



FTSE Global Factor Index Series

v5.4



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Section 1

Introduction

1.0 Introduction

- 1.1 This document sets out the Ground Rules for the construction and management of the FTSE Global Factor Index Series. Copies of the Ground Rules are available from www.ftserussell.com.
- 1.2 The FTSE Global Factor Index Series is designed to reflect the performance of stocks representing a specific set of factor characteristics.
- 1.3 These Ground Rules should be read in conjunction with the FTSE Global Equity Index Series Ground Rules, FTSE China A All Cap Index Series, FTSE UK Index Series Ground Rules, FTSE/JSE Africa Index Series Ground Rules, the Corporate Actions and Events Guide for Non Market Cap Weighted Indexes and the Russell U.S. Equity Indexes Construction and Methodology which are available at www.ftserussell.com. Unless stated in these Ground Rules, the FTSE Global Factor Index Series will follow the same process as the FTSE Global Equity Index Series.
- 1.4 The FTSE Global Factor Index Series does not take account of ESG factors in its index design.
- 1.5 Price and Total Return Indexes will be calculated on an end of day basis.

Total return indexes include income based on ex dividend adjustments. All dividends are applied as declared in FTSE total return indexes.
- 1.6 The base currency is US Dollars for global or regional indexes and local currency for single country indexes. Index values may also be published in other currencies.
- 1.7 The indexes may be calculated in real time (See Appendix A).
- 1.8 **FTSE Russell**

FTSE Russell is a trading name of FTSE International Limited, Frank Russell Company, FTSE Global Debt Capital Markets Limited (and its subsidiaries FTSE Global Debt Capital Markets Inc. and MTSNext Limited), Mergent, Inc., FTSE Fixed Income LLC, The Yield Book Inc and Beyond Ratings.
- 1.9 FTSE Russell hereby notifies users of the index series that it is possible that circumstances, including external events beyond the control of FTSE Russell, may necessitate changes to, or the cessation of, the index series and therefore, any financial contracts or other financial instruments that reference the index series or investment funds which use the index series to measure their performance should be able to withstand, or otherwise address the possibility of changes to, or cessation of, the index series.

- 1.10 Index users who choose to follow this index series or to buy products that claim to follow this index series should assess the merits of the index series rules-based methodology and take independent investment advice before investing their own or client funds. No liability whether as a result of negligence or otherwise is accepted by FTSE Russell (or any person concerned with the preparation or publication of these Ground Rules) for any losses, damages, claims and expenses suffered by any person as a result of:
- any reliance on these Ground Rules, and/or
 - any errors or inaccuracies in these Ground Rules, and/or
 - any non-application or misapplication of the policies or procedures described in these Ground Rules, and/or
 - any errors or inaccuracies in the compilation of the index series or any constituent data.



Section 2

Management Responsibilities

2.0 Management Responsibilities

2.1 FTSE International Limited (FTSE)

2.1.1 FTSE is the benchmark administrator of the index series.¹

2.1.2 FTSE is responsible for the daily calculation, production and operation of the Index Series and will:

- maintain records of the index weightings of all constituents;
- make changes to the constituents and their weightings in accordance with the Ground Rules;
- carry out periodic index reviews of the Index Series and apply the changes resulting from the reviews as required by the Ground Rules;
- publish changes to the constituent weightings resulting from their ongoing maintenance and the periodic reviews;
- disseminate the indexes.

2.2 Amendments to These Ground Rules

2.2.1 These Ground Rules shall be subject to regular review (at least once a year) by FTSE Russell to ensure that they continue to best reflect the aims of the index series. Any proposals for significant amendments to these Ground Rules will be subject to consultation with FTSE Russell advisory committees and other stakeholders if appropriate. The feedback from these consultations will be considered by the FTSE Russell Product Governance Board before approval is granted.

2.2.2 As provided for in the Statement of Principles for FTSE Russell Equity Indexes, where FTSE Russell determines that the Ground Rules are silent or do not specifically and unambiguously apply to the subject matter of any decision, any decision shall be based as far as practical on the Statement of Principles. After making any such determination, FTSE Russell shall advise the market of its decision at the earliest opportunity. Any such treatment will not be considered as an exception or change to the Ground Rules, or to set a precedent for future action, but FTSE Russell will consider whether the Ground Rules should subsequently be updated to provide greater clarity.

¹ The term administrator is used in this document in the same sense as it is defined in [Regulation \(EU\) 2016/1011 of the European Parliament and of the Council of 8 June 2016 on indices used as benchmarks in financial instruments and financial contracts or to measure the performance of investment funds](#) (the European Benchmark Regulation).



Section 3

FTSE Russell Index Policies

3.0 FTSE Russell Index Policies

These Ground Rules should be read in conjunction with the following policy documents which can be accessed using the links below:

3.1 Corporate Actions and Events Guide

- 3.2 Full details of changes to constituent companies due to corporate actions and events can be accessed in the Corporate Actions and Events Guide for Non Market Cap Weighted Indexes using the following link:

[Corporate Actions and Events Guide for Non Market Cap Weighted Indices.pdf](#)

3.3 Statement of Principles for FTSE Russell Equity Indexes (the Statement of Principles)

Indexes need to keep abreast of changing markets and the Ground Rules cannot anticipate every eventuality. Where the Ground Rules do not fully cover a specific event or development, FTSE Russell will determine the appropriate treatment by reference to the Statement of Principles which summarises the ethos underlying FTSE Russell's approach to index construction. The Statement of Principles is reviewed annually and any changes proposed by FTSE Russell are presented to the FTSE Russell Policy Advisory Board for discussion before approval by FTSE Russell's Product Governance Board.

The Statement of Principles can be accessed using the following link:

[Statement of Principles.pdf](#)

3.4 Queries and Complaints

FTSE Russell's complaints procedure can be accessed using the following link:

[Benchmark Determination Complaints Handling Policy.pdf](#)

3.5 Index Policy for Trading Halts and Market Closures

- 3.5.1 Guidance for the treatment of index changes in the event of trading halts or market closures can be found using the following link:

[Index Policy for Trading Halts and Market Closures.pdf](#)

3.6 Index Policy in the Event Clients are Unable to Trade a Market

- 3.6.1 Details of FTSE Russell's treatment can be accessed using the following link:

[Index Policy in the Event Clients are Unable to Trade a Market.pdf](#)

3.7 **Recalculation Policy and Guidelines**

- 3.7.1 The FTSE Global Factor Index Series are recalculated whenever errors or distortions occur that are deemed to be significant. Users of the FTSE Global Factor Index Series are notified through appropriate media.

For further information refer to the FTSE Russell Recalculation Policy and Guidelines document which is available from the FTSE Russell website using the link below or by contacting info@ftserussell.com.

[Recalculation Policy and Guidelines Equity Indexes.pdf](#)

3.8 **Policy for Benchmark Methodology Changes**

- 3.8.1 Details of FTSE Russell's policy for making benchmark methodology changes can be accessed using the following link:

[Policy for Benchmark Methodology Changes.pdf](#)

3.9 **FTSE Russell Governance Framework**

- 3.9.1 To oversee its indexes, FTSE Russell employs a governance framework that encompasses product, service and technology governance. The framework incorporates the London Stock Exchange Group's three lines of defence risk management framework and is designed to ensure compliance with the IOSCO Principles for Financial Benchmarks² and the European benchmark regulation³. The FTSE Russell Governance Framework can be accessed using the following link:

[FTSE Russell Governance Framework.pdf](#)

² IOSCO Principles for Financial Benchmarks Final Report, FR07/13 July 2013

³ Regulation (EU) 2016/1011 of the European Parliament and of the Council of 8 June 2016 on indices used as benchmarks in financial instruments and financial contracts or to measure the performance of investment funds



Section 4

Eligible Securities

4.0 Eligible Securities

- 4.1 The eligible securities of each factor index are the constituents of indexes defined by the FTSE Global Equity Index Series⁴, FTSE China A All Cap Index Series, FTSE UK Index Series, FTSE/JSE Africa Index Series and the Russell US Equity Indexes.
- 4.1.1 The eligible universe of the FTSE All-World ex CW Balanced Factor Index, including the March and September annually reviewed indexes will consist of constituent securities of the FTSE All-World Index excluding companies that manufacture or provide specific parts for anti-personnel mines, cluster munitions, chemical and biological weapons. The controversial weapon (CW) exclusions will be reviewed semi-annually in March and September (see Rule 7.1).
- 4.2 **Multiple Lines**
- 4.2.1 All lines of the same company that are eligible securities are eligible for inclusion in the relevant factor indexes.

⁴ Saudi Arabia was assigned Secondary Emerging market status in March 2019. Securities will be eligible for inclusion in the FTSE Global Factor Index Series from September 2019.

China A Shares (available under the Northbound China Stock Connect Scheme) was assigned Secondary Emerging market status beginning in June 2019. Securities will be eligible for inclusion in the FTSE Global Factor Index Series from September 2019.

