

Methodology overview

FTSE
Russell

Comprehensive Factor Indexes

Part of the FTSE Global Factor Index Series

Overview

The Comprehensive Factor Indexes are designed to capture a broad set of five recognized factors contributing to equity market performance. Available on a variety of FTSE and Russell underlying benchmarks, the Indexes apply a consistent and transparent methodology to achieve controlled exposure to target factors, while considering levels of diversification and capacity.

Features

- Eligible securities of each Comprehensive factor index are the constituents of the relevant underlying FTSE All-World Index or Russell 1000®/Russell 2000® Indexes respectively.
- The indexes derived from a FTSE underlying index are reviewed semi-annually in March and September.
- The indexes derived from a Russell index are reviewed semi-annually in June and December.

Results

- Tilt-Tilt methodology provides greater index factor exposure, in a more controlled manner, while balancing concerns about liquidity, capacity, diversification and turnover.
- The indexes are designed to target specific factor return premia in a rules-based and investable format.
- Potential improvement in risk-adjusted index outcomes.
- Multi-factor combinations can help mitigate investment cyclicality by diversifying across several factors.

Comprehensive Factor Index Series

Available indexes:

- FTSE All-World
- FTSE Developed
- FTSE Developed ex US
- FTSE Emerging
- FTSE 350
- Russell 1000®
- Russell 2000® "FTSE 350 ex Invt Trust"

Factors at a glance

| | | |
|---------|----------------|----------|
| Value | Size | Momentum |
| Quality | Low Volatility | |

The factors

A factor is a stock characteristic that is important in explaining a security's risk and return. The Comprehensive Factor Indexes reference five equity factors, each of which is supported by academic research, with strong theoretical explanations as to why the factor historically has provided a premium.

- Factor-based investing is premised on the ability to identify factors that are expected to earn a positive premium in the future (i.e. factor exposures which are compensated).
- Not all factors are equal – some factors are uncorrelated, which means they may perform differently in different parts in the cycle.
- FTSE Russell's factors represent common factor characteristics supported by a body of empirical evidence across different geographies and time periods.

Factor premia and definitions

| Factor | Description | Definition |
|-----------------------|--|---|
| Value | <p>The Value Premium: Stocks that appear cheap tend to perform better than stocks that appear expensive.</p> <p>Value tilts: Can help capture exposures at a reasonable price relative to their fundamentals.</p> | Composite of cash flow yield, earnings yield and country relative Sales: Price Ratio. |
| Quality | <p>The Quality Premium: Higher quality companies tend to demonstrate higher performance than lower quality companies.</p> <p>Quality tilts: Can help capture companies with the ability to consistently generate strong future cash flows, while limiting exposures to stocks that are unprofitable or highly levered.</p> | Composite of profitability, efficiency, earnings quality and leverage. |
| Size | <p>The Size Premium: Smaller companies tend to demonstrate higher performance than larger companies.</p> <p>Size tilts: Can help capture excess returns of smaller companies relative to their larger counterparts.</p> | Log of full market cap. |
| Low Volatility | <p>The Low Volatility Premium: Stocks that exhibit low volatility tend to perform better than stocks with higher volatility.</p> <p>Low volatility tilts: Can help capture companies with a historically lower risk (and higher return) profile relative to higher risk counterparts.</p> | Standard deviation of 5 years of weekly local total returns. |
| Momentum | <p>The Momentum Premium: Stock performance tends to persist, either continuing to rise or fall.</p> <p>Momentum tilts: Can lead to the selection of companies with strong recent performance, with the expectation that this will continue to produce short term excess returns in the future.</p> | Cumulative 11 month return. |

Multi-factor strategies and the power of diversification

There may be room in well diversified portfolios to shift focus from industry and country diversification to factor diversification. In the same way as different asset classes have distinct risk and return characteristics, the returns accruing to different equity factors can also be seen as distinct, varying according to the economic cycle and market environment (see Figure 1). For example, the value factor is typically considered to exhibit pro-cyclical performance, performing strongly during periods of strong economic growth and higher risk appetite. In contrast, the performance of quality is typically counter-cyclical.

In the absence of compelling evidence supporting factor timing or rotation strategies, the use of multi-factor indexes has become increasingly popular as a diversification tool. Multi-factor indexes are commonly used strategically, to target long-term sources of excess returns. This compares to single factor models, for which the payoff for exposure to any one factor is highly variable through the investment cycle.

