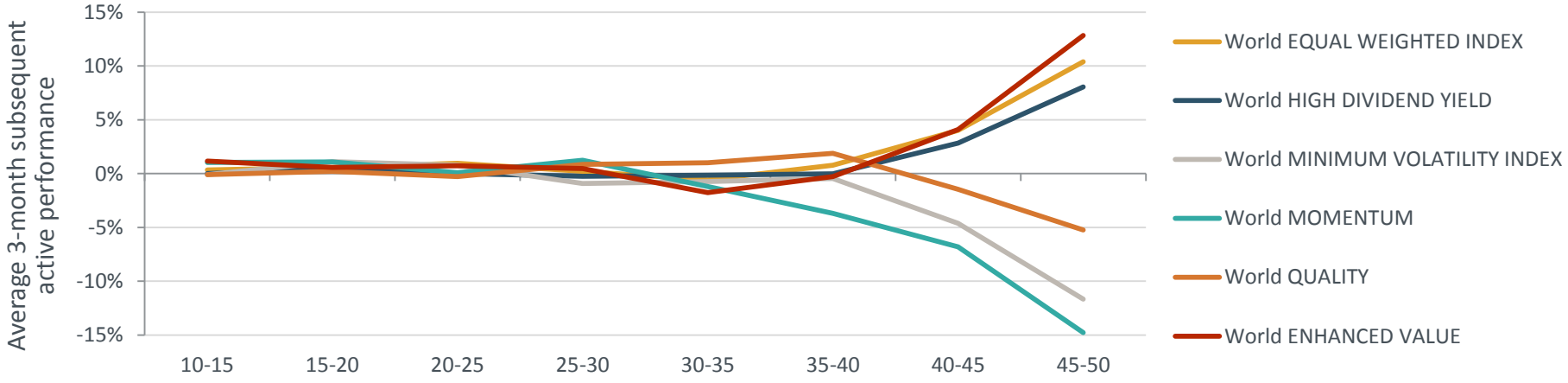
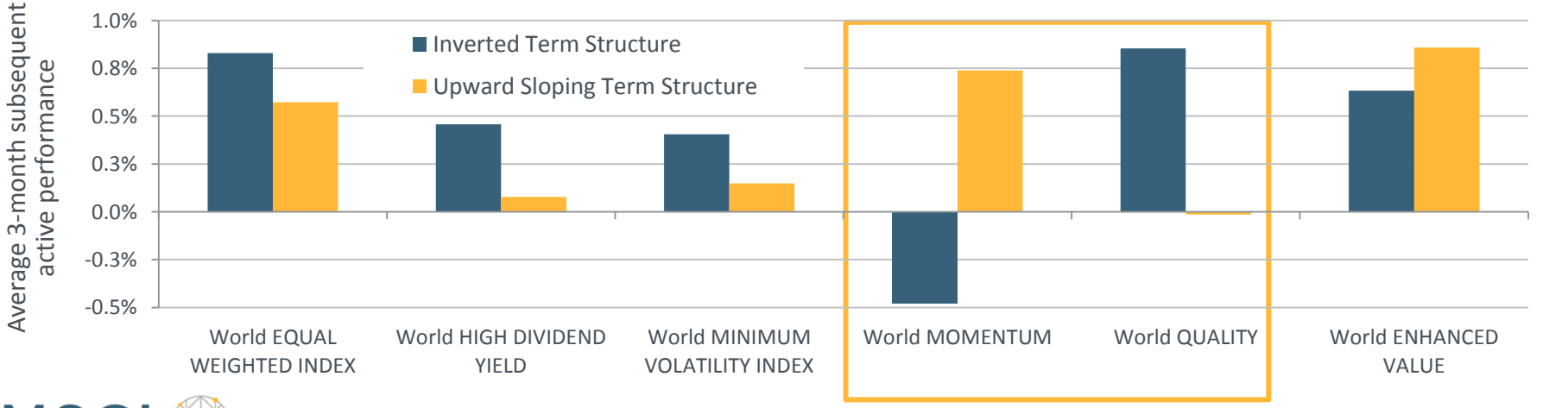
Based on MSCI data from December 1988 to December 30, 2016

# HISTORICAL FACTOR PERFORMANCE CONDITIONED ON THE VIX

## HEIGHTENED LEVELS OF VIX HAVE LED TO OUTPERFORMANCE IN SIZE, VALUE AND YIELD




## VIX INVERSIONS HAVE BEEN POSITIVE FOR QUALITY AND NEGATIVE FOR MOMENTUM

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Source: MSCI, CBOE, Bloomberg
Data: Jan 2002–Mar 2017

# SHORT-TERM MOMENTUM IN FACTOR PERFORMANCE

***Consider different historical look-back return windows and different strategy holding periods***

**Universe**

6 High Exposure Factor indexes + Parent Market Cap index

**Ranking**

Ranking indexes based on historical performance

**Strategy**

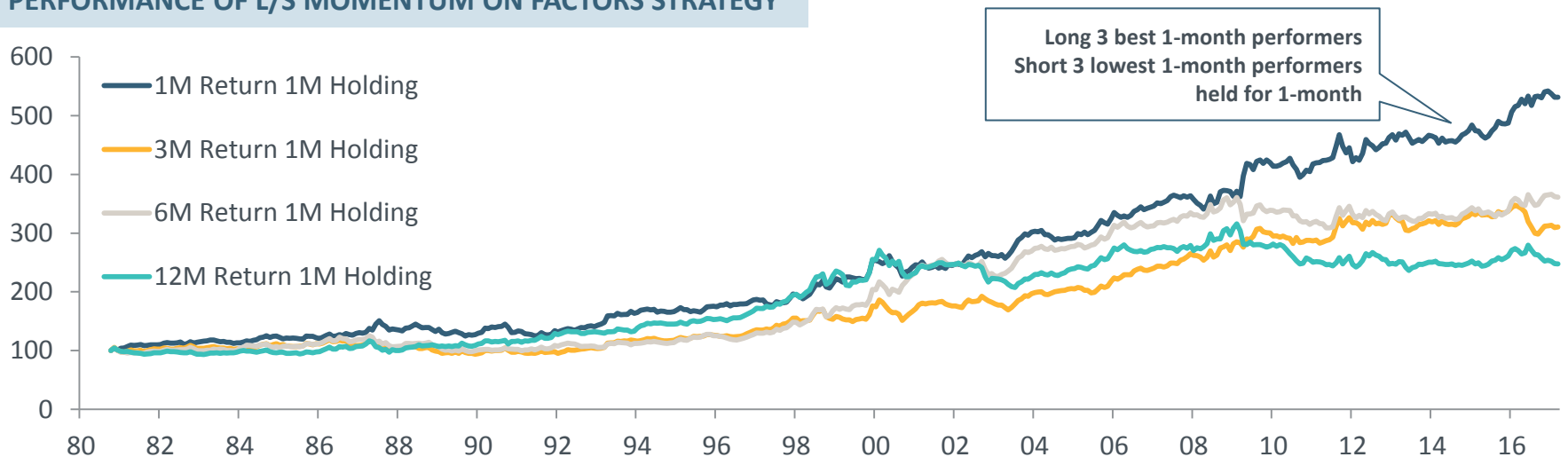
Long outperformers and short underperformers, cash neutral

## ANN. RETURN ON L/S MOMENTUM ON FACTORS STRATEGY

| | Signal (Lookback Return) | | | | | |
|---|---|---|---|---|---|---|
| Holding Period | 1m | 3m | 6m | 12m | 36m | 60m |
| 1m | **4.9%** | **3.4%** | **3.8%** | **2.8%** | 0.6% | 0.4% |
| 3m | **2.5%** | **2.3%** | **2.5%** | 2.2% | 0.1% | 0.1% |
| 6m | **1.6%** | **1.7%** | **2.0%** | 1.7% | -0.2% | -0.1% |
| 12m | **1.3%** | **1.6%** | **1.7%** | 1.0% | -0.4% | -0.1% |
| 36m | 0.3% | 0.5% | 0.4% | 0.1% | -0.8% | 0.1% |
| 60m | 0.1% | 0.2% | 0.1% | -0.1% | -0.1% | 0.9% |