Section 5

Factor Construction

5.0 Factor Construction

The data cut-off date for the calculation of all factor data is the close of business on the last business day of the month prior to the review month.

5.1 Z-Scores and Missing Data Treatment

- 5.1.1 Individual stock factor values are normalised cross-sectionally to create Z-Scores within each eligible universe according to:

$$Z_{F,i} = \frac{F_i - \mu_F}{\sigma_F} \quad \text{where} \quad F \in \{V, Q, M, LV, S, Y, C, \beta\} \quad (1)$$

where F_i is the F -factor value of the i^{th} stock and μ_F and σ_F are its cross-sectional factor mean and standard deviation respectively. See 5.2 – 5.9 for factor definitions.

Z-Scores that are greater (less) than three (minus three) are truncated to a value of three (minus three). Post-truncation, individual Z-Scores are renormalized by the re-application of equation (1). All Z-Scores, including truncated ones are included in this re-application. This process is repeated until all Z-Scores lie in a range between plus and minus three.

- 5.1.2 If a factor consists of multiple sub-factors, e.g. Profitability which has three components, a stock's initial factor Z-Score is formed by taking the average of its individual sub-factor Z-Scores calculated via Rule 5.1.1. This average is taken across non missing sub-factor Z-Scores. The normalisation procedure detailed in Rule 5.1.1 is then re-applied to this average to form the final factor Z-Score.
- 5.1.3 For all factors with the exception of Yield, stocks with missing factor data are allocated a neutral Z-Score of zero after the application of the normalisation procedure detailed in Rules 5.1.1 and 5.1.2. For Yield missing (or zero) values are assigned a Z-Score of minus three.

5.2 Momentum (M)

Momentum is defined as the cumulative total local return, calculated over the period that starts twelve months prior to the effective date, and ends the Monday following the third Friday of the previous month. A full history is required to calculate Momentum. Country Relative Momentum is calculated in excess of the country median stock level of Momentum. A Z-Score for Momentum and Country Relative Momentum is created following the procedure detailed in Rules 5.1.1 and 5.1.3.

5.3 Quality (Q)

Quality is defined as a composite of Profitability and Leverage. Indexes derived from each eligible universe consider three individual measures of Profitability and a single measure of Leverage. The Profitability and Leverage Z-Scores are combined to create a single Z-Score for Quality following the procedure described in Rules 5.1.2 and 5.1.3. Annual reported financial statement items are sourced from a third party data provider.

5.3.1 Profitability

Profitability is defined for indexes derived from each eligible universe by a combination of the Z-Scores of the following three measures according to Rule 5.1.2:

Return on Assets (ROA):

$$ROA = \frac{\text{Net Income}}{\text{Average Total Assets}} \quad (2)$$

Change in Asset Turnover:

$$\Delta \text{ Asset Turnover} = \frac{\text{Sales}_t}{\text{Total Assets}_t} - \frac{\text{Sales}_{t-1}}{\text{Total Assets}_{t-1}} \quad (3)$$

Accruals:

$$\text{Accruals} = - \frac{\Delta WC + \Delta NCO + \Delta FIN}{\text{Average Total Assets}} \quad (4)$$

where:

- Average Total Assets = $(\text{Total Assets}_t + \text{Total Assets}_{t-1})/2$
- WC (Working Capital) = $(\text{Current Assets} - \text{Cash \& Short-term Investments}) - (\text{Current Liability} - \text{Short-term Debt})$
- Non-current Net Operating Assets (NCO) = $(\text{Total Assets} - \text{Current Assets} - \text{Investments and Advances}) - (\text{Total Liability} - \text{Current Liabilities} - \text{Long-term Debt})$
- Net Financial Assets (FIN) = $(\text{Short-term Investments} + \text{Long-term Investments}) - (\text{Long-term Debt} + \text{Short-term Debt} + \text{Preferred Stock})$

Note, a high level of Accruals is considered an indicator of lower levels of future profitability. We therefore reverse the sign by multiplying by minus 1 in equation (6). All the above measures are calculated relative to the relevant regional median stock level.

Negative total or average assets are assigned a neutral Z-Score of zero.

5.3.2 Leverage Ratio

Leverage for indexes derived from each eligible universe is the ratio of Operating Cash Flow to Total Debt measured relative to the regional industry (ICB) median stock level.

$$\text{Leverage Ratio} = \frac{\text{Operating Cash Flow}}{\text{Total Debt}} \quad (5)$$

The Leverage measure is normalised following the procedure described in Rule 5.1.1 and Rule 5.1.3.

A company whose net operating cash flow is greater than total debt or has no debt is assigned a maximum Leverage Ratio of one.

5.3.3 Financials and Real Estate

Securities within each eligible universe that are classified as Financials and Real Estate (Old ICB Industry Code 8000/ New ICB Industry Code 30 & 35), utilise ROA as the sole measure of Quality. Certain Quality measures such as operating cash flow and accruals cannot meaningfully be calculated or are not applicable to financial and real estate companies.

5.4 Size (S)

Size is calculated as the natural logarithm of each company's full market capitalisation in USD. Shares in issue as of the review effective date and price and foreign exchange rates as of the data cut-off date are used to calculate each company's full market capitalisation. A Z-Score for Size is created following the procedure detailed in Rules 5.1.1 and 5.1.3.

5.5 Value (V)

For indexes derived from each eligible universe, Value is represented by a composite of three common valuation measures:

- Cash-flow Yield = Latest Annual Cash-Flow / Full Market Capitalisation
- Earnings Yield = Latest Annual Net Income / Full Market Capitalisation
- Sales to Price = Latest Annual Sales / Full Market Capitalisation

Sales to Price is calculated in excess of the country median stock level. Annual measures of cash-flow, net income and sales are sourced from a third party data provider. Individual value Z-Scores are combined to create a single Z-Score for Value following the procedure described in Rules 5.1.2 and 5.1.3.

5.6 Volatility (LV)

Volatility is defined as the standard deviation of five years of weekly (Wednesday to Wednesday) total local returns prior to the rebalance month. A minimum of 52 weekly return observations are required to calculate volatility. Country Relative Volatility is calculated in excess of the country median stock level of Volatility. A Z-Score for Volatility and Country Relative Volatility is created following the procedure detailed in Rules 5.1.1 and 5.1.3.

5.7 Yield (Y)

Yield is calculated as the natural logarithm of each company's twelve month trailing dividend yield. Companies whose trailing dividend yield is zero are assigned a Z-Score of minus three. A Z-Score for Yield is created following the procedure detailed in Rules 5.1.1 and 5.1.3.

5.8 Beta (β)

Beta is calculated as the covariance between stock total return and the underlying (market) index total return divided by the variance of the underlying index total return using two years of daily data. Betas are calculated using stock returns or global and regional indexes and in local currency for single country indexes.

5.9 **Composite (C)**

Z-Scores of Quality and Volatility are combined to create a single Z-Score following the procedure described in Rules 5.1.2 and 5.1.3. We refer to this as the Composite factor.

Section 6

Index Construction

6.0 Index Construction

6.1 Tilt Indexes

6.1.1 All factor indexes in the Global Factor index Series are constructed using the following multiple tilt methodology. The general expression for index weights $W_{F,i}$ is:

$$W_{F,i} = \frac{1}{\Lambda} \times S_{V,i}^n \times S_{Q,i}^p \times S_{M,i}^q \times S_{LV,i}^r \times S_{S,i}^s \times S_{Y,i}^t \times S_{C,i}^u \times S_{\beta,i}^v \times C_i \times I_i \times \Phi_i \times \Psi_i \times W_{M_i} \quad (6)$$

where, for each stock i in a subset \mathcal{N} of the entire stock universe \mathcal{U} , the tilts are defined by:

- $S_{F,i}^n$ is a factor tilt to factor F of strength n , $S_{F,i} = S(Z_{F,i})$ and $S(Z)$ is a monotonic mapping of Z-Scores to positive real numbers.
- C_i and I_i are defined by:

$$C_i = \begin{cases} c_1 & \text{if } i \in \mathcal{C}_1 \\ \vdots & \\ c_K & \text{if } i \in \mathcal{C}_K \end{cases} \quad \text{and} \quad I_i = \begin{cases} l_1 & \text{if } i \in \mathcal{J}_1 \\ \vdots & \\ l_J & \text{if } i \in \mathcal{J}_J \end{cases} \quad (7)$$

where \mathcal{C}_H and \mathcal{J}_H are the H^{th} Country and Industrial ICB groupings respectively.

- Φ_i is the maximum stock capacity/maximum weight tilt.
- Ψ_i is the maximum turnover tilt.
- W_{M_i} is the Market Capitalization weight.
- Λ is the normalization factor defined by:

$$\Lambda = \sum_{i \in \mathcal{N}} S_{V,i}^n \times S_{Q,i}^p \times S_{M,i}^q \times S_{LV,i}^r \times S_{S,i}^s \times S_{Y,i}^t \times S_{C,i}^u \times S_{\beta,i}^v \times C_i \times I_i \times \Phi_i \times \Psi_i \times W_{M_i} \quad (8)$$

This ensures that the tilt weights sum to one, i.e. $\sum_{i \in \mathcal{N}} W_{F_i} = 1$.