Figure 1: Calendar year performance of single factor, multi-factor Comprehensive Factor and market cap indexes.

Underlying Market Cap Index: Russell 1000. Ranked from highest index returns (top row) to lowest index returns (bottom row).

| 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|--------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|
| -7.5% | 44.4% | 21.3% | 15.3% | 19.4% | 11.6% | -31.1% | 41.7% | 27.8% | 8.5% | 19.2% | 38.2% | 15.9% | 3.1% | 18.7% |
| -15.9% | 31.4% | 18.0% | 11.1% | 18.3% | 9.1% | -31.1% | 32.2% | 23.6% | 8.5% | 18.8% | 36.6% | 14.9% | 2.7% | 16.0% |
| -16.0% | 30.0% | 16.6% | 9.2% | 15.9% | 5.9% | -31.4% | 28.4% | 20.1% | 6.3% | 16.5% | 36.4% | 13.3% | 2.1% | 13.1% |
| -17.2% | 29.9% | 11.8% | 8.4% | 15.5% | 5.8% | -36.7% | 26.7% | 17.1% | 2.3% | 16.4% | 33.6% | 13.2% | 2.0% | 12.1% |
| -18.7% | 26.9% | 11.6% | 7.5% | 14.6% | 3.9% | -36.7% | 24.9% | 16.1% | 1.8% | 16.1% | 33.1% | 12.9% | 0.9% | 11.6% |
| -19.6% | 24.2% | 11.4% | 6.3% | 14.3% | 3.7% | -37.6% | 22.4% | 14.6% | 1.5% | 15.5% | 31.7% | 12.7% | -2.3% | 10.7% |
| -21.7% | 20.6% | 10.5% | 4.2% | 14.3% | 3.5% | -37.6% | 17.9% | 11.8% | -1.2% | 13.3% | 29.6% | 11.3% | -3.3% | 7.9% |

Comprehensive
 Size
 Value
 Quality
 Volatility
 Momentum
 Russell 1000

Source: FTSE Russell. Past performance is not a guarantee of future results.

The factor index construction process

Steps 1-3 explain the high level process for a single factor index construction process. There are a number of ways that multiple factors can be targeted in an index. FTSE Russell employs a 'Tilt-Tilt' approach, which is briefly described in Step 4, and over the page.

Step 1

Calculate factor scores

Assign a 'raw' value for a given factor to each stock in the underlying index. Remove outliers and normalize results (Z Score)¹. Assign each of the Z-Scores to a score in the range 0 to 1 by mapping to the cumulative normal distribution. Stocks which exhibit the highest factor characteristics will have a score closer to 1.

Step 1 Step 2

Translate scores into index weights

Combine scores with weights in the underlying index to form a broad factor index (unadjusted weights are normalized to ensure they total 100%).

- Underlying weights may be of any type (Market cap, Risk weight etc) or geographical region. The resulting factor index can be understood as a 'Factor Tilt' on the underlying index, by tilting the underlying weights according to factor score. The index weights are then rescaled to ensure final weights sum to 100%.

$$\text{Underlying Weight X Factor Score} = \text{Unadjusted Weight} \rightarrow \text{Final Weight}$$

Step 1 Step 2 Step 3

Narrow index and constrain final weights

Remove stocks which do not contribute to the overall factor objective, whilst ensuring that diversification constraints are not breached.

The following constraints are applied during this process:

- Country and Industry weight constraints
- Maximum stock level capacity ratio
- Minimum stock weight

