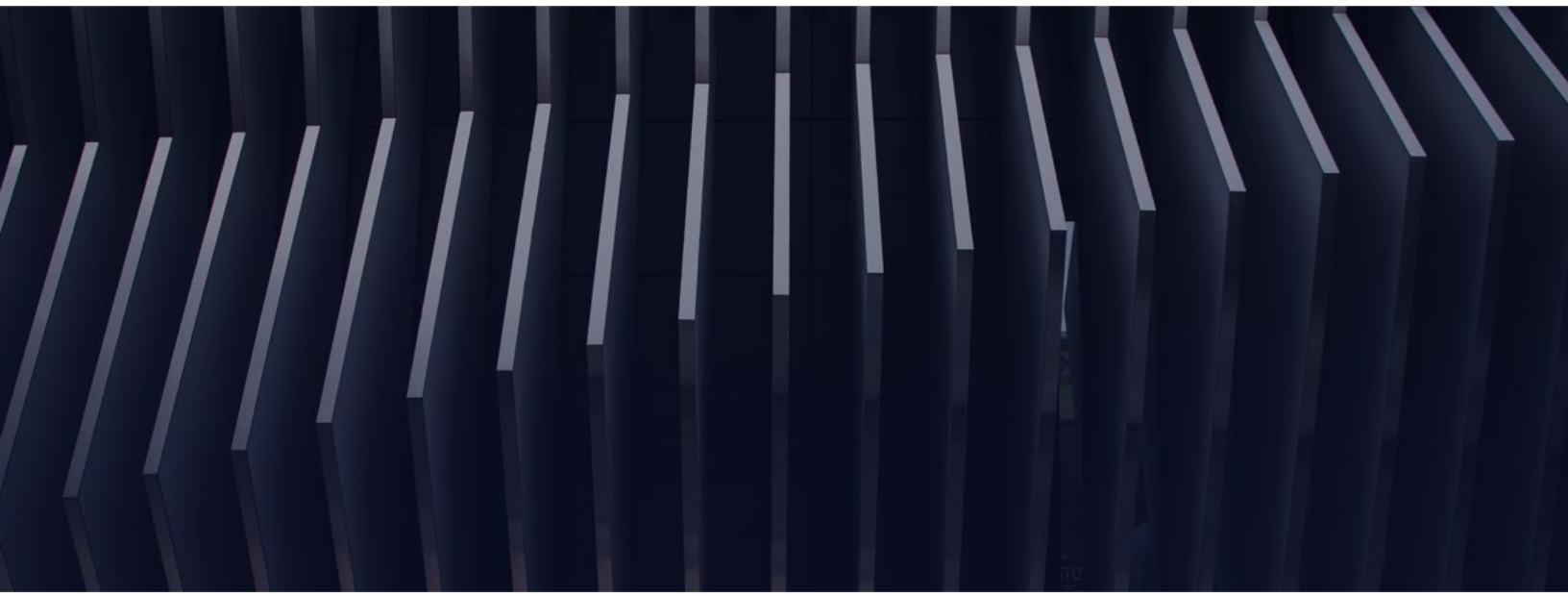
Wilshire Indexes

FT Wilshire Factor Index Series Methodology

February 2024



Contents

1 Introduction

The indexes within the FT Wilshire Factor Index Series are designed to deliver precisely defined levels of exposure to academically verified factors including Value, Momentum, Quality, Size and Beta. This is achieved via a factor tilting methodology where an initial set of index weights are multiplied by positive scores to yield a new set of index weights with the required exposures. The details of the construction are set out below.

2 Index Construction

2.1 Constituents and Free Float Market Capitalization Weights

Constituents and their free floats and shares outstanding are taken from post close updates on the third Friday of the reconstitution month. Price is defined as the closing price at the cut-off date, adjusted for corporate actions which will go ex between the cut-off date and the post close updated data on the third Friday of the reconstitution month.

A constituent's free float market capitalization is then defined as the product of its free-float, shares outstanding and adjusted cut-off date price. A constituent's free float market capitalization weight is then defined by its free float market capitalization divided by the total free float market capitalization of the entire set of constituents.