6.1.2 Fixed Tilt Indexes: The strength of the factor tilt is a fixed number for all rebalances.

6.1.3 Target Exposure Indexes: Variable tilt strengths are chosen to satisfy fixed exposure targets.

6.1.4 The general tilt expression (6) can be broken up into several sequential tilts consisting of Factor Tilts, Country and Industry Tilts, a Capacity and Maximum Weight Tilt and a Turnover Tilt.

6.2 Factor Tilts

6.2.1 The factor tilt is given by:

$$W_{1i} = \frac{1}{\Pi} \times S_{V,i}^n \times S_{Q,i}^p \times S_{M,i}^q \times S_{LV,i}^r \times S_{S,i}^s \times S_{Y,i}^t \times S_{C,i}^u \times S_{\beta,i}^v \times W_{M_i} \quad (9)$$

where Π is the normalization factor defined by:

$$\Pi = \sum_{i \in \mathcal{N}} S_{V,i}^n \times S_{Q,i}^p \times S_{M,i}^q \times S_{LV,i}^r \times S_{S,i}^s \times S_{Y,i}^t \times S_{C,i}^u \times S_{\beta,i}^v \times W_{M_i} \quad (10)$$

Factors that are not targeted are assigned zero tilt strength.

6.2.2 Fixed Tilt Indexes:

- For Broad Indexes: $\mathcal{N} = \mathcal{U}$.
- For Narrow Indexes: \mathcal{N} is a subset of \mathcal{U} defined in Appendix A.
- $S(Z) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^Z e^{-x^2/2} dx$; $S^n \stackrel{\text{def}}{=} S(-Z)^{-n}$ when n is negative.
- Tilts are of a fixed strength and do not vary from rebalance to rebalance.

6.2.3 Target Exposure Indexes:

- $\mathcal{N} = \mathcal{U}$.
- $S(Z) = \text{Exp}(Z)$.
- Tilts strengths vary from rebalance to rebalance and result from the solution of the following set of equations for active factor exposure:

$$\sum_{i \in \mathcal{U}} (W_{1i} - W_{M_i}) Z_{F,i} = T_F \quad \text{for each targeted } F \in \{V, Q, M, LV, S, Y, C\} \quad (11)$$

and for weighted beta:

$$\sum_{i \in \mathcal{U}} W_{1i} \beta_i = T_\beta \quad \text{where } T_\beta \in [\beta_L, \beta_U] \quad (12)$$

where β_i is the beta factor, T_F is the active exposure target for factor F and β_L and β_U are lower and upper bounds for the index level beta.

We begin by solving system of equations (11) for the factor tilt strengths. If equation (12) is satisfied using the solution for W_{1_i} from (11), a tilt strength of 0 is assigned to the beta tilt. If the weighted beta is lower than β_L we set $T_\beta = \beta_L$, if it is higher than β_U we set $T_\beta = \beta_U$ and then solve the system of equations (11) and (12) simultaneously.

6.3 Country and Industry Tilts

6.3.1 Country and industry tilts are applied to the weights resulting from the factor tilt in 6.2:

$$W_{2_i} = C_i \times I_i \times W_{1_i} \quad (13)$$

The quantities C_i and I_i are defined in equation (7) and are chosen to satisfy:

$$\sum_{i \in \mathcal{C}_H} W_{2_i} = T_{C_H} \quad \text{where} \quad H = 1, \dots, K \quad (14)$$

where $T_{C_H} \in [C_{H_L}, C_{H_U}]$ is the target country weight for the H^{th} country, and

$$\sum_{i \in \mathcal{J}_H} W_{2_i} = T_{J_H} \quad \text{where} \quad H = 1, \dots, J \quad (15)$$

where $T_{J_H} \in [J_{H_L}, J_{H_U}]$ is the target industry weight for the H^{th} industry.

The country lower and upper bounds are defined by:

$$C_{H_L} = \text{Max} \left[(1 - P_C) \sum_{i \in \mathcal{C}_H} W_{M_i} - Q_C, 0 \right] \quad \text{and} \quad C_{H_U} = \text{Min} \left[(1 + P_C) \sum_{i \in \mathcal{C}_H} W_{M_i} + Q_C, 1 \right] \quad (16)$$

and the industry lower and upper bounds by:

$$J_{H_L} = \text{Max} \left[(1 - P_J) \sum_{i \in \mathcal{J}_H} W_{M_i} - Q_J, 0 \right] \quad \text{and} \quad J_{H_U} = \text{Min} \left[(1 + P_J) \sum_{i \in \mathcal{J}_H} W_{M_i} + Q_J, 1 \right] \quad (17)$$

where the P and Q parameters in (16) and (17) are in the range 0 to 1. Values for particular indexes are given in Tables 1 and 2 of Rules 6.10 and 6.11.

The method to obtain the target country T_{C_H} and industry T_{J_H} weights that are consistent with the constraints set out in (16) and (17) is as follows.

Starting with the country and industry weights of the factor tilt weights defined by (9) one sets the weight of industries and countries that breach the relevant constraint to the nearest of their upper and lower bounds. For Fixed Tilt indexes the lower bound is modified to be the minimum of twice the country or industry weighting of the factor tilt weights defined by (9) and the lower bounds defined in (16) and (17).

Weight is then re-assigned proportionately to countries/ industries that are not in breach of their upper or lower bounds.

6.3.2 Fixed Tilt Indexes:

Where such a reallocation causes breaches in previously “good” industries or countries then all original constraints are marginally and repeatedly relaxed until no such breaches occur.

6.3.3 Target Exposure Indexes:

Where such a reallocation causes breaches in previously “good” industries or countries the process is repeated iteratively until no such breaches occur. If the iteration does not converge to a solution that satisfies the original constraints then those constraints are marginally relaxed and the iteration repeated. This relaxation/iteration process continues until a consistent solution with no breaches is found.

6.3.4 The country and industry weightings determined in Rules 6.3.2 or 6.3.3 are the target country T_{C_H} and industry T_{J_H} weights to be used in (14) and (15).

6.4 **Capacity, Maximum and Minimum Weight Tilt**

6.4.1 A capacity and maximum weight tilt is applied to the weights resulting from the country and industry tilt described in 6.3:

$$W_{3_i} = \Phi_i \times W_{2_i} \quad (18)$$

Let X_i and Y_i be the maximum and minimum weights for the i^{th} stock. Y_i is initially set to zero but will later be set to a positive minimum weight in 6.7.2. Let C be the maximum stock capacity ratio which is set to 20 unless otherwise explicitly stated. The weight W_{3_i} is then found by iterating:

$$\widehat{W}_i = \text{Max}[\text{Min}[W_{3_i}, C * W_{M_i}, X_i], Y_i]; \quad W_{3_i} = \widehat{W}_i / \sum_{i \in \mathcal{N}} \widehat{W}_i \quad (19)$$

with a starting value $W_{3_i} = W_{2_i}$, to convergence. The value for the tilt is then defined by:

$$\Phi_i = \frac{W_{3_i}}{W_{2_i}} \quad (20)$$

6.5 Turnover Tilt

6.5.1 A turnover tilt is applied to the weights resulting from the capacity and maximum weight tilt in 6.4.1:

$$W_{4i} = \Psi_i \times W_{3i} \quad (21)$$

Ψ_i is calculated as follows. Let W_{0i} be the current set of weights evaluated at the price cut-off date then the two-way turnover between this set of weights and W_{3i} is given by:

$$T = \sum_{i \in \mathcal{N} \cup \mathcal{P}} |W_{3i} - W_{0i}| \quad (22)$$

where \mathcal{P} is the stock universe associated with the current set of weights. Let T_{TO} represent the maximum allowable turnover for the rebalance. Define the following parameter:

$$\alpha = \text{Min} \left[1, \frac{T_{TO}}{T} \right] \quad (23)$$

Then we have the following equation for a partial rebalance of the index:

$$W_{4i} = \alpha * W_{3i} + (1 - \alpha) * W_{0i} \quad (24)$$

If $T \leq T_{TO}$ or equivalently we have no turnover constraint (i.e. T_{TO} is arbitrarily large) then $\alpha = 1$ and we have a full rebalance. The turnover tilt is thus defined by:

$$\Psi_i = \left[\alpha + (1 - \alpha) \frac{W_{0i}}{W_{3i}} \right] \quad (25)$$

6.6 Final Index

6.6.1 Fixed Tilt Indexes:

The final index is thus given by the following sequential tilt from Market capitalization weights:

$$W_{Fi} = \Psi_i \times \Phi_i \times C_i \times I_i \times \frac{1}{\Pi} \times S_{V,i}^n \times S_{Q,i}^p \times S_{M,i}^q \times S_{LV,i}^r \times S_{S,i}^s \times S_{Y,i}^t \times S_{C,i}^u \times S_{\beta,i}^v \times W_{Mi} \quad (26)$$

This is equivalent to equation (6) where all tilts are applied simultaneously.