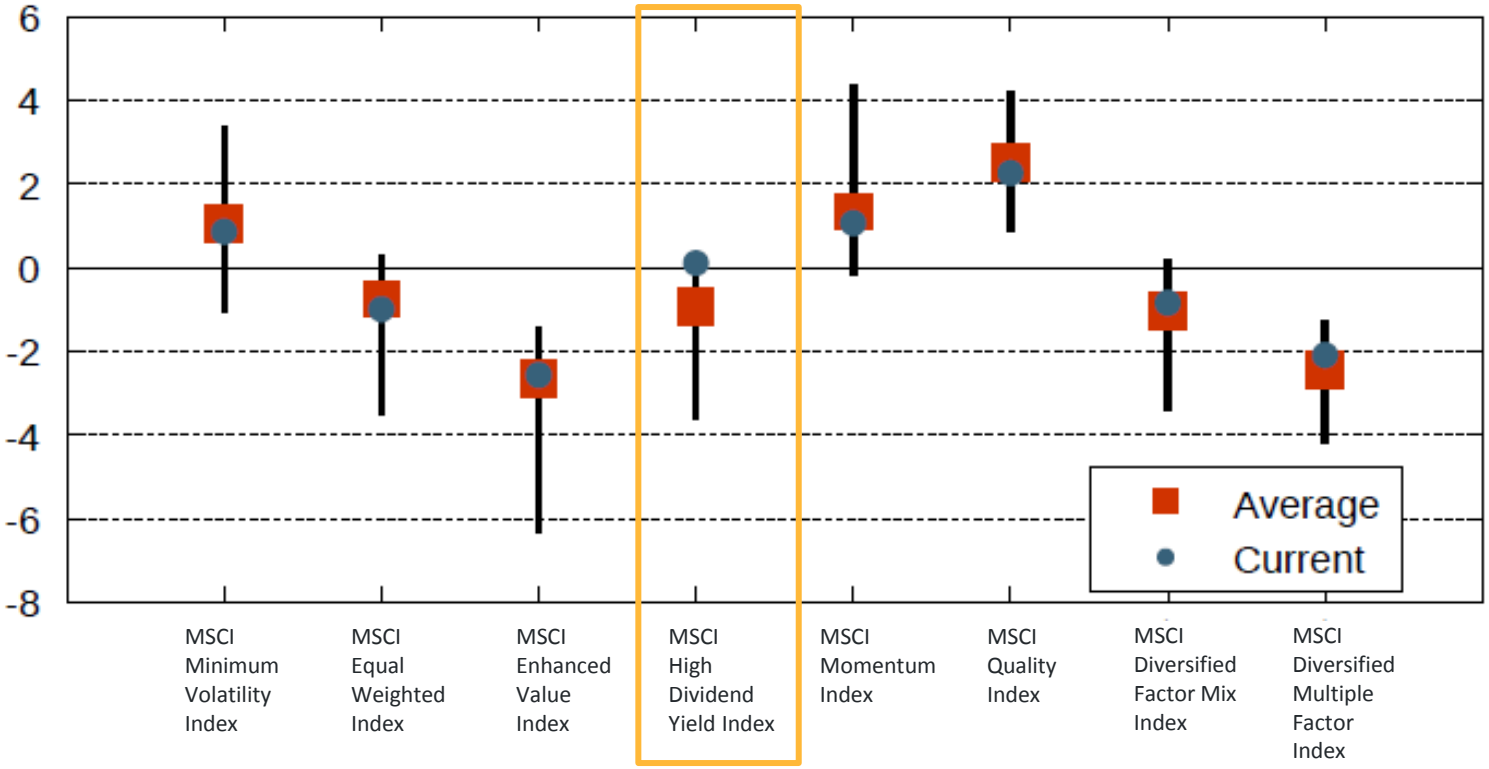
**1%** **2.5%** **Statistical significance**

## PERFORMANCE OF L/S MOMENTUM ON FACTORS STRATEGY



# VALUATIONS – MSCI WORLD INDEX

## RELATIVE VALUATIONS (NOV '01–MAR '17)




Based on price to earnings, price to book value, price to cash earnings and price to sales at month end dates. Values below 0 indicate the factor is cheaper than the parent. A current value below average indicates that the factor is cheap relative to its own history. The line endpoints indicate historical minima and maxima.

Source: MSCI

# CAN VALUATIONS BRING VALUE TO FACTOR ROTATION?

***Identifying how cheap/expensive a factor index is on an absolute scale***

**Cross-Sectional Value Exposure**

Calculate the Barra (GEMLT) value exposure of each factor index

**Time-Series Value Exposure**

Compare these value exposures to their historical levels

**Normalize Scores and Set Weights**

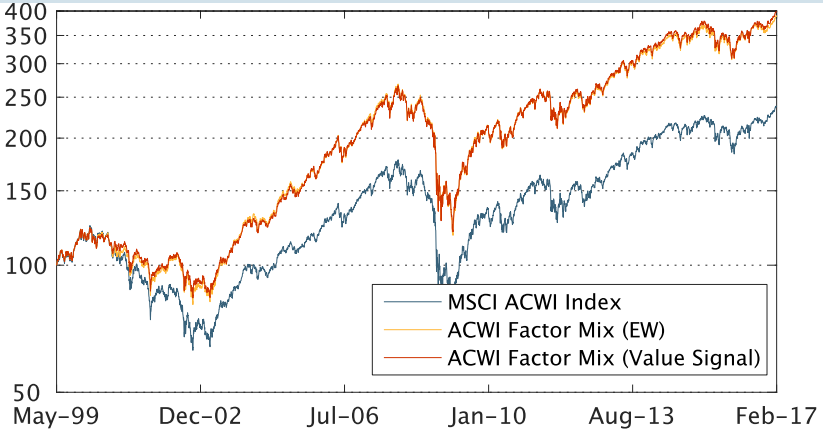
Normalized z-scores of all the factors (sum to 1)

## KEY METRICS

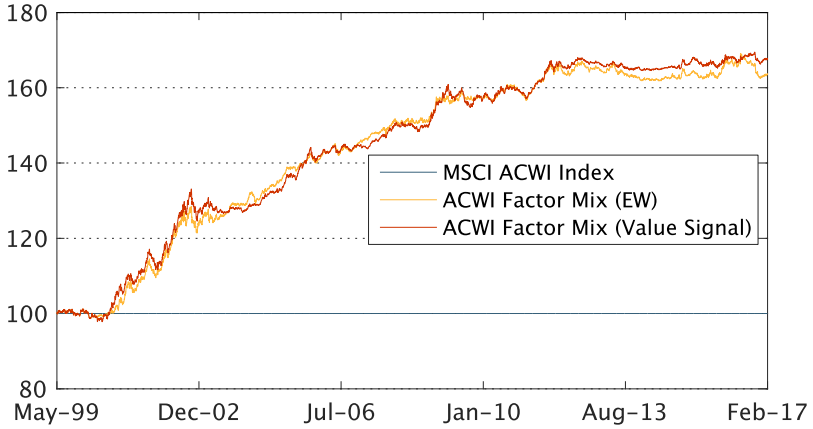
| | MSCI ACWI Index | ACWI Factor Mix (EW) | ACWI Factor Mix (Value Signal) |
|---|---|---|---|
| Total Return* (%) | 5.0 | 7.9 | 8.1 |
| Total Risk (%) | 15.7 | 14.7 | 14.3 |
| Return/Risk | 0.32 | 0.54 | 0.56 |
| Sharpe Ratio | 0.18 | 0.40 | 0.42 |
| Active Return (%) | 0.0 | 3.0 | 3.1 |
| Tracking Error (%) | 0.0 | 2.9 | 3.1 |
| Information Ratio | NaN | 1.01 | 0.99 |
| Turnover** (%) | 3.3 | 32.4 | 42.7 |