2.2 Factor Definitions

The factor definitions set out in this section are in broad consensus with those found in the academic literature.

2.2.1 Value (V)

Value is defined as an equally weighted composite of the latest Earnings Yield, Sales to Price Ratio, Cash Flow Yield and Book to Price Ratio. Individual raw quantities are rescaled and winsorized as described in section 2.3 below. They are then averaged, and the resulting composite quantity is rescaled and winsorized again so that the distribution has mean zero, standard deviation one, and is restricted to the range -3 to +3. Historical fundamental data is lagged by two months.

2.2.2 Momentum (M)

Momentum is defined as the cumulative local price return, starting twelve months prior to, and ending one month before, the data cut-off date. Price data at the beginning and end of this period is therefore required to calculate Momentum.

2.2.3 Quality (Q)

Quality is defined as an equally weighted composite of the latest ROE, Accruals Ratio and Debt to Equity Ratio. Individual raw quantities are rescaled and winsorized as described in section 2.3 below. They are then averaged, and the resulting composite quantity is rescaled and winsorized again so that the distribution has mean zero, standard deviation one, and is restricted to the range -3 to +3. Historical fundamental data is lagged by two months.

2.2.4 Size (S)

Size is defined as the negative of the natural logarithm of the full company market capitalization calculated in USD. Shares are taken from post close updates on the third Friday of the reconstitution month. Price is defined as the closing price of cutoff-date, adjusted for corporate actions which will go ex between the cutoff-date and the third Friday of the reconstitution month.

2.2.5 Beta (β)

Beta is calculated as the negative of 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 prior to the data cutoff date. A minimum of 252 daily return observations are required to calculate a valid beta.

2.2.6 Industry Factor

The industry factor is defined by the variable:

$$\delta_{i \in I_J} = \begin{cases} 1 & \text{if} \quad i \in I_J \\ 0 & \text{if} \quad i \notin I_J \end{cases} \tag{1}$$

In other words, this variable takes the value of one if the stock i is a member of industry I_J and zero otherwise. The groupings comprise of the 11 industries set out in "Wilshire Indexes Global Assets Taxonomy System".

2.2.7 Country Factor

The country factor is defined by the variable:

$$\delta_{i \in C_K} = \begin{cases} 1 & \text{if} \quad i \in C_K \\ 0 & \text{if} \quad i \notin C_K \end{cases} \tag{2}$$

In other words, this variable takes the value of one if the stock i is a member of country C_K and zero otherwise. The countries are the Developed and Emerging countries set out in the FT Wilshire Global Equity Market Series Methodology.

2.3 Calculation of Z-Scores and S-Scores

Raw factor values defined in Section 2 range over different scales. To put them on the same scale we subtract the cross-sectional mean from each raw value and then divide by the cross-sectional standard deviation. A winsorization process is then applied to ensure that all the results lie in the range -3 to +3. Missing values are assigned a value of zero.

Market capitalization weighted Z-Scores are then calculated as:

$$Z_{F,i} = \frac{F_i - \mu_M}{\sigma_M} \tag{3}$$

where F_i is the rescaled factor value and the market capitalization weighted mean and standard deviation is given by:

$$\mu_M = \sum_{i=1}^{N} M_i \times F_i \quad \text{and} \quad \sigma_M = \sqrt{\sum_{i=1}^{N} M_i \times (F_i - \mu_M)^2} \tag{4}$$

respectively and where M_i are the free float market capitalization weights.

Factor Z-Scores are mapped to "S-Scores" according to:

$$S_{F,i} = \text{Exp}[Z_{F,i}] \tag{5}$$

Similarly, industry and country "S-Scores" are calculated thus:

$$S_{I_J,i} = \text{Exp}\left[\delta_{i \in I_J}\right] \quad \text{and} \quad S_{C_K,i} = \text{Exp}\left[\delta_{i \in C_K}\right] \tag{6}$$

Hence each stock is assigned a set of positive numbers that increase monotonically with its factor Z-Scores or industry or country factors.