6.6.2 Target Exposure Indexes:

If all of the following set of conditions are satisfied:

- Absolute weight difference between W_{1i} and W_{4i} is less than or equal to 25 basis points:

$$\sum_{i \in \mathcal{U}} |W_{4i} - W_{1i}| \leq 25 \text{ b.p.} \quad (27)$$

- Factor exposure targets T_F are less than 0.01 different than the factor exposures of W_{4i} :

$$\left| \sum_{i \in \mathcal{U}} (W_{4i} - W_{M_i}) Z_{F,i} - T_F \right| \leq 0.01 \quad \text{for each targeted } F \in \{V, Q, M, LV, S, Y\} \quad (28)$$

- Effective N of W_{4i} is greater than 25% of the Effective N of Market Capitalization weights W_{M_i} :

$$1 / \sum_{i \in \mathcal{U}} W_{4i}^2 \geq 0.25 / \sum_{i \in \mathcal{U}} W_{M_i}^2 \quad (29)$$

then the final index weights are given by $W_{F_i} = W_{4i}$.

Otherwise the operations in 6.2, 6.3, 6.4 and 6.5 are repeated but with W_{4i} replacing W_{M_i} in equations (9) and (10). This loop is continued until each of the conditions (27), (28) and (29) are satisfied.

This is essentially the solution method by which the set of tilts are chosen in equation (6) so as to satisfy all exposure targets and constraints simultaneously.

Relaxation of Exposure and Turnover Targets:

If after 100 iterations any of equations (27), (28) and (29) are not satisfied, all targeted active exposures are reduced by 2.5% and the whole process is attempted again. If this continues to be the case after 10 reductions (i.e. after the exposure targets have been reduced by 25%), then the turnover target is increased by 50% and the whole process is repeated using the original active exposure targets.

Finally if no solution is reached by this point the turnover target is relaxed completely and a solution with the original exposure targets is attempted. In the event that a solution remains infeasible the active exposure targets are reduced by 2.5% up to a maximum of 40 times.

6.7 Minimum Stock Weight

6.7.1 A minimum security level weight threshold is applied to each final factor index. Any security level factor index weight that is less than the minimum weight threshold is treated as having a zero weight in the relevant FTSE Global Factor Index. Any resulting excess weight will be redistributed amongst the remaining constituents and may cause small changes in the active weights and exposures of the final index.

6.7.2 Target Exposure Indexes:

The weights resulting from 6.7.1 are used as starting weights, replacing W_{M_i} in equations (9) and (10). Operations in 6.2, 6.3, 6.4 and 6.5 are repeated but with the parameter Y_i in equation (19) changed to the minimum security weight only for those stocks with non-zero weights. The iteration is continued until each of the conditions (27), (28) and (29) are satisfied. This process ensures that the targeted active exposures and constraints are consistent with the minimum security weight. If the solution is infeasible then the weights obtained in 6.7.1 are retained as the final index weights.

6.8 Fixed Tilt Indexes

6.8.1 Table 1 displays the parameters used in the Fixed Tilt Indexes.

Table 1: Fixed Tilt Index Parameters

Index	Tilt Strengths							Constraints						Review
	V	Q	M	LV	S	Y	C	Narrow	P	Q	Min Stock weight (b.p.)	Max Stock weight (%)	Max 2-way T/O (%)	
FTSE All-World Qual/Val/Vol Factor Index	1	0	0	0	0	0	1	Y	0.2	0.05	0.5	-	-	S
FTSE All-World Comprehensive Factor Index	1	1	1	1	1	0	0	N	0.2	0.05	0.5	-	-	MS
FTSE All-World ex US Comprehensive Factor Index	1	1	1	1	1	0	0	N	0.2	0.05	2	-	-	MS
FTSE All-World ex CW Balanced Factor Index@	1	1	0	1	0.25	0	0	N	0.2	0.05	0.5	-	-	MS
FTSE Developed Qual/Val/Vol Factor Index	1	0	0	0	0	0	1	Y	0.2	0.05	0.5	-	-	S
FTSE Developed Comprehensive Factor Index	1	1	1	1	1	0	0	N	0.2	0.05	0.5	-	-	MS
FTSE Developed ex US Qual/Val/Vol Factor Index	1	0	0	0	0	0	1	Y	0.2	0.05	0.5	-	-	S
FTSE Developed ex US Comprehensive Factor Index	1	1	1	1	1	0	0	N	0.2	0.05	0.5	-	-	MS
FTSE Developed ex US Select Factor Index	1	1	1	1	0.5	0	0	N	0.2	0.05	10	-	-	MS
FTSE Developed ex US Qual/Vol/Yield Factor Index	0	1	0	1	0	1	0	Y	0.2	0.05	0.5	-	-	S
FTSE Developed ex US Qual/Vol/Yield 5% Capped Factor Index	0	1	0	1	0	1	0	Y	0.2	0.05	0.5	5*	-	S
FTSE Developed ex Korea Qual/Vol Factor Index	0	1	0	1	0	0	0	Y	0.2	0.05	0.5	-	-	S
FTSE Developed ex Korea Qual/2Vol Factor Index	0	1	0	2	0	0	0	Y	0.2	0.05	0.5	-	-	S

Table 1: Fixed Tilt Index Parameters

Index	Tilt Strengths							Constraints						Review
	V	Q	M	LV	S	Y	C	Narrow	P	Q	Min Stock weight (b.p.)	Max Stock weight (%)	Max 2-way T/O (%)	
FTSE Developed Europe Comprehensive Factor Index	1	1	1	1	1	0	0	N	0.2	0.05	2	-	-	MS
FTSE Emerging Qual/Val/Vol Factor Index	1	0	0	0	0	0	1	Y	0.2	0.05	0.5	-	-	S
FTSE Emerging Comprehensive Factor Index	1	1	1	1	1	0	0	N	0.2	0.05	0.5	-	-	MS
FTSE Emerging Qual/Vol/Yield Factor Index	0	1	0	1	0	1	0	Y	0.2	0.05	0.5	-	-	S
FTSE Emerging Qual/Vol/Yield 5% Capped Factor Index	0	1	0	1	0	1	0	Y	0.2	0.05	0.5	5*	-	S
FTSE Emerging Plus Korea Select Factor Index	1	1	1	1	0.5	0	0	N	0.2	0.05	10	-	-	MS
FTSE Asia ex Japan Qual/Val/Vol 10% Capped Factor Index	1	1	0	1	0	0	0	Y	0.2	0.05	2	10*	-	S
FTSE Asia ex Japan Comprehensive 10% Capped Factor Index	1	1	1	1	1	0	0	N	0.2	0.05	2	10*	-	MS
FTSE Asia ex Japan Yield Focused 10% Capped Factor Index	1	1	0	0	1	2	0	Y	0.2	0.05	2	10*	-	S
FTSE/JSE All Share Comprehensive Factor Index	1	1	1	1	1	0	0	N	0.2	0.05	2	-	-	MS
FTSE/JSE All Share Low Volatility Focused Factor Index	1	1	0	2	1	0	0	N	0.2	0.05	2	-	-	S
Russell 1000 Comprehensive Factor Index	1	1	1	1	1	0	0	N	0.2	0.05	0.5	-	-	JD
Russell 1000 Low Volatility Focused ex Tobacco Factor Index*	1	1	0	2	1	0	0	Y	0.2	0.05	0.5	-	-	J
Russell 1000 Low Volatility Focused Factor Index	1	1	0	2	1	0	0	Y	0.2	0.05	0.5	-	-	J
Russell 1000 Yield Focused Factor Index	1	1	0	0	1	2	0	Y	0.2	0.05	0.5	-	-	J

Table 1: Fixed Tilt Index Parameters

Index	Tilt Strengths							Constraints						Review
	V	Q	M	LV	S	Y	C	Narrow	P	Q	Min Stock weight (b.p.)	Max Stock weight (%)	Max 2-way T/O (%)	
Russell 1000 Momentum Focused Factor Index	1	1	1	0	1	0	0	N	0.2	0.05	0.5	-	-	JD
Russell 1000 Mom/2Val Factor Index	2	0	1	0	0	0	0	Y	0.2	0.05	0.5	-	-	MJSD
Russell 1000 2Size/2Val 5% Capped Factor Index	2	0	0	0	2	0	0	Y	0.2	0.05	2	5	-	J
Russell 1000 2Mom/Size/Val 5% Capped Factor Index	1	0	2	0	1	0	0	N	0.2	0.05	2	5	-	JD
Russell 1000 2Qual/2Vol 5% Capped Factor Index	0	2	0	2	0	0	0	Y	0.2	0.05	2	5	-	J
Russell 1000 2Mom/2Qual/2Vol 5% Capped Factor Index	0	2	2	2	0	0	0	N	0.2	0.05	2	5	-	JD
Russell 1000 2Qual/Val 5% Capped Factor Index	1	2	0	0	0	0	0	Y	0.2	0.05	2	5	50	J
Russell 1000 Select Factor Index	1	1	1	1	0.5	0	0	N	0.2	0.05	2	-	-	JD
Russell Midcap Select Factor Index	1	1	1	1	0	0	0	N	0.2	0.05	10	-	-	JD
Russell 2000 Comprehensive Factor Index	1	1	1	1	1	0	0	N	0.2	0.05	0.5	-	-	JD
Russell 2000 2Size/2Val 3% Capped Factor Index	2	0	0	0	2	0	0	Y	0.2	0.05	2	3	-	J
Russell 2000 2Mom/Size/Val 3% Capped Factor Index	1	0	2	0	1	0	0	N	0.2	0.05	2	3	-	JD
Russell 2000 2Mom/2Qual/2Vol 3% Capped Factor Index	0	2	2	2	0	0	0	N	0.2	0.05	2	3	-	JD
Russell 2000 2Qual/2Vol 3% Capped Factor Index	0	2	0	2	0	0	0	Y	0.2	0.05	2	3	-	J
FTSE USA Qual/Val/Vol Factor Index	1	0	0	0	0	0	1	Y	0.2	0.05	0.5	-	-	S