Period: 31-May-1999 to 30-Dec-2016
* Gross returns annualized in USD
** Annualized one-way index turnover over index reviews
The definitions of all statistical parameters are available in the Appendix

## INDEX PERFORMANCE (USD)

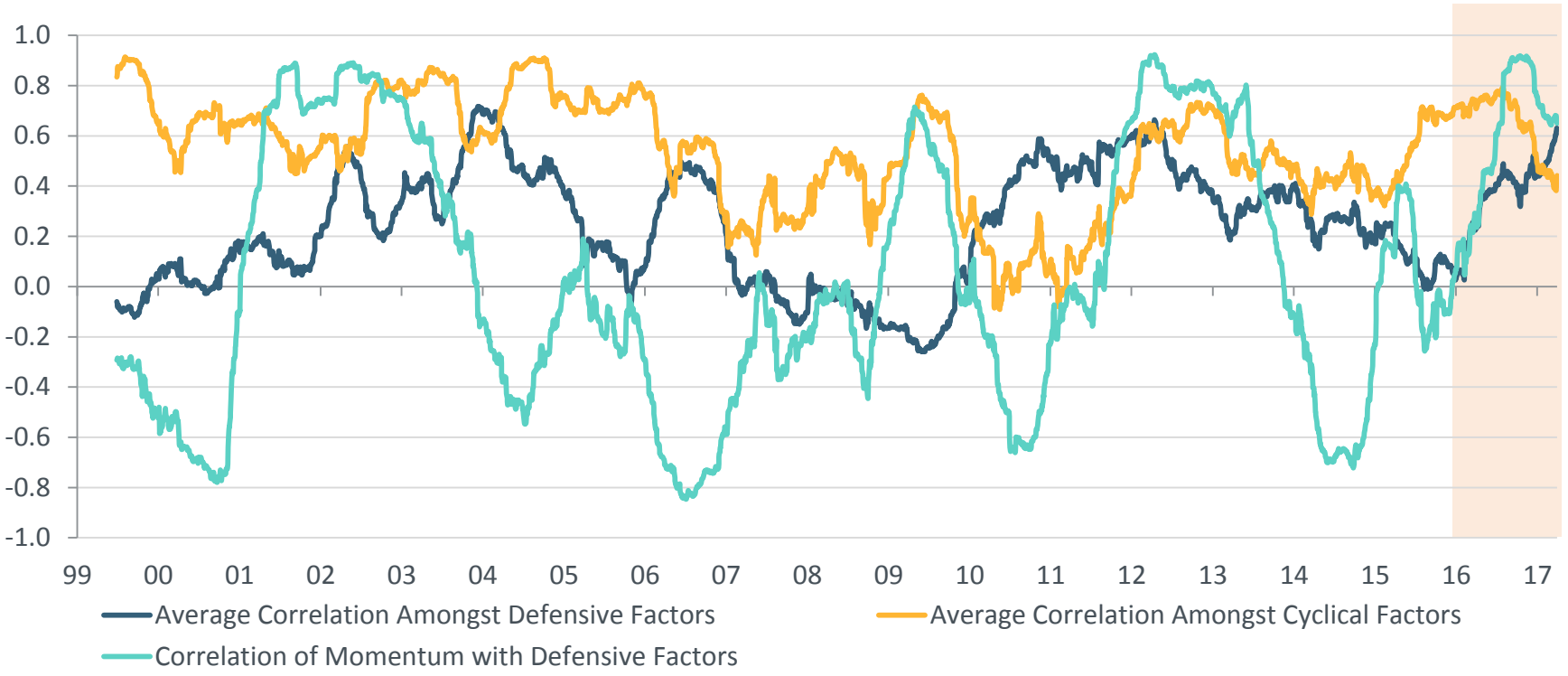



## RELATIVE PERFORMANCE




Note: Factor Mix: Six high exposure factor indexes.

# FACTORING IN CORRELATIONS

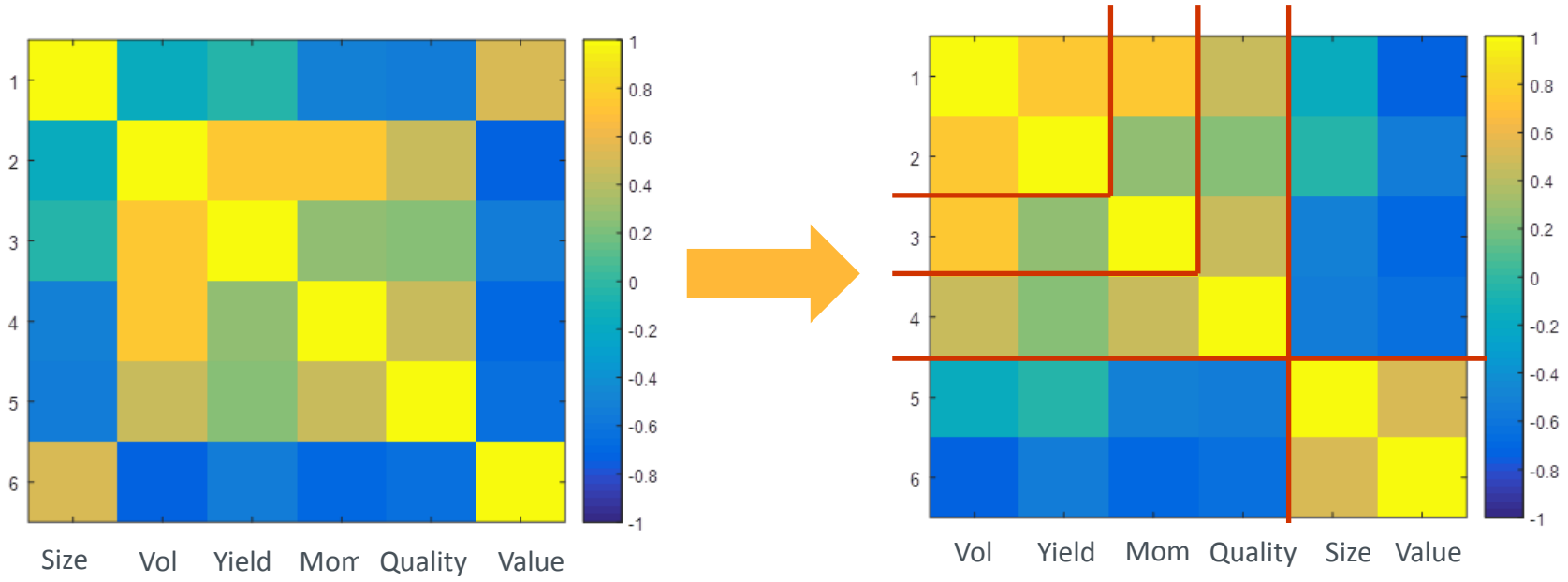



- 2016 – The risk-on / risk-off macro environment increased correlations within defensive and within cyclical factors to extreme levels
- 2017 YTD – Some correlations are starting to fall, particularly between Momentum and Defensive factors, and Value / Size