2.4 Multiple Tilt Equation

The factor index weights are given by the multiple tilt equation:

$$W_i = \frac{1}{\Omega} \times S_{V,i}^{n} \times S_{M,i}^{p} \times S_{S,i}^{q} \times S_{Q,i}^{r} \times S_{\beta,i}^{s} \times S_{I_1,i}^{t} \times \ldots \times S_{I_{11},i}^{u} \times S_{C_1,i}^{v} \times \ldots \times S_{C_{48},i}^{x} \times M_i \quad (7)$$

where $S_{F,i}^{n}$ is the tilt to factor F of strength n, $S_{I_J,i}^{t}$ is the J^{th} industry tilt of strength t, $S_{C_K,i}^{v}$ is the K^{th} country tilt of strength v and:

$$\Omega = \sum_{i=1}^{N} S_{V,i}^{n} \times S_{M,i}^{p} \times S_{S,i}^{q} \times S_{Q,i}^{r} \times S_{\beta,i}^{s} \times S_{I_1,i}^{t} \times \ldots \times S_{I_{11},i}^{u} \times S_{C_1,i}^{v} \times \ldots \times S_{C_{48},i}^{x} \times M_i \quad (8)$$

Tilt strengths can take positive or negative values. Varying the tilt strengths in equation (7) give rise to different levels of active factor, industry and country exposures. Other tilts that control maximum weight, capacity and turnover may also be applied.

2.5 Exposure Targets

A set of factor exposure targets T_F is specified such that:

$$\sum_{i=1}^{N} W_i \times Z_{F,i} = T_F \quad \text{where} \quad F \in (V, M, Q, S, \beta) \quad (9)$$

where the L.H.S of equation (9) represents the factor exposure of a set of weights W_i. Note that since: $\sum_{i=1}^{N} M_i \times Z_{F,i} = 0$ this is also the active factor exposure between the factor index and the underlying free float market capitalization index.

Lower L_{I_J} and upper U_{I_J} allowable limits are also specified for active industry target weights according to:

$$L_{I_J} \leq \sum_{i=1}^{N} (W_i - M_i) \times \delta_{i \in I_J} \leq U_{I_J} \quad \text{where} \quad J \in (1, 2, \ldots, 11) \quad (10)$$

where the middle term of equation (10) gives the active J^{th} industry weight of the factor index relative to the underlying market capitalization benchmark.

Similarly upper U_{C_K} and lower bounds L_{C_K} can be set for active country target weights:

$$L_{C_K} \leq \sum_{i=1}^{N} (W_i - M_i) \times \delta_{i \in C_K} \leq U_{C_K} \quad \text{where} \quad K \in (1, 2, \ldots, 48) \quad (11)$$

2.6 Factor Index Weights

Tilt strengths in equation (7) are found that satisfy equations (9), (10) and (11) along with any constraints on maximum weight, minimum weight, capacity ratio (factor index weight / market cap weight) and 2-way turnover. Where a target or range is not specified for a particular factor, industry or country, the tilt strength is set to zero.

Should the solution be infeasible, the active factor exposure targets are reduced by 2.5%, the lower and upper industry/country bounds are relaxed by 10bp and 2-way turnover target increased by 5%. This process is repeated until a solution is found or else up to a maximum of 40 times. Should the solution continue to be infeasible or be further away from

the targeted factor, industry and country exposures than the current index weights, the index weights will consist of the pre-reconstitution index weights, renormalized to account for exclusion of stocks that are not members of the underlying index on the effective date.

3 Available Factor Indexes

Tables 1 and 2 set out the various factor indexes in the series and the sets of targets and parameters that specify them:

Table 1: Exposure Targets and Implementation Parameters for US Factor Indexes

	Active Exposure Targets						Implementation Parameters			
Index Name	V	M	Q	S	β	Industry	Max Weight (%)	Min Weight (bps)	Max Capacity Ratio	2-Way Turnover (%)
FT Wilshire US Large Pure Value	1.0	0	0	0	0	Neutral	5	5	20	80
FT Wilshire US Large Pure Momentum	0	1.0	0	0	0	Neutral	5	5	20	80
FT Wilshire US Large Pure Quality	0	0	1.0	0	0	Neutral	5	5	20	80
FT Wilshire US Large Pure Size	0	0	0	1.0	0	Neutral	5	5	20	80
FT Wilshire US Large Pure Beta	0	0	0	0	1.0	Neutral	5	5	20	80
FT Wilshire US Large 4-Factor Beta Neutral	0.5	0.5	0.5	0.5	0	Neutral	5	5	20	80
FT Wilshire US Large 5-Factor	0.4	0.4	0.4	0.4	0.4	Neutral	5	5	20	80
FT Wilshire US Small 4-Factor Size Neutral	0.5	0.5	0.5	0	0.5	Neutral	2	2	10	80

Notes:

The underlying benchmark for all “US Large” indexes is the FT Wilshire US Large Cap Index.

The underlying benchmark for all “US Small” indexes is the FT Wilshire US Small Cap Index.

Table 2: Exposure Targets and Implementation Parameters for Developed Factor Indexes

	Active Exposure Targets						Implementation Parameters			
Index Name	V	M	Q	S	β	Industry Country	Max Weight (%)	Min Weight (bps)	Max Capacity Ratio	2-Way Turnover (%)
FT Wilshire Developed Large Pure Value	1.0	0	0	0	0	Neutral +/-1%	5	2	20	80
FT Wilshire Developed Large Pure Momentum	0	1.0	0	0	0	Neutral +/-1%	5	2	20	80
FT Wilshire Developed Large Pure Quality	0	0	1.0	0	0	Neutral +/-1%	5	2	20	80
FT Wilshire Developed Large Pure Size	0	0	0	1.0	0	Neutral +/-1%	5	2	20	80
FT Wilshire Developed Large Pure Beta	0	0	0	0	1.0	Neutral +/-1%	5	2	20	80
FT Wilshire Developed Large 4-Factor Beta Neutral	0.5	0.5	0.5	0.5	0	Neutral +/-1%	5	2	20	80
FT Wilshire Developed Large 5-Factor	0.4	0.4	0.4	0.4	0.4	Neutral +/-1%	5	2	20	80

Notes:

The underlying benchmark for the “Developed Large” indexes is the FT Wilshire Developed Large Cap Index.

4 Index Maintenance

4.1 Index Reconstitution

The FT Wilshire Factor Index Series is reconstituted semi-annually in March and September. The data cutoff date is Wednesday before the first Friday of the reconstitution month. Constituent and free-float changes are updated after the close of trading on the third Friday of the reconstitution month.

4.2 Intra-Reconstitution Additions

Additions to the underlying benchmark will be eligible for inclusion at the next index reconstitution of the FT Wilshire Factor Index in March or September.

4.3 Intra-Reconstitution Deletions

A constituent will be removed from a FT Wilshire Factor Index if it is removed from the corresponding underlying benchmark. The deletion will be concurrent with that from the underlying benchmark and its weight will be distributed pro-rata amongst the remaining constituents in the FT Wilshire Factor Index.

5 Corporate Events

5.1 Corporate Action Treatment

Corporate action treatment for the FT Wilshire Factor Index Series can be found in the Wilshire Indexes Equity Index Calculation and Corporate Action Guide. The Index Series will follow the non-market capitalization sections of the guide.

5.2 Suspension of Dealing

Suspension of Dealing rules can be found in Wilshire Indexes Equity Index Calculation and Corporate Action Guide.

5.3 Takeovers, Mergers and Spinoffs

The treatment of takeovers, mergers and spinoffs can be found in the Wilshire Indexes Equity Index Calculation and Corporate Action Guide .

Approval

This Methodology was approved by the Wilshire OpCo UK Limited Index Management Committee.

Legal Notices

1. Intellectual Property

No material published by Wilshire OpCo UK Limited and its affiliates ("Wilshire Indexes") should be construed as granting any license or right to use any copyright, trademark, service mark or other intellectual property right for any purpose whatsoever without the written permission of the lawful owner and an appropriate license.

Wilshire and Wilshire 5000 are registered service marks owned by Wilshire Advisors LLC and are used under license. "FT" is the trade mark of the Financial Times Limited and is used under licence.