Table 1: Fixed Tilt Index Parameters

Index	Tilt Strengths							Constraints						Review
	V	Q	M	LV	S	Y	C	Narrow	P	Q	Min Stock weight (b.p.)	Max Stock weight (%)	Max 2-way T/O (%)	
FTSE USA Qual/Vol/Yield Factor Index	0	1	0	1	0	1	0	Y	0.2	0.05	0.5	-	-	S
FTSE USA Qual/Vol/Yield 5% Capped Factor Index	0	1	0	1	0	1	0	Y	0.2	0.05	0.5	5*	-	S
FTSE Japan Comprehensive Factor Index	1	1	1	1	1	0	0	N	0.2	0.05	2	-	-	MS
Russell 1000 Universe Volatility Factor Index	0	0	0	1	0	0	0	Y	0.2	0.05	2	-	-	J
Russell 1000 Universe Size Factor Index	0	0	0	0	1	0	0	Y	0.2	0.05	2	-	-	J
Russell 1000 Universe Yield Factor Index	0	0	0	0	0	1	0	Y	0.2	0.05	2	-	-	J
Russell 1000 Universe Value Factor Index	1	0	0	0	0	0	0	Y	0.2	0.05	2	-	-	J
Russell 1000 Universe Quality Factor Index	0	1	0	0	0	0	0	Y	0.2	0.05	2	-	-	J
Russell 1000 Universe Momentum Factor Index	0	0	1	0	0	0	0	N	0.2	0.05	2	-	-	JD
FTSE 350 ex Inv Trust Comprehensive Factor Index ^^	1	1	1	1	1	0	0	N	0.2	0.05	2	-	-	MS
FTSE All-World ex CW Balanced Factor (Mar) Index	1	1	0	1	0.25	0	0	N	0.2	0.05	0.5	-	-	M
FTSE All-World ex CW Balanced Factor (Sep) Index	1	1	0	1	0.25	0	0	N	0.2	0.05	0.5	-	-	S
FTSE Universe # Value Factor Index	1	0	0	0	0	0	0	Y	0.2	0.05	0.5	-	-	S
FTSE Universe # Quality Factor Index	0	1	0	0	0	0	0	Y	0.2	0.05	0.5	-	-	S
FTSE Universe # Momentum Factor Index	0	0	1	0	0	0	0	N	0.2	0.05	0.5	-	-	MS

Table 1: Fixed Tilt Index Parameters

Index	Tilt Strengths							Constraints						Review
	V	Q	M	LV	S	Y	C	Narrow	P	Q	Min Stock weight (b.p.)	Max Stock weight (%)	Max 2-way T/O (%)	
FTSE Universe # Volatility Factor Index	0	0	0	1	0	0	0	Y	0.2	0.05	0.5	-	-	S
FTSE Universe # Size Factor Index	0	0	0	0	1	0	0	Y	0.2	0.05	0.5	-	-	S
FTSE Universe # Yield Factor Index	0	0	0	0	0	1	0	Y	0.2	0.05	0.5	-	-	S
Russell 1000 Universe Value Factor Index	1	0	0	0	0	0	0	Y	0.2	0.05	2	-	-	J
Russell 1000 Universe Volatility Factor Index	0	0	0	1	0	0	0	Y	0.2	0.05	2	-	-	J
Russell 1000 Universe Quality Factor Index	0	1	0	0	0	0	0	Y	0.2	0.05	2	-	-	J
Russell 1000 Universe Momentum Factor Index	0	0	1	0	0	0	0	N	0.2	0.05	2	-	-	JD
Russell 1000 Universe Size Factor Index	0	0	0	0	1	0	0	Y	0.2	0.05	2	-	-	J
Russell 1000 Universe Yield Factor Index	0	0	0	0	0	1	0	Y	0.2	0.05	2	-	-	J
Russell 2000 Universe Value Factor Index	1	0	0	0	0	0	0	Y	0.2	0.05	0.5	-	-	J
Russell 2000 Universe Quality Factor Index	0	1	0	0	0	0	0	Y	0.2	0.05	0.5	-	-	J
Russell 2000 Universe Momentum Factor Index	0	0	1	0	0	0	0	N	0.2	0.05	0.5	-	-	JD
Russell 2000 Universe Volatility Factor Index	0	0	0	1	0	0	0	Y	0.2	0.05	0.5	-	-	J
Russell 2000 Universe Size Factor Index	0	0	0	0	1	0	0	Y	0.2	0.05	0.5	-	-	J
Russell 2000 Universe Yield Factor Index	0	0	0	0	0	1	0	Y	0.2	0.05	0.5	-	-	J

Table 1: Fixed Tilt Index Parameters

Index	Tilt Strengths							Constraints						Review
	V	Q	M	LV	S	Y	C	Narrow	P	Q	Min Stock weight (b.p.)	Max Stock weight (%)	Max 2-way T/O (%)	
FTSE Brazil Value Factor Index ~	1	0	0	0	0	0	0	Y	-	-	40	10*	-	S
FTSE Brazil Quality Factor Index ~	0	1	0	0	0	0	0	Y	-	-	40	10*	-	S
FTSE Brazil Momentum Factor Index ~	0	0	1	0	0	0	0	N	-	-	40	10*	-	MS
FTSE Brazil Volatility Factor Index ~	0	0	0	1	0	0	0	Y	-	-	40	10*	-	S
FTSE Brazil Size Factor Index ~	0	0	0	0	1	0	0	Y	-	-	40	10*	-	S
FTSE Brazil Yield Factor Index ~	0	0	0	0	0	1	0	Y	-	-	40	10*	-	S
FTSE Developed ex US Country Relative Momentum Factor Index	0	0	1**	0	0	0	0	N	0.2	0.05	2	-	-	MS
FTSE Developed ex US Country Relative Volatility Factor Index	0	0	0	1**	0	0	0	Y	0.2	0.05	2	-	-	MS
FTSE Emerging Country Relative Momentum Factor Index	0	0	1**	0	0	0	0	N	0.2	0.05	2	-	-	MS
FTSE Emerging Country Relative Volatility Factor Index	0	0	0	1**	0	0	0	Y	0.2	0.05	2	-	-	MS
FTSE Indonesia Volatility Factor Index	0	0	0	1	0	0	0	N	0.2	0.05	0.5	-	-	S
FTSE/JSE All Share Capped 5% Value Factor Index ^	1	0	0	0	0	0	0	N	0.2	0.05	0.5	5	-	S
FTSE/JSE All Share Capped 5% Quality Factor Index ^	0	1	0	0	0	0	0	N	0.2	0.05	0.5	5	-	S
FTSE/JSE All Share Capped 5% Momentum Factor Index ^	0	0	1	0	0	0	0	N	0.2	0.05	0.5	5	-	MS
FTSE/JSE All Share Capped 5% Volatility Factor Index ^	0	0	0	1	0	0	0	N	0.2	0.05	0.5	5	-	S