[1] Correlations are computed over rolling 6-month daily returns.
Source: MSCI

# ORGANIZING CLUSTERS BASED ON CORRELATIONS

## ACTIVE FACTOR RETURN CORRELATION MATRIX (JAN 2015 – SEP 2016 MONTHLY DATA)

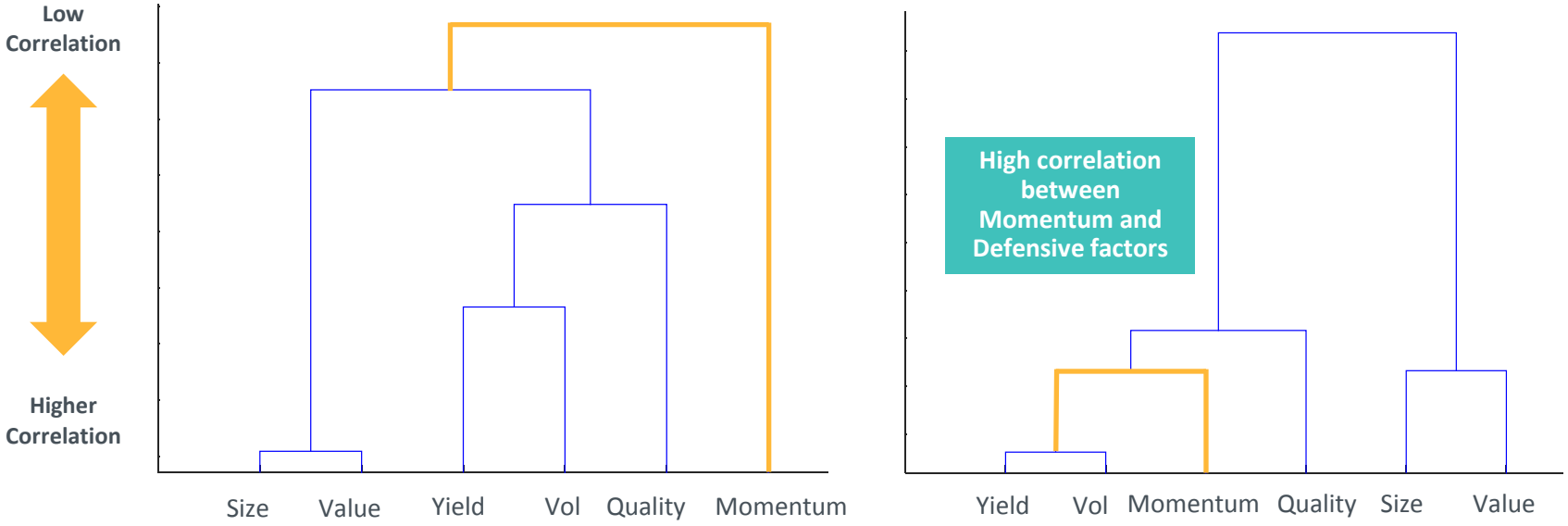



- Clustering based on correlations re-organizes the correlation matrix
- Groups assets that are broadly more correlated and move apart assets that are less correlated

# THE COMPOSITION OF CLUSTERS CAN CHANGE OVER TIME

**1970–2016 MONTHLY DATA**

**JAN 2015–SEP 2016 MONTHLY DATA**

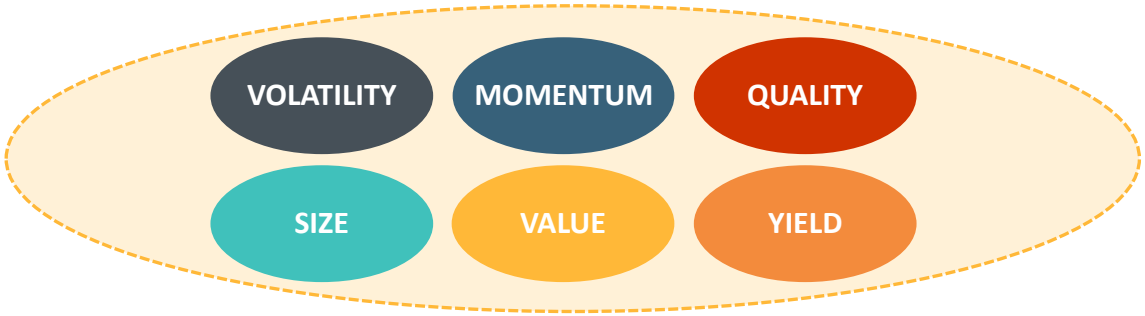



- Correlations between the active factor returns can be use to create clusters
- Allocations made across clusters (composed of factors) can potentially bring diversification benefits

# METHODOLOGY – CLUSTER BASED FACTOR ALLOCATION

**Original Factor Indexes**

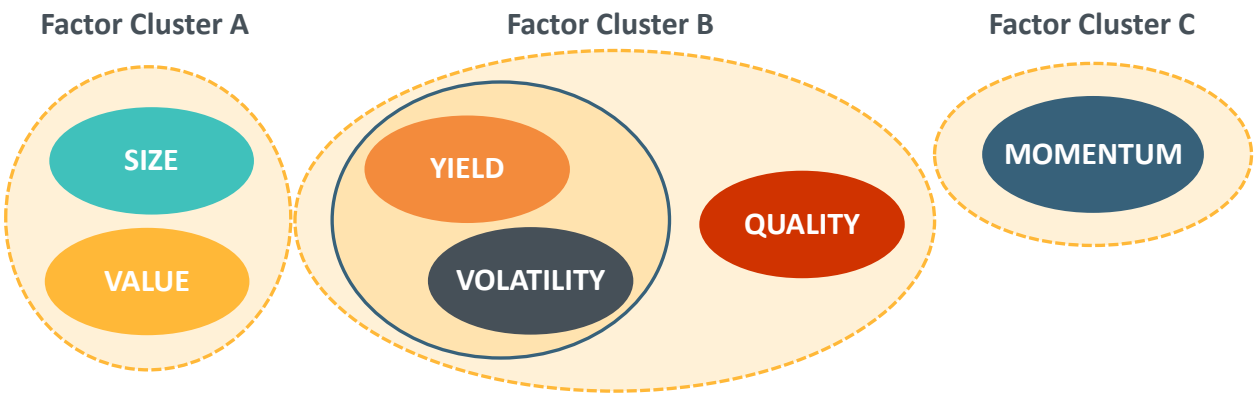
1




**Cluster Factors Closest 'Distance'**

**Asset Allocation *within* Clusters**

2




**Asset Allocation *across* Clusters**

3


**Cluster Based Factor Allocation**

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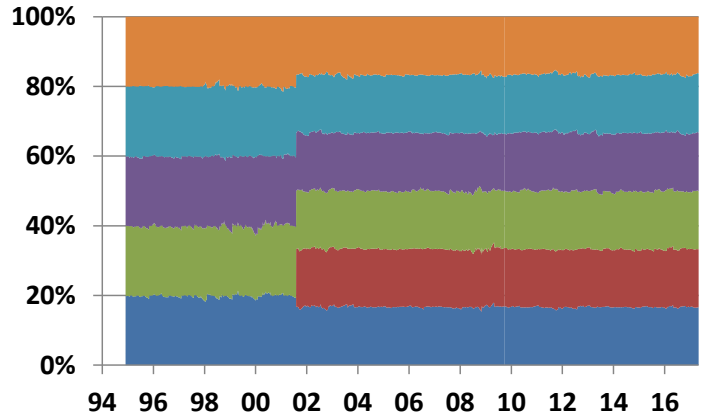
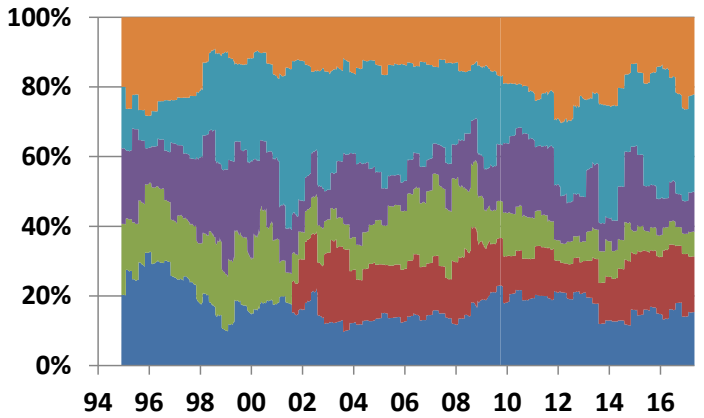
# WEIGHTS MULTI-FACTOR ALLOCATION