"Information" means any data, text, or other material published or made available by Wilshire Indexes whether owned by Wilshire Indexes or a third-party. This includes presentations, factsheets, product files, methodology documents, benchmark statements, policies or other documents relating to the operation, calculation or administration of Wilshire Indexes benchmarks, whether supplied physically or published electronically, for example on Wilshire Indexes websites or the websites or materials of Wilshire Indexes clients that relate to Wilshire Indexes.

All Information is provided for information purposes only and is made available "as is" without warranty or other commitment of any kind.

Use or distribution of Information requires a license from Wilshire Indexes.

No part of the Information contained herein may be copied, stored in a retrieval system, distributed, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior written permission from Wilshire Indexes.

None of the Information may be used to create derivative works or to verify or correct other data or Information. For example (but without limitation), the Information may not be used to create indexes, databases, risk models, analytics, software, or in connection with the issuing, offering, sponsoring, managing or marketing of any securities, portfolios, financial products or other investment vehicles utilizing or based on, linked to, tracking or otherwise derived from the Information or any other Wilshire Indexes data, Information, products or services.

2. Disclaimers

Wilshire Indexes entities and their respective directors, officers, employees, partners and licensors make no claim, prediction, warranty, representation or other commitment whatsoever, expressly or impliedly, as to the accuracy, timeliness, completeness, merchantability of any Information available or of results to be obtained from the use of the Information or the fitness or suitability of the Information for any particular purpose to which it might be put.

Any representation of historical data is provided for informational purposes only and is not a reliable indicator of future performance. The Information may contain back-tested data. Back-tested performance is not actual performance but is hypothetical. There may be differences between back-tested performance results and actual results subsequently achieved by any investment strategy.

To the fullest extent permitted by applicable law, Wilshire Indexes entities and their respective directors, officers, employees, partners, and licensors accept no responsibility or liability for:

a) any loss or damage in whole or in part caused by, resulting from, or relating to any error (negligent or otherwise) or other circumstance involved in procuring, collecting, calculating, analyzing, editing, transcribing, transmitting, communicating, or delivering the Information or from use of the Information; and
b) any direct, indirect, special, consequential, or incidental damages whatsoever, even if Wilshire Indexes (or the relevant person) is advised in advance of the possibility of such damages, resulting from the use of, or inability to use, the Information.

Wilshire Indexes entities and their respective directors, officers, employees, partners, and licensors do not provide investment advice and nothing in the Information or any links thereto, including statistical data and industry reports, should be taken as constituting financial or investment advice or a financial promotion.

Wilshire Indexes entities and their respective directors, officers, employees, partners, and licensors are not responsible for and make no representation regarding the appropriateness or suitability of using, or investing in any financial instrument or entering into any contract linked to, Wilshire Indexes benchmarks or other Information provided by Wilshire Indexes and any decision to engage in such use or to invest in any such instrument or enter into any such contract should not be made in reliance on Wilshire Indexes benchmarks or other Information provided or published by Wilshire Indexes. All Information is impersonal and not tailored to the needs of any person, entity, or group of persons.

To the fullest extent permitted by applicable law, Wilshire Indexes entities and their respective directors, officers, employees, partners and licensors will not be liable in contract or tort (including negligence), for breach of statutory duty, misrepresentation or otherwise, in respect of any inaccuracies, errors, omissions, delays, failures, cessations or changes (material or otherwise) in Wilshire Indexes benchmarks or other Information.

Wilshire Indexes is the trading name of Wilshire OpCo UK Limited, a company registered in England and Wales under registered number 12991656, with its registered office at C/O Tmf Group, 13th Floor, One Angel Court, London EC2R 7HJ, United Kingdom. Wilshire OpCo UK Limited is authorized and regulated by the Financial Conduct Authority as a benchmark administrator, with reference number 985021.

Contact Us

wilshireindexes.com/contact

About Wilshire Indexes

Wilshire Indexes provides institutional investors, asset managers and retail intermediaries with a global benchmark platform that offers global coverage of the markets through the leading FT Wilshire Index Series.

To learn more about FT Wilshire Indexes, visit **wilshireindexes.com**