Table 1: Fixed Tilt Index Parameters

Index	Tilt Strengths							Constraints						Review
	V	Q	M	LV	S	Y	C	Narrow	P	Q	Min Stock weight (b.p.)	Max Stock weight (%)	Max 2-way T/O (%)	
FTSE/JSE All Share Capped 5% Size Factor Index ^	0	0	0	0	1	0	0	N	0.2	0.05	0.5	5	-	S
FTSE/JSE All Share Capped 5% Yield Factor Index ^	0	0	0	0	0	1	0	N	0.2	0.05	0.5	5	-	S
FTSE 350 ex Inv. Trust Capped 2% Value Factor Index ^^	1	0	0	0	0	0	0	Y	0.2	0.05	0.5	-	-	S
FTSE 350 ex Inv. Trust Capped 2% Quality Factor Index ^^	0	1	0	0	0	0	0	Y	0.2	0.05	0.5	-	-	S
FTSE 350 ex Inv. Trust Capped 2% Momentum Factor Index ^^	0	0	1	0	0	0	0	N	0.2	0.05	0.5	-	-	MS
FTSE 350 ex Inv. Trust Capped 2% Volatility Factor Index ^^	0	0	0	1	0	0	0	Y	0.2	0.05	0.5	-	-	S
FTSE 350 ex Inv. Trust Capped 2% Size Factor Index ^^	0	0	0	0	1	0	0	Y	0.2	0.05	0.5	-	-	S
FTSE 350 ex Inv. Trust Capped 2% Yield Factor Index ^^	0	0	0	0	0	1	0	Y	0.2	0.05	0.5	-	-	S
FTSE Developed ex US 2Size/2Val 5% Capped Factor Index	2	0	0	0	2	0	0	Y	0.2	0.05	2	5*	-	S
FTSE Developed ex US 2Mom/Size/Val 5% Capped Factor Index	1	0	2**	0	1	0	0	N	0.2	0.05	2	5*	-	MS
FTSE Developed ex US 2Qual/2Vol 5% Capped Factor Index	0	2	0	2**	0	0	0	Y	0.2	0.05	2	5*	-	S
FTSE Developed ex US 2Mom/2Qual/2Vol 5% Capped Factor Index	0	2	2**	2**	0	0	0	N	0.2	0.05	2	5*	-	MS

Table 1: Fixed Tilt Index Parameters

Indexes	Tilt Strengths							Constraints						Review
	V	Q	M	LV	S	Y	C	Narrow	P	Q	Min Stock weight (b.p.)	Max Stock weight (%)	Max 2-way T/O (%)	
FTSE Developed ex US 2Size/2Val 5% Capped Factor Index	2	0	0	0	2	0	0	Y	0.2	0.05	2	5^		S

FTSE Developed ex US 2Mom/Size/Val 5% Capped Factor Index	1	0	2**	0	1	0	0	N	0.2	0.05	2	5^		MS
FTSE Developed ex US 2Qual/2Vol 5% Capped Factor Index	0	2	0	2**	0	0	0	Y	0.2	0.05	2	5^		S
FTSE Developed ex US 2Mom/2Qual/2Vol 5% Capped Factor Index	0	2	2**	2**	0	0	0	N	0.2	0.05	2	5^		MS

Notes:

@ FTSE All-World ex CW Balanced Factor Index results from phased reviews (see Rule 6.9).

~ The most illiquid securities, representing 1% of investable market capitalisation are removed. Illiquidity is defined using the Amihud Ratio, the median ratio of absolute daily return-to-volume over the 12 month period prior to the review month. A minimum of 120 daily observations are required. Company level capping of 10% is applied to the underlying at review.

^ Company level capping of 5% is applied to the underlying at review.

^^ Company level capping of 2% is applied to the underlying at review.

* Company level capping is applied quarterly using prices as at the close of business on the second Friday in March, June, September and December as per Rule 7.2.

** Country Relative.

Universe: All-World, Developed, Developed ex US, Emerging, USA, Japan.

Review: M=March, J=June, S=September and D=December.

6.8.2 The FTSE All-World ex CW Balanced Factor Index (see Table 1 of 6.8.1) consists of a combination of two annually reviewed indexes - the FTSE All-World ex CW Balanced Factor (Mar) Index and the FTSE All-World ex CW Balanced Factor (Sep) Index. The two indexes are reviewed annually in March and September respectively, and a set of constituent review weights for each index determined following Rules 6.2-6.7. The effective weight of each constituent in the FTSE All-World ex CW Balanced Factor Index is calculated as an equal combination of each annually reviewed index:

$$W_{i,t}^* = 0.5 \times W_{i,t}^{Mar} + 0.5 \times W_{i,t}^{Sep} \quad (30)$$

where:

- $W_{i,t}^{Mar}$ is the weight of stock i in the FTSE All-World ex CW Balanced Factor (Mar) Index.
- $W_{i,t}^{Sep}$ is the weight of stock i in the FTSE All-World ex CW Balanced Factor (Sep) Index.
- $W_{i,t}^*$ is the effective weight of stock i in the FTSE All-World ex CW Balanced Factor Index.

6.8.3 A constituent will be removed from the FTSE All-World ex CW Balanced Factor Indexes if it is also removed from the underlying FTSE All-World Index.

6.9 Target Exposure Indexes

6.9.1 Fixed Exposure Indexes: Active exposure targets are expressed in units derived from equally weighted Z-Scores defined by equation (1). Such targets may also be expressed in units of market capitalization weighted standard deviation $\hat{\sigma}_F$, given by:

$$\hat{\sigma}_F^2 = \sum_{i \in \mathcal{U}} W_{M_i} * (Z_{F,i} - \hat{\mu}_F)^2 \quad (31)$$

where $\hat{\mu}_F = \sum_{i \in \mathcal{U}} W_{M_i} * Z_{F,i}$ is the market capitalization weighted mean. An active exposure of $\hat{\sigma}_F * X$ in equally weighted exposure units is therefore equivalent to X units of capitalization weighted exposure, where capitalization weighted Z-Scores are defined by:

$$\hat{Z}_{F,i} = \frac{Z_{F,i} - \hat{\mu}_F}{\hat{\sigma}_F} \quad (32)$$

6.9.2 Equal Factor Risk Contribution Indexes: The factor exposure targets are set such that:

- The index ex-ante active risk is equal to an index active risk target
- A given set of factors contribute equally to ex-ante active risk

Ex-ante active risk is calculated using a factor covariance matrix formed using the daily factor returns from the two years preceding the price cut-off date of the review.

Factor returns are derived from cross-sectional market capitalization weighted regressions of total daily USD stock returns on prior month end factor exposures with industry and country effects. This is illustrated by the following equation:

$$R_i = \alpha + \sum_H \delta_{i \in \mathcal{C}_H} r_{\mathcal{C}_H} + \sum_J \delta_{i \in \mathcal{J}_J} r_{\mathcal{J}_J} + \sum_F \hat{Z}_{F,i} r_F + \varepsilon_i \quad (33)$$

where for stock i :

- R_i is the stock return
- $\delta_{i \in \mathcal{C}_H} = \begin{cases} 1 & \text{if } i \in \mathcal{C}_H \\ 0 & \text{if } i \notin \mathcal{C}_H \end{cases}$ is a dummy variable representing membership of country (or industry)
- $\hat{Z}_{F,i}$ is the capitalization-weighted Z-score for factor $F \in \{V, Q, M, LV, S, \beta\}$
- ε_i is the residual return

α is the return of the capitalization weighted benchmark, $r_{\mathcal{C}_H}$ and $r_{\mathcal{J}_J}$ are the pure country and industry returns respectively and r_F are the pure factor returns of interest.

For country and industry neutral indexes the model of ex-ante tracking error is related to levels of active factor exposure E_F by:

$$[\text{Ex-Ante Tracking Error}]^2 = \sum_F \sum_G E_F E_G C_{FG} \quad (34)$$

where C_{FG} is the covariance of factor returns to factors F and G .

Factors chosen to contribute equally to ex-ante risk satisfy:

$$E_F * \sum_G E_G C_{FG} = k \quad (35)$$

where the scalar k is set to achieve a specified level of ex-ante tracking error. Active exposures of factors that are used in the estimation of factor returns but are not chosen to contribute to ex-ante risk are set to zero.

Table 2 displays the selected factors and active risk targets for the equal factor risk contribution indexes.

Table 2: Equal Factor Risk Contribution Parameters

Index	ERC Factors	Annualized Ex-Ante Target
Russell 1000 Comprehensive Equal Factor Risk Contribution Target Exposure Index	Momentum, Quality, Size, Value, Volatility	2.5%
FTSE Developed ex US Comprehensive Equal Factor Risk Contribution Target Exposure Index	Momentum, Quality, Size, Value, Volatility	2.5%