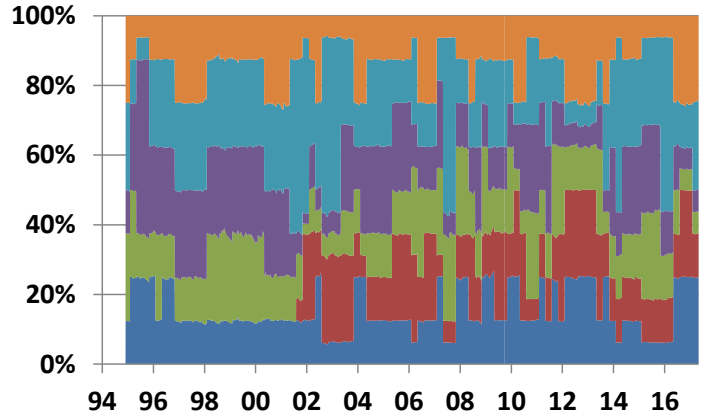
## EW



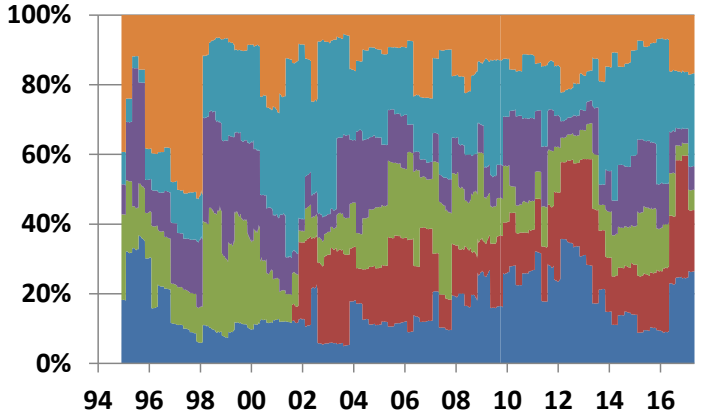

## ERC




## Cluster – EW




## Cluster – ERC




World EQUAL WEIGHTED INDEX
World HIGH DIVIDEND YIELD
World MINIMUM VOLATILITY INDEX
World MOMENTUM
World QUALITY
World ENHANCED VALUE INDEX

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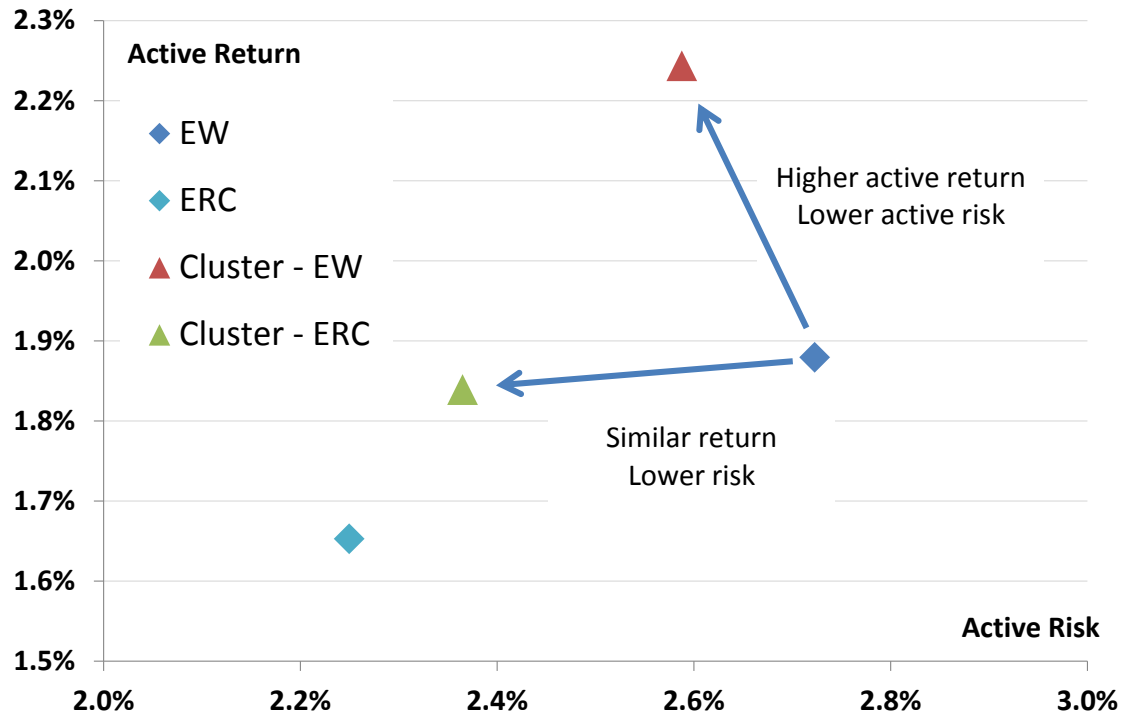
Notes: High Dividend Yield not available prior to Dec 2000. Value-weighted Index used instead of Enhanced Value prior to Dec 1997.

# CLUSTER BASED FACTOR ALLOCATION – RISK/RETURN

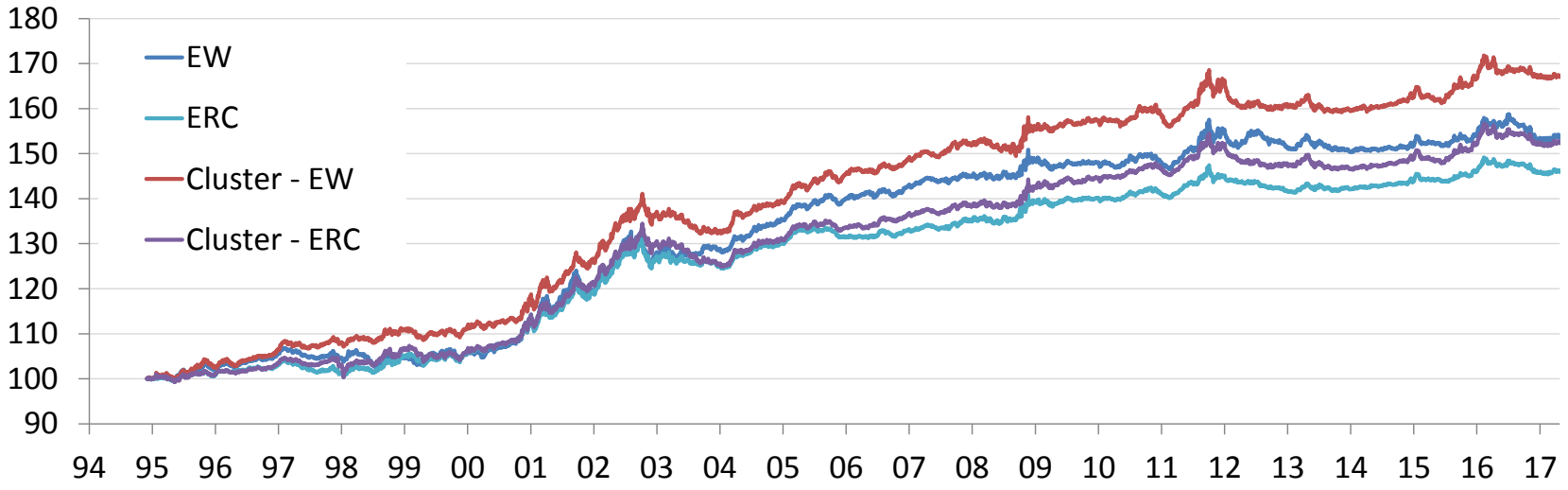
## ACTIVE RETURN VS. TRACKING RISK (1994–2017 YTD[1])




- Cluster based allocation to factors have outperformed simple diversification in terms of risk-adjusted returns relative to the benchmark index.