Step 1 Step 2 Step 3 Step 4

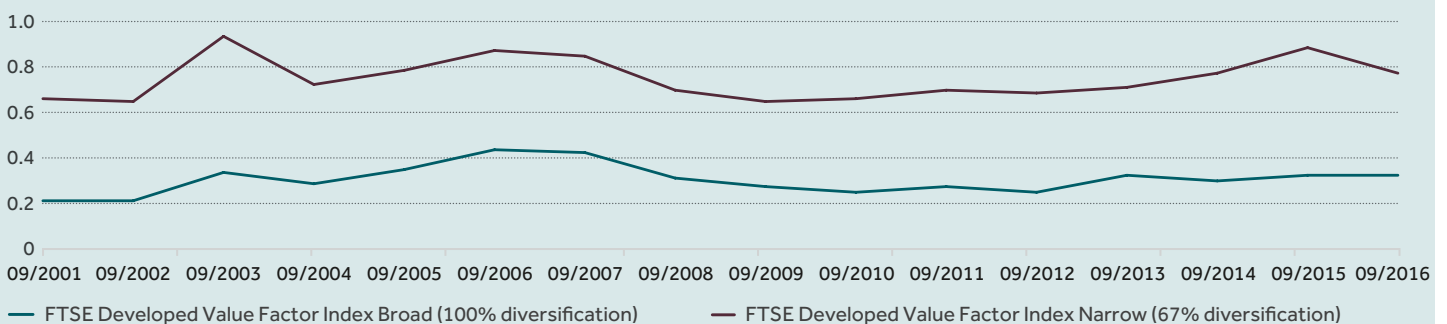
Combining factors

The application of consecutive 'factor tilts' (or, a tilt of one factor on another) towards multiple factors through the repeated application of the above steps results in a set of broad multi factor index weights. This can be understood as a modified Step 2, in which several factor scores are combined with the underlying index weight, as below.

$$\text{Underlying Weight X Factor Score 1 X Factor Score 2 X Factor Score 3...} = \text{Unadjusted Weight} \rightarrow \text{Final Weight}$$

Why do we narrow?

Narrowing ensures greater Factor exposure in the final index



Source: FTSE Russell. Data as of September 30, 2016. Past performance is no guarantee of future results. Returns shown may reflect hypothetical historical performance. See disclaimer page for legal disclosures.

¹ A 'Z-Score' is a statistical measurement of a score's relationship to the mean in a group of scores. A Z-Score of 0 means the score is the same as the mean. A Z-Score can be positive or negative, indicating whether it is above or below the mean.

The factor combination process

Gaining exposure to multiple factors becomes increasingly challenging using allocations to multiple individual single factor indexes. Targeting multiple factors can be achieved in several ways:

Composite index ('Top down' portfolio construction)

- Combine the weightings of individual factor indexes (e.g. 33.3% value, 33.3% quality, 33.3% size).
- However, at times, this may result in a dilution of exposures to the target factors.

Composite factor

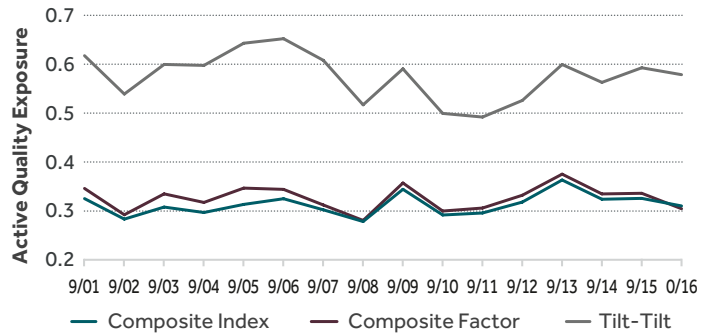
- Combine individual factor 'Z-Scores' to create a composite 'Z-Score'.
- Works for positively correlated factors (e.g. quality and low volatility) but is less effective for negatively correlated factors (e.g. quality and value).

The FTSE Russell preferred approach: Tilt-Tilt ('Bottom up' portfolio construction)

- Sequential, or 'multiplicative' tilts on each factor – outcome is independent of ordering.
- Approximately the same exposures of single factor indexes, without the dilutive effects of other methods.
- The magnitude of tilt determined by implementation concerns such as liquidity, capacity, diversification and turnover.