6.9.3 Table 3 displays the parameters used in the Target Exposure Indexes.

Table 3: Target Exposure Index Parameters

Index	Active Factor Exposure Targets						Constraints						Review
	V	Q	S	M	LV	Y	Beta Banding	Country	Industry	Max 2-Way T/O (%)*	Max Stock Weight (%)	Min Stock Weight (b.p.)	
FTSE All-World 0.4 Target Exposure Comprehensive Factor Index	0.4	0.4	0.4	0.4	0.4	-	0.95-1.05	Neutral	Neutral	50	5	0.5	MS
FTSE All-World Target Exposure Qual Vol Factor Index	0	0.5	0	0	0.5	-	0.7-1.3	Neutral	Neutral	50	5	0.5	MS
FTSE All-World Target Exposure Comprehensive Factor Index	0.4σ	0.4σ	0.4σ	0.4σ	0.4σ	-	Neutral	Neutral	Neutral	40	5	0.5	MS
FTSE Developed 0.4 Target Exposure Comprehensive Factor Index	0.4	0.4	0.4	0.4	0.4	-	0.95-1.05	Neutral	Neutral	50	5	0.5	MS
FTSE Developed Target Exposure Comprehensive Factor Index	0.4σ	0.4σ	0.4σ	0.4σ	0.4σ	-	Neutral	Neutral	Neutral	40	5	0.5	MS
Russell 1000 0.4 Target Exposure Comprehensive Factor Index	0.4	0.4	0.4	0.4	0.4	-	0.95-1.05	-	Neutral	50	5	0.5	JD
Russell 1000 Comprehensive Target Exposure Factor Index	0.4σ	0.4σ	0.4σ	0.4σ	0.4σ	-	Neutral	-	Neutral	40	5	0.5	JD
Russell 1000 Comprehensive High Target Exposure Factor Index	0.6σ	0.6σ	0.6σ	0.6σ	0.6σ	-	0.7-1.3	-	Banded	50	5	0.5	JD
FTSE All-World Comprehensive High Target Exposure Factor	0.6σ	0.6σ	0.6σ	0.6σ	0.6σ	-	0.7-1.3	Banded	Banded	50	5	0.5	MS
FTSE Developed Comprehensive High Target Exposure Factor	0.6σ	0.6σ	0.6σ	0.6σ	0.6σ	-	0.7-1.3	Banded	Banded	50	5	0.5	MS
FTSE Emerging Comprehensive Target Exposure Factor Index	0.4σ	0.4σ	0.4σ	0.4σ	0.4σ	-	Neutral	Neutral	Neutral	50	10	0.5	MS
FTSE All Share ex Investment Trusts Comprehensive Target Exposure Factor Index	0.3σ	0.3σ	0.3σ	0.3σ	0.3σ	-	Neutral	-	Neutral	40	10	0.5	MS
FTSE China A Free Pure Value Target Exposure Factor Index	1σ	0	0	0	0	-	Neutral	-	Neutral	40	5	2	MS
FTSE China A Free Pure Quality Target Exposure Factor Index	0	1σ	0	0	0	-	Neutral	-	Neutral	40	5	2	MS

Table 3: Target Exposure Index Parameters

Index	Active Factor Exposure Targets						Constraints						Review
	V	Q	S	M	LV	Y	Beta Banding	Country	Industry	Max 2-Way T/O (%)*	Max Stock Weight (%)	Min Stock Weight (b.p.)	
FTSE China A Free Pure Size Target Exposure Factor Index	0	0	1 σ	0	0	-	Neutral	-	Neutral	40	5	2	MS
FTSE China A Free Pure Momentum Target Exposure Factor Index	0	0	0	1 σ	0	-	Neutral	-	Neutral	50	5	2	MS
FTSE China A Free Pure Low Volatility Target Exposure Factor Index	0	0	0	0	1 σ	-	Neutral	-	Neutral	50	5	2	MS
FTSE China A Free Qual/Vol/Yield Target Exposure Factor Index	0	0.5 σ	0	0	0.5 σ	0.5 σ	0.7-1.3	-	Banded	40	5	2	MS
FTSE China A Free Comprehensive High Target Exposure Factor Index	0.6 σ	0.6 σ	0.6 σ	0.6 σ	0.6 σ	-	0.7-1.3	-	Banded	50	5	2	MS
Russell 1000 Target Exposure Pure Value Factor Index	1 σ	0	0	0	0	-	Neutral	-	Neutral	37.5	5	0.5	JD
Russell 1000 Target Exposure Pure Quality Factor Index	0	1 σ	0	0	0	-	Neutral	-	Neutral	37.5	5	0.5	JD
Russell 1000 Target Exposure Pure Size Factor Index	0	0	1 σ	0	0	-	Neutral	-	Neutral	37.5	5	0.5	JD
Russell 1000 Target Exposure Pure Momentum Factor Index	0	0	0	1 σ	0	-	Neutral	-	Neutral	50	5	0.5	JD
Russell 1000 Target Exposure Pure Low Volatility Factor Index	0	0	0	0	1 σ	-	Neutral	-	Neutral	50	5	0.5	JD
Russell 2000 0.4 Target Exposure Quality Factor Index	0	0.4	0	0	0	-	-	-	Neutral	-	5	2	J
Russell 1000 Comprehensive Equal Factor Risk Contribution Target Exposure Index	See Table 2 of 6.9.2					-	Neutral	-	Neutral	40	5	0.5	JD
FTSE Developed ex US Comprehensive Equal Factor Risk Contribution Target Exposure Index	See Table 2 of 6.9.2					-	Neutral	Neutral	Neutral	40	5	0.5	MS

Notes:

σ is the market capitalization weighted standard deviation of factor Z scores.

Country/Industry Neutral: $P = 0$ and $Q = 0$.

Country/Industry Banded: $P = 0.2$ and $Q = 0.05$.

Beta Neutral: Beta = 1.

Review: M=March, J=June, S=September and D=December.

* Per review.

6.9.4 Treatment of suspensions during reviews on the FTSE China A Free Index universe

For a target exposure index built upon the FTSE China A Free Index, existing suspended constituents of the target exposure index at the time of the index review remain members of the index and take part in the index review with their weights constrained to be unchanged pre and post the index review.

Suspended stocks that are not constituents of the target exposure index at the index review are ineligible and do not form part of the review process and consequently will not be constituents of the target exposure index following the index review.

6.10 **Index Back-Histories**

6.10.1 The availability of factor data prior to the launch date of each index is simulated through the application of six month lag on fundamental data. All index reviews prior to the launch date that utilize realized fundamental data incorporate a lag of six months. For example each component of the value factor detailed in Rule 5.5 incorporates annual Cash-flow, Net Income and Sales measures that were announced six months prior to the data cut-off date.



Section 7

Periodic Review of Constituents

7.0 Periodic Review of Constituents

7.1 Review and Price Dates

7.1.1 FTSE Global Factor Indexes are reviewed periodically based on the stock prices available at the close of Wednesday before first Friday of the review month (Price Cut-off Date) incorporating underlying index constituent changes according to the implementation dates shown in Rules 7.1.2 and 7.1.3.

Factor indexes derived from a Russell 1000 or Russell 2000 underlying are reviewed periodically based on the stock prices available at close of Wednesday before second Friday in June (Price Cut-off Date) incorporating underlying index constituent changes according to the Russell implementation dates shown in Rule 7.1.3. The December review is periodically based on the stock prices available at close of Wednesday before first Friday incorporating underlying index constituent changes according to the Russell implementation dates shown in Rule 7.1.3

7.1.2 For factor indexes derived from a FTSE underlying index the review will be implemented after the close of business on the third Friday of the review month.

7.1.3 For factor indexes derived from a Russell 1000 or Russell 2000 underlying the review will be implemented on the same date as the Russell annual reconstitution. For details of the implementation dates of Russell 1000 and Russell 2000, please refer to the Russell U.S. Equity Indexes Construction and Methodology available at [Russell-US](#)

7.2 Quarterly Capping

7.2.1 Company level capping is applied quarterly using prices as at the close of business on the second Friday in March, June, September and December.

7.3 Review Capping

7.3.1 Company level capping is applied at the reviews of corresponding indexes specified in Rule 7.1.2 using stock prices available at the price cut off date as specified in Rule 7.1.



Section 8

Changes to Constituent Companies

8.0 Changes to Constituent Companies

8.1 Intra-review Additions

8.2 Additions to each FTSE Russell underlying index will be considered for inclusion at the next review of the relevant FTSE Global Factor Index, respectively.

8.3 Intra-review Deletions

8.3.1 A constituent will be removed from a FTSE Global Factor Index if it is also removed from its corresponding underlying index. The deletion will be concurrent with the deletion from the underlying index and its weight will be distributed pro-rata amongst the remaining constituents in their respective FTSE Global Factor Index.

Section 9

Corporate Actions and Events

9.0 Corporate Actions and Events

9.1 If a constituent in the underlying index has a stock split, stock consolidation, rights issue, bonus issue, a change in the number of shares in issue or a change in free float, the constituent's weighting in the corresponding FTSE Global Factor Index will remain unchanged pre and post such an event.

9.2 Full details of changes to constituent companies due to corporate actions and events can be accessed in the Corporate Actions and Events Guide for Non Market Cap Weighted Indexes using the following link:

[Corporate Actions and Events Guide for Non Market Cap Weighted Indices.pdf](#)

A Corporate 'Action' is an action on shareholders with a prescribed ex date. The share price will be subject to an adjustment on the ex date. The index will be adjusted in line with the ex date.

These include the following:

- Capital Repayments
- Rights Issues/Entitlement Offers
- Stock Conversion
- Splits (sub-division) / Reverse splits (consolidation)
- Scrip issues (Capitalisation or Bonus Issue)

A Corporate 'Event' is a reaction to company news (event) that may impact the index depending on the index rules. For example, a company announces a strategic shareholder is offering to sell their shares (secondary share offer) – this could result in a free float weighting change in the index.

Where an index adjustment is required FTSE Russell will provide notice advising of the timing of the change.

9.3 Suspension of Dealing

Suspension of Dealing rules can be found within the Corporate Actions and Events Guide for Non Market Cap Weighted Indexes.