1. Data: 1st June 1994 – 1st May 2017

# MULTI-FACTOR ALLOCATION
## (CONSTRUCTED FROM ACTIVE RISK)



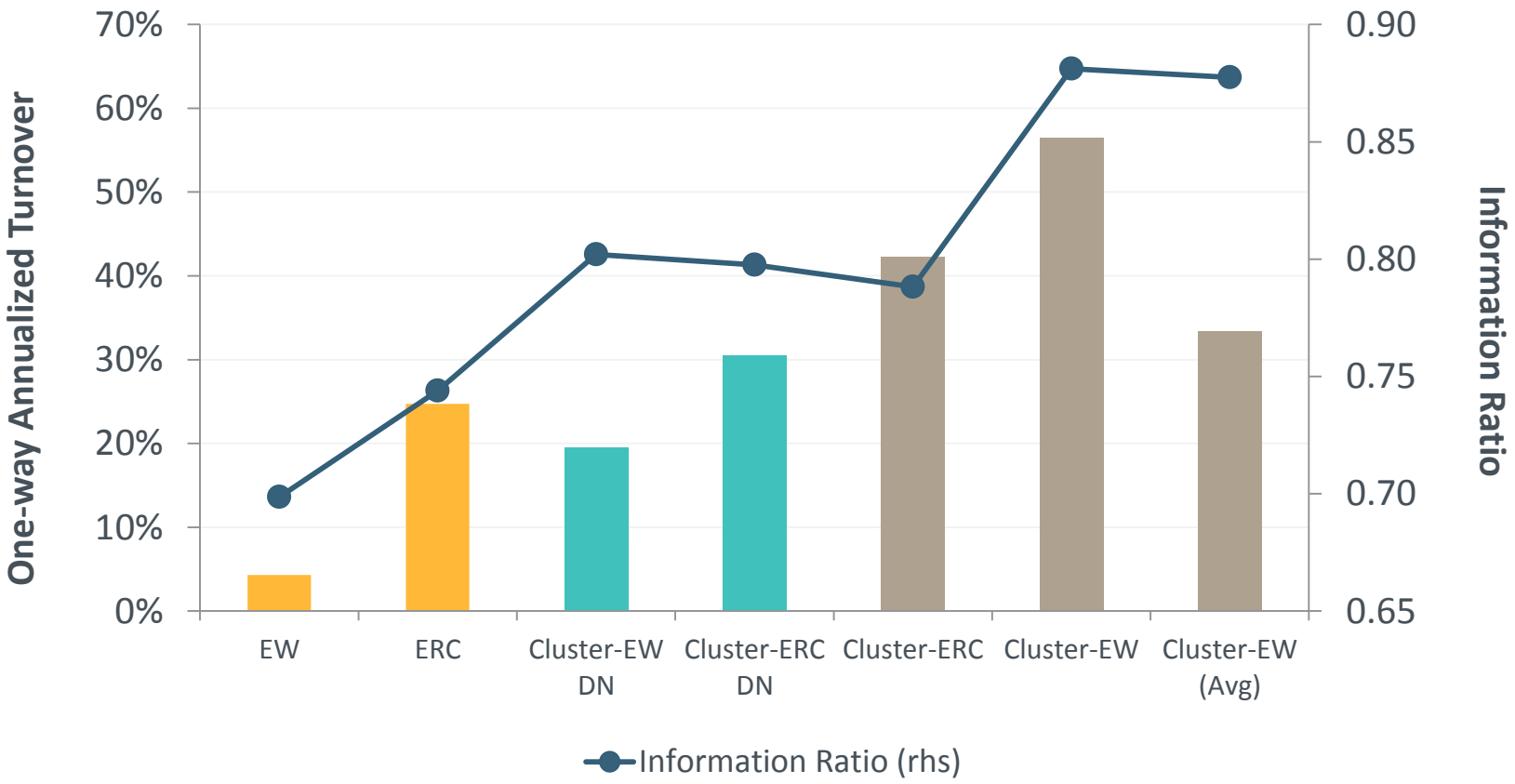

### PERFORMANCE 1994–2017[1]

| Metrics | MSCI World | EW | ERC | Cluster - EW | Cluster - ERC |
|---|---|---|---|---|---|
| **Total Return (Ann.)** | 8.23% | 10.11% | 9.89% | 10.48% | 10.07% |
| **Volatility (Ann.)** | 15.23% | 13.84% | 14.17% | 14.11% | 14.15% |
| **Sharpe Ratio** | 0.54 | 0.73 | 0.70 | 0.74 | 0.71 |
| **Active Return (Ann.)** | | **1.88%** | **1.65%** | **2.24%** | **1.84%** |
| **Active Risk (Ann.)** | | **2.72%** | **2.25%** | **2.59%** | **2.36%** |
| **Information Ratio** | | **0.69** | **0.73** | **0.87** | **0.78** |

Notes: Correlations computed over trailing 6-months. High Dividend Yield not available prior to Dec 2000. Value-weighted Index used instead of Enhanced Value prior to Dec 1997.

1. Data: 1st June 1994–1st May 2017

# ANNUALIZED ONE-WAY TURNOVER (INDEX LEVEL)




Average 1994–2016, excludes 2001 – when High Dividend Yield was added.

# DYNAMIC FACTOR ALLOCATION STRATEGIES

## DYNAMIC FACTOR ALLOCATION STRATEGIES

| Macro Sensitivities | Trend | Fundamental | Risk |
|---|---|---|---|
| • Growth<br>• Inflation | • Cross-sectional<br>• Time-series | • Valuations<br>• Cross-sectional<br>• Time-series | • Correlations<br>• Volatility |