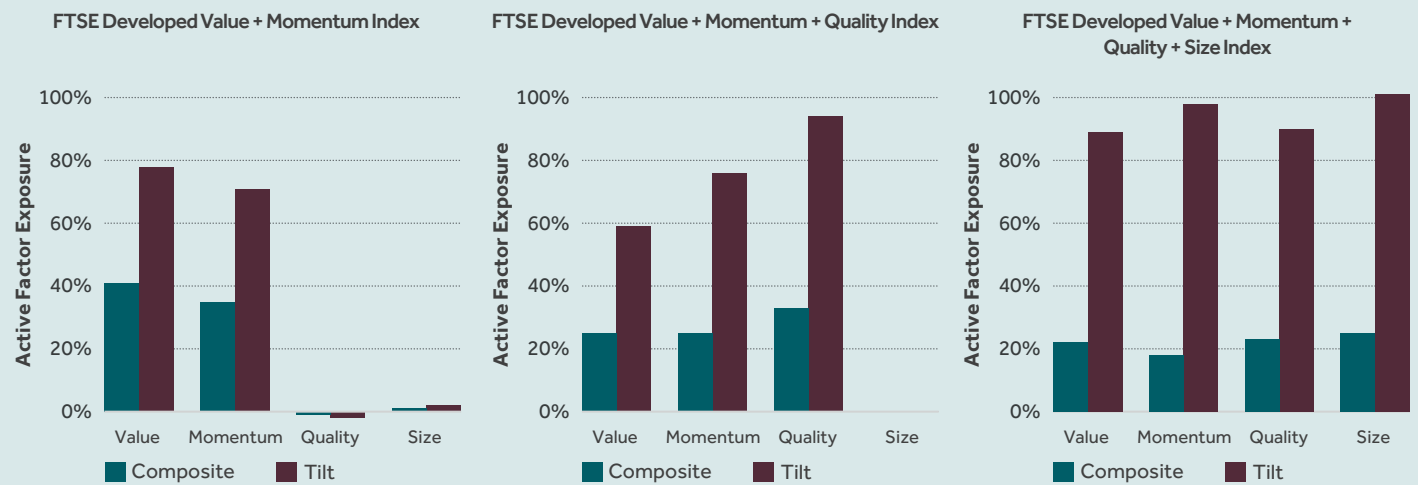
Tilt-Tilt improves factor exposure for positively corrected factors

FTSE Developed, Quality + Low Volatility Factor Index



Source: FTSE Russell. Data as of September 2001 to September 2016. Past performance is no guarantee of future results. Returns shown may reflect hypothetical historical performance. See disclaimer page for legal disclosures. Chart shows active factor loading relative to the FTSE Developed Index, calculated using an annual rebalance frequency.

Tilt-Tilt also improves factor exposure for negatively correlated factors






- Greater factor exposure across all target factors, compared to other approaches:
- Composite approaches result in subdued levels of exposure to target factors.
 - Tilt-tilt results in a factor index with approximately the same level of exposure as the single factor indexes.
 - Highlights stocks displaying all characteristics.

Source: FTSE Russell. Data as of September 2001 to September 2016. Past performance is no guarantee of future results. Returns shown may reflect hypothetical historical performance. See disclaimer page for legal disclosures. Chart shows active factor loading relative to the FTSE Developed Index, calculated using an annual rebalance frequency.

Case study: Tilt-tilt methodology and calculating constituent weights

Constituent weights are derived using FTSE Russell's 'Tilt-Tilt' methodology. Factor scores are combined with the underlying market cap weight to create a factor weight for each constituent. The weight is rescaled (to sum to 100%), and constraints are applied to arrive at the final weight in the factor index.

| | Cap Weight | X | Qual. Score | X | Mom. Score | X | Value Score | X | Size Score | X | Vol Score | = | Unadj Wgt | → | Final Wgt. |
|---|------------|---|-------------|---|------------|---|-------------|---|------------|---|-----------|---|-----------|---|------------|
|  | 0.22% | X | 0.91 | X | 0.76 | X | 0.70 | X | 0.18 | X | 0.63 | = | 0.012% | → | 1.00% |
|  | 0.17% | X | 0.86 | X | 0.22 | X | 0.32 | X | 0.27 | X | 0.73 | = | 0.002% | → | 0.16% |
|  | 0.05% | X | 0.02 | X | 0.11 | X | 0.03 | X | 0.40 | X | 0.00 | = | 0.00% | → | 0.00% |

Factor indexes rebalance away from the market cap weighted benchmark – the difference in stock weights represents active weights.

Weights are rescaled and constraints are applied.

Information for illustrative purposes only.

Narrowing and constraints

When building single or multi-factor indexes, we want to capture factor risk premia through maintaining controlled exposure to the target factor, while retaining the benefits of the market cap-weighted benchmark, namely diversification and capacity. We add the following general diversification parameters to the FTSE Comprehensive Factor Series;

| | |
|------------------------------------|---|
| Maximum stock level capacity ratio | 20x |
| Minimum stock weight | 0.5 basis points |
| Country and Industry Constraints: | <ul style="list-style-type: none"> • Upper and lower bounds: <ul style="list-style-type: none"> • +/- 20% (relative to the starting universe weight) AND • +/- 5% (absolute) buffer |

For more information about our indexes, please visit ftserussell.com.

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