9.4 Takeovers, Mergers and Demergers

The treatment of takeovers, mergers and demergers can be found within the Corporate Actions and Events Guide for Non Market Cap Weighted Indexes.

Section 10

Indexes Algorithm and Calculation Method

10.0 Indexes Algorithm and Calculation Method

10.1 Prices

10.1.1 The FTSE Global Factor Index Series use actual closing mid-market or last trade prices, where available, for securities with local market quotations. Further details can be accessed using the following link:

[Closing Prices Used For Index Calculation.pdf](#)

10.2 Calculation Frequency

10.2.1 The FTSE Global Factor Index Series will be calculated on an end of day basis and displayed to eight decimal points.

10.3 Index Calculation

10.3.1 The FTSE Global Factor Indexes are calculated using the algorithm described below:

$$\sum_{i=1}^N \frac{(p_i \times e_i \times s_i \times f_i \times c_i)}{d} \quad (36)$$

Where:

- $i = 1, 2, \dots, N$
- N is the number of securities in the Index.
- p_i is the latest trade price of the component security (or the price at the close of the index on the previous day).
- e_i is the exchange rate required to convert the security's currency into the index's base currency.
- s_i is the number of shares in issue used by FTSE Russell for the security, as defined in these Ground Rules.
- f_i is the Investability Weighting Factor to be applied to a security to allow amendments to its weighting, expressed as a number between 0 and 1, where 1 represents a 100% free float. This factor is published by FTSE Russell for each security in the underlying index.

- c_i is the Weighting Factor to be applied to a security to correctly weight that security in the index. This factor maps the investable market capitalisation of each stock to a notional market capitalisation for inclusion in the index.
- d is the divisor, a figure that represents the total issued share capital of the Index at the base date. The divisor can be adjusted to allow changes in the issued share capital of individual securities to be made without distorting the index.

Appendix A: Narrow Index

A.1 Single Factor Narrowing

Our aim is to obtain the narrow universe $\mathcal{N} \subset \mathcal{U}$. Let the number of stocks in \mathcal{U} be given by R . Rank stocks in order of their contribution to active factor exposure: $(W_{1i} - W_{Mi}) Z_{F,i}$. The highest value is assigned rank 1 and lowest rank is assigned the value of R .

Let \mathcal{N}_p be the set of stocks whose rank less than or equal to p . So, in particular, $\mathcal{N}_R = \mathcal{U}$.

Define the set of weights by:

$$\Omega_{p_i} = \frac{\omega_{p_i}}{\sum_{i \in \mathcal{U}} \omega_{p_i}} \quad \text{where} \quad \omega_{p_i} = \begin{cases} W_{1i} & \text{if } i \in \mathcal{N}_p \\ 0 & \text{if } i \notin \mathcal{N}_p \end{cases} \quad (37)$$

and three conditions:

1. Active Exposure Condition:

$$\sum_{i \in \mathcal{U}} (\Omega_{p_i} - W_{Mi}) Z_{F,i} < 2 * \sum_{i \in \mathcal{U}} (W_{1i} - W_{Mi}) Z_{F,i} \quad (38)$$

2. Weighted Capacity Ratio Condition:

$$\sum_{i \in \mathcal{U}} \Omega_{p_i} * \frac{\Omega_{p_i}}{W_{Mi}} < 2.5 * \sum_{i \in \mathcal{U}} W_{1i} * \frac{W_{1i}}{W_{Mi}} \quad (39)$$

3. Effective N Condition:

$$\frac{1}{\sum_{i \in \mathcal{U}} \Omega_{p_i}^2} < 0.67 * \frac{1}{\sum_{i \in \mathcal{U}} W_{1i}^2} \quad (40)$$

Moving down from $p = R$ to $p = 1$ in steps of minus one, we find the first value of p for which any one of these conditions is violated. Our narrow universe is then given by: $\mathcal{N} = \mathcal{N}_{p-1}$.

A.2 Multi-Factor Narrowing

Rank stocks in order of their multi-factor score: W_{1i}/W_{Mi} . Let R be the number of stocks in the universe \mathcal{U} . The highest value is assigned rank 1 and lowest rank is assigned R . Repeat the process outlined section A.1 but without the Active Exposure Condition.



Appendix B: Index Opening and Closing Hours

Index	Open	Close
Monday to Friday		
FTSE Developed ex US Comprehensive Factor Net Tax (US RIC) Index	00:30	21:10
FTSE Developed ex US Qual/Vol /Yield Factor 5% Capped Index	23:30	20:10
FTSE Emerging Comprehensive Factor Net Tax (US RIC) Index	00:30	21:10
FTSE China A Free Pure Value Target Exposure Factor Index	01:30	07:00
FTSE China A Free Pure Quality Target Exposure Factor Index	01:30	07:00
FTSE China A Free Pure Size Target Exposure Factor Index	01:30	07:00
FTSE China A Free Pure Momentum Target Exposure Factor Index	01:30	07:00
FTSE China A Free Pure Low Volatility Target Exposure Factor Index	01:30	07:00
FTSE China A Free Qual/Vol/Yield Target Exposure Factor Index	01:30	07:00
FTSE China A Free Comprehensive High Target Exposure Factor Index	01:30	07:00
FTSE Indonesia Low Volatility Factor Index	02:00	10:00
FTSE USA Qual/Vol/Yield Factor 5% Capped Index	13:30	20:10
FTSE USA Small Cap Qual/Vol/Yield Factor 3% Capped Index	14:30	21:10
FTSE USA Small Cap ex Real Estate 2Qual/Vol/Yield 3% Capped Factor Index	13:30	21:10
Russell 1000 Comprehensive Factor Index	14:30	21:10
Russell 1000 Low Volatility Factor Index	13:30	20:10
Russell 1000 Low Volatility Focused Factor Index	14:30	21:10
Russell 1000 Momentum Factor Index	13:30	20:10
Russell 1000 Momentum Focused Factor Index	14:30	21:10
Russell 1000 Quality Factor Index	13:30	20:10
Russell 1000 Size Factor Index	13:30	20:10
Russell 1000 Value Factor Index	13:30	20:10
Russell 1000 Yield Factor Index	13:30	20:10
Russell 1000 Yield Focused Factor Index	14:30	21:10
Russell 1000 2Size/2Val 5% Capped Factor Index	14:30	21:10
Russell 1000 2Mom/Size/Val 5% Capped Factor Index	14:30	21:10
Russell 1000 2Qual/2Vol 5% Capped Factor Index	14:30	21:10
Russell 1000 2Mom/2Qual/2Vol 5% Capped Factor Index	14:30	21:10
Russell 1000 2Qual/Val 5% Capped Factor Index	14:30	21:10
Russell 2000 Comprehensive Factor Index	14:30	21:00
Russell 2000 2Size/2Val 3% Capped Factor Index	14:30	21:10
Russell 2000 2Mom/Size/Val 3% Capped Factor Index	14:30	21:10
Russell 2000 2Qual/2Vol 3% Capped Factor Index	14:30	21:10
Russell 2000 2Mom/2Qual/2Vol 3% Capped Factor Index	14:30	21:10

Notes:

1. All times are UK hours.
2. Reuters real time exchange rates are used in the real-time index calculations.
3. Except for the target exposure factor indexes on the FTSE China A Free Index universe, exchange rates used in the End of Day calculations are WM/Reuters Closing Spot Rates™, collected at 16:00 UK time.
4. For the target exposure factor indexes on the FTSE China A Free Index universe, exchange rates used in the End of Day calculations are the foreign exchange rates received from Reuters at the closing time of the index.



Appendix C: Status of Index

The FTSE Global Factor Index Series may be calculated in real time and, if so, may exist in the following states:

A. Firm

The indexes are being calculated using trade prices from the relevant local stock exchanges for all constituents during the hours of the Official Index Period.

The Official Closing Index values for the Index Series are the last index values calculated at the end of the firm period.

B. Closed

When the index has ceased all calculations for the day, the message '**CLOSED**' is displayed against the index value.

C. Held

During the firm period, an index has exceeded pre-set operating parameters and calculation has been suspended pending resolution of the problem. The message '**HELD**' is displayed against the last index value calculated.

D. Indicative

If there is a system problem or a situation in the market that is judged to be affecting the quality of the constituent prices at any time when the index is being calculated, the index will be declared indicative. The message '**IND**' will be displayed against the index value.

The official opening and closing hours of the Indexes are set out in Appendix A. Variations to the official hours of the Indexes will be published by FTSE Russell.

The FTSE Global Factor Index Series is calculated on public holidays whenever at least one market is trading. The index series will not be calculated on 1 January.



Appendix D: Further Information

A Glossary of Terms used in FTSE Russell's Ground Rule documents can be found using the following link:
[Glossary.pdf](#)

Further information on the FTSE Global Factor Index Series is available from FTSE Russell.

For contact details please visit the FTSE Russell website or contact FTSE Russell client services at
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Website: www.ftserussell.com

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