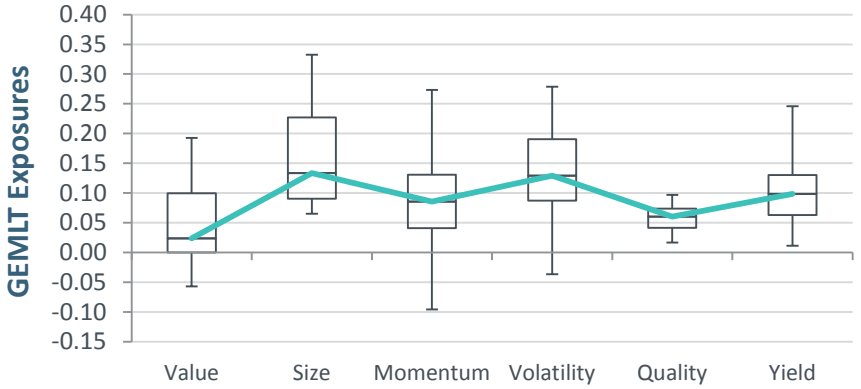
# APPENDIX

# DIFFERENT APPROACHES TO BUILDING CLUSTERS

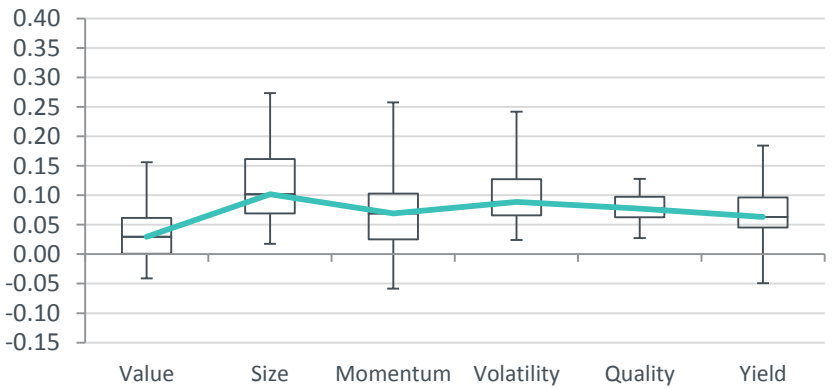
| FIXED NUMBER OF CLUSTERS (e.g., 2 CLUSTERS) | DYNAMIC NUMBER (DN) OF CLUSTERS | N – 1 CLUSTERS |
|---|---|---|
| **MERGE CLUSTERS** | **MERGE SIMILAR CLUSTERS** | **BINARY COMBINATION CLUSTERS** |
| **Example**<br>• Cluster A: Value, Size, Yield, Volatility, Quality<br>• Cluster B: Momentum<br>• A + B = Factor Mix | **Example**<br>• Cluster A: Value, Size<br>• Cluster B: Yield, Volatility<br>• Cluster C: Quality<br>• Cluster D: Momentum<br>• Cluster BC: Yield, Volatility, Quality<br>• A + BC + D = Factor Mix | **Example**<br>• Cluster A: Value, Size<br>• Cluster B: Yield, Volatility<br>• Cluster C: Quality<br>• Cluster D: Momentum<br>• Cluster E: B + C<br>• Cluster F: A + E<br>• E + F = Factor Mix |

# EXPOSURES MULTI-FACTOR ALLOCATION

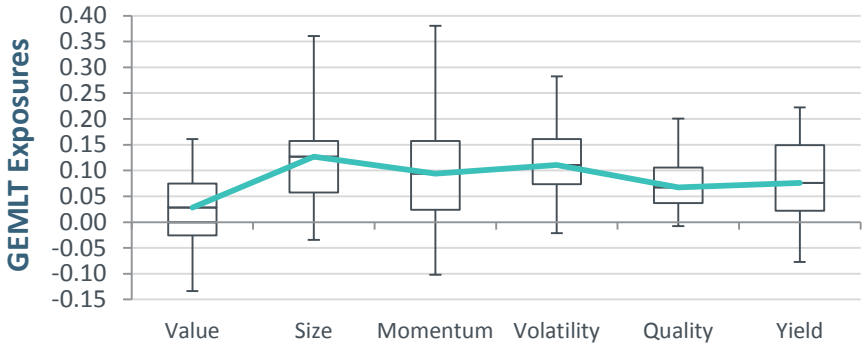
## EW



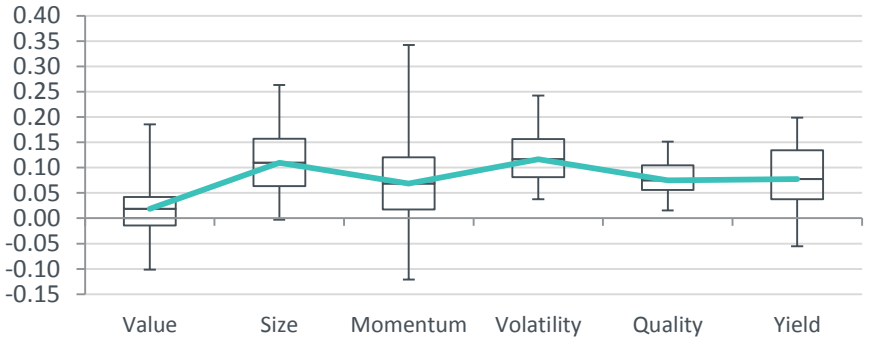

## ERC



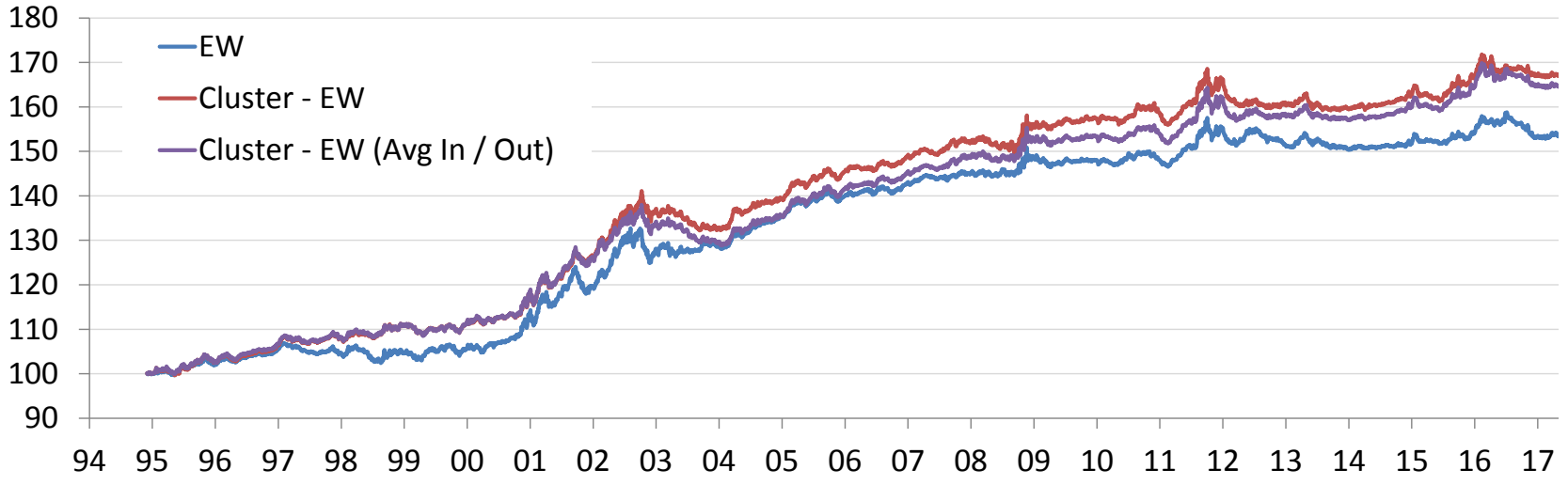

## Cluster – EW




## Cluster – ERC



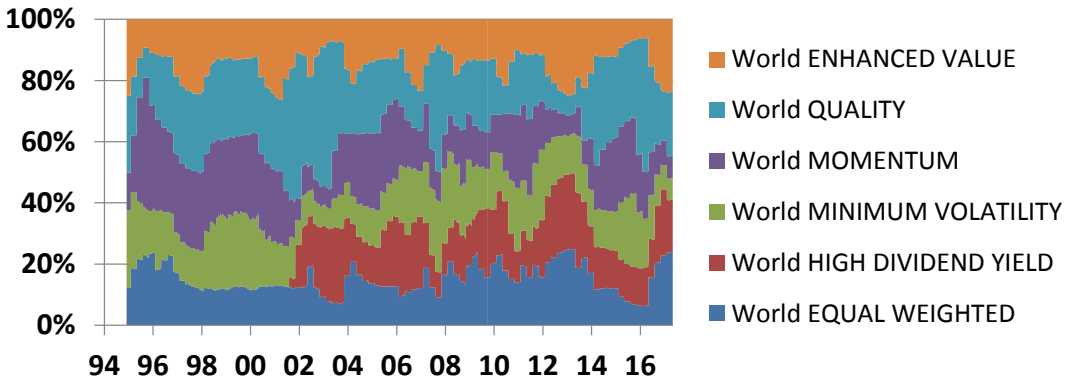
# AVERAGING WEIGHTS IN AND OUT




## PERFORMANCE 1994–2017[1]

| Metrics | Cluster – EW | Cluster – EW (Avg. In/Out) |
|---|---|---|
| Total Return (Ann.) | 10.48% | 10.41% |
| Volatility (Ann.) | 14.11% | 14.05% |
| Sharpe Ratio | 0.74 | 0.74 |
| Active Return (Ann.) | 2.24% | 2.18% |
| Active Risk (Ann.) | 2.59% | 2.53% |
| Information Ratio | 0.87 | 0.86 |

## CLUSTER – EW (AVERAGING WEIGHTS IN AND OUT)




Notes: High Dividend Yield not available prior to Dec 2000. Value-weighted Index used instead of Enhanced Value prior to Dec 1997.

1. Data: 1st June 1994–1st May 2017

# QUARTERLY AND ANNUAL ACTIVE RETURNS

## CLUSTER EW (AVERAGE IN / OUT)

| | Q1 | Q2 | Q3 | Q4 | Annual |
|---|---|---|---|---|---|
| 1995 | 0.7% | 1.5% | 0.5% | 0.0% | 2.7% |
| 1996 | 0.8% | 1.0% | 0.5% | 1.5% | 3.9% |
| 1997 | 0.8% | -0.6% | 1.0% | 0.3% | 1.5% |
| 1998 | 1.5% | -1.4% | 1.8% | 0.6% | 2.5% |
| 1999 | -1.4% | 0.4% | 0.5% | 1.1% | 0.5% |
| 2000 | -0.1% | 1.0% | 0.5% | 4.7% | 6.1% |
| 2001 | 3.0% | 0.1% | 3.8% | -0.7% | 6.3% |
| 2002 | 2.8% | 3.5% | 2.2% | -1.9% | 6.6% |
| 2003 | 0.0% | -1.4% | -1.1% | -0.9% | -3.4% |
| 2004 | 2.3% | 0.4% | 1.3% | 0.4% | 4.6% |
| 2005 | 2.6% | 0.9% | 1.1% | -0.3% | 4.4% |
| 2006 | 0.6% | 0.4% | 0.2% | 1.5% | 2.6% |
| 2007 | 1.0% | -0.3% | 1.1% | 0.5% | 2.2% |
| 2008 | 0.4% | -0.1% | -0.3% | 2.9% | 2.9% |
| 2009 | -0.5% | 0.6% | -0.1% | 0.3% | 0.4% |
| 2010 | -0.4% | 0.7% | 1.0% | -1.0% | 0.3% |
| 2011 | -0.2% | 1.8% | 4.6% | -1.0% | 5.2% |
| 2012 | -2.9% | 1.1% | -0.8% | 0.3% | -2.4% |
| 2013 | 0.7% | -0.4% | -0.5% | -0.4% | -0.7% |
| 2014 | 0.4% | 0.1% | 0.6% | 0.8% | 1.9% |
| 2015 | 0.4% | -0.5% | 2.6% | 0.4% | 2.8% |
| 2016 | 2.1% | 0.0% | -0.6% | -1.1% | 0.3% |
| 2017 | -0.1% | | | | -0.3% |

## EQUAL-WEIGHT

| Q1 | Q2 | Q3 | Q4 | Annual |
|---|---|---|---|---|
| 0.3% | 1.8% | 0.1% | 0.0% | 2.2% |
| 0.7% | 0.9% | 0.4% | 1.4% | 3.4% |
| 0.5% | -1.3% | 0.3% | -0.3% | -0.9% |
| 1.4% | -2.8% | 0.7% | 0.9% | 0.2% |
| -1.2% | 1.5% | 0.8% | -0.2% | 0.9% |
| -0.9% | 2.0% | 1.2% | 5.1% | 7.5% |
| 3.3% | 0.3% | 3.9% | -2.2% | 5.3% |
| 2.9% | 5.2% | 2.3% | -3.4% | 7.0% |
| 0.0% | -0.1% | 1.2% | -0.5% | 0.6% |
| 2.1% | 0.5% | 1.6% | 0.8% | 5.1% |
| 2.2% | 0.9% | 0.8% | -0.5% | 3.4% |
| 0.6% | 0.2% | -0.2% | 1.5% | 2.1% |
| 0.9% | -0.2% | 0.4% | 0.2% | 1.4% |
| 0.2% | 0.5% | -0.7% | 2.5% | 2.6% |
| -1.0% | 0.5% | 0.1% | 0.0% | -0.5% |
| -0.5% | 1.4% | 0.4% | -1.2% | 0.0% |
| 0.1% | 1.8% | 4.0% | -1.0% | 4.9% |
| -2.1% | 1.6% | -0.9% | -1.1% | -2.5% |
| 1.2% | -0.3% | -0.8% | -0.7% | -0.7% |
| 0.4% | 0.1% | 0.1% | 0.4% | 1.0% |
| 0.5% | -0.4% | 1.3% | 0.1% | 1.6% |
| 1.6% | 0.9% | -1.3% | -1.7% | -0.5% |
| 0.1% | | | | -0.1% |

## CLUSTER VS. EW

| Outperformance Annual |
|---|
| 0.5% |
| 0.5% |
| 2.3% |
| 2.4% |
| -0.4% |
| -1.4% |
| 1.0% |
| -0.4% |
| -3.9% |
| -0.5% |
| 1.0% |
| 0.5% |
| 0.9% |
| 0.3% |
| 0.8% |
| 0.3% |
| 0.4% |
| 0.1% |
| 0.0% |
| 0.9% |
| 1.2% |
| 0.8% |
| -0.2% |

# HOW ARE CLUSTERS FORMED?

| Correlation | Momentum | Quality | Value |
|---|---|---|---|
| Momentum | 1.0 | 0.2 | -0.1 |
| Quality | 0.2 | 1.0 | -0.5 |
| Value | -0.1 | -0.5 | 1.0 |

| Correlation | Momentum | Quality | Value |
|---|---|---|---|
| Momentum | 0.0 | 0.6 | 0.8 |
| Quality | 0.6 | 0.0 | 0.9 |
| Value | 0.8 | 0.9 | 0.0 |

| Correlation | Momentum | Quality | Value |
|---|---|---|---|
| Momentum | 0.0 | 0.6 | 0.8 |
| Quality | 0.6 | 0.0 | 0.9 |
| Value | 0.8 | 0.9 | 0.0 |

**Iteratively, cluster pairs that are the closest and aggregate bottom-up (agglomerative hierarchical clusters)**

## Correlation Matrix

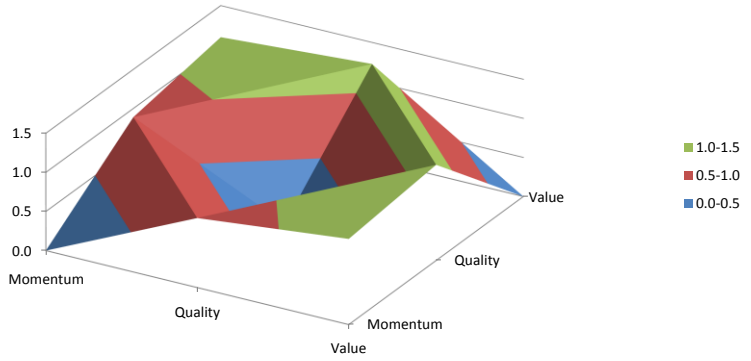
- Measure of directional co-movement

## Correlation Distance (pairs)

- SQRT[ (1 – CORR)/2 ] between 0 (close) and 1 (far)

## Euclidean Distance (from all pairs)

- SQRT[ SUM [F(i,j) – F(k,j)]^2 ]

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# REFERENCES


- Building Diversified Portfolios that Outperform Out-of-Sample, Marcos Lopez de Prado, May 23, 2016 (*Journal of Portfolio Management*, 2016, Forthcoming)

- Quantum-ready hierarchical risk parity, Alipour et al, 1QB IT, Nov 14, 2016.

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