Guide to Calculation FTSE Global Equity Index Series

v3.7

FTSE RUSSELL
An LSEG Business

Contents

Section 1

Purpose of the guide

1. Purpose of the guide

The aims of the guide are:

A. to describe how the indices are calculated;

B. to facilitate users' replication of the indices in order to support their investment and trading activities; and

C. to assist users in understanding the factors that influence the performance of the indices.

Section 2

Definition of terms

2. Definition of terms

Throughout this guide, the following terms are used. Subscripts i, j, k and t refer to individual securities, countries, regions and time respectively.

n	:	The number of index constituents
$p_{i,t}$	:	The price of stock i in local currency on day t
$p^*_{i,t}$	:	The price of stock i at t-1 in local currency adjusted for corporate actions effective on day t
$d_{i,t}$	:	Dividend per share of stock i in local currency on day t
T_{it}	:	Net-of-tax dividend adjustment for stock i on day t
$d^{12}_{i,t}$	:	Twelve-month trailing dividend per share of stock i on day t
$dy_{i,t}$	:	Twelve-month trailing dividend yield of stock i on day t
$s_{i,t}$	:	Shares in issue of stock i on day t
$r_{i,t}$	:	Restricted shares in issue of stock i on day t
$nr_{i,t}$	:	Non-restricted shares in issue of stock i on day t
$f_{i,t}$	:	Free float percentage of ordinary shares in issue of stock i on day t
$f^*_{i,t}$	:	Free float percentage of ordinary shares in issue after the application of buffers of stock i on day t
$for_{i,t}$	:	Foreign ownership restriction applicable to stock i on day t
$iw_{i,t}$	:	Investable weight of stock i on day t
$e_{i,t}$	:	Refinitiv 16:00 London time exchange rate applicable to security i on day t
$e_{i,t-1}$	:	Refinitiv 16:00 London time exchange rate applicable to security i on day t-1
TRI_t	:	Total return index of index on day t
TRI_{t-1}	:	Total return index of index on day t-1
CI_t	:	Capital return index on day t
CI_{t-1}	:	Capital return index on day t-1
M_t	:	Aggregate index market value on day t
M^*_t	:	Aggregate index market value on day t-1 adjusted for corporate actions effective on day t
D_t	:	Aggregate or index level dividend on day t
XD_t	:	Aggregate or index level ex-dividend adjustment in index points on day t: $XD_t=D_t/(\frac{M^*_t}{CI_{t-1}})$
DY_t	:	Twelve-month trailing index level dividend yield on day t

Section 3

Capital return indices

3. Capital return indices

3.1 The FTSE Global Equity Index Series is arithmetic weighted index series where the weights are the free float market capitalisation of each constituent company. The free float market capitalisation of each constituent company consists of shares-in-issue multiplied by the share price multiplied by a free float factor (and any applicable foreign ownership restriction). The price index is the summation of the free float adjusted market value (or capitalisation) of all companies within the index divided by the divisor (see 3.2). A given percentage price change will, therefore, have a larger effect on the index for a larger company than a smaller one.

3.2 Divisor adjustment

The index value is a number relating the total market value of all companies within the index at a particular point in time to the total market value of the index constituents at the index start or base date.

The daily index value is calculated by dividing the total market value of all constituent companies by the divisor. The divisor is an arbitrary number chosen to fix the index starting or base value. The divisor is adjusted to reflect capitalisation amendments to the constituents of the index, thereby allowing index values to remain comparable through time.

$$\textit{Index Value}_t = CI_t = \frac{\textit{Index Market Value}_t}{\textit{Index Divisor}_t}$$

$$\textit{Index Market Value}_t = M_t = \sum_{i=1}^{n} p_{i,t} \times s_{i,t} \times f_{i,t} \times e_{i,t}$$

and

$$\textit{Index Divisor}_t = \frac{\textit{Index Market Value}_t}{\textit{Index Value}_t}$$

The following example illustrates the adjustment to the index divisor to reflect a capital repayment of USD 0.7 for company A:

Step one: index at close

Company	Share price ($)	Shares-in issue (m)	Free float factor	Free float market value ($m)
A	2.83	61,443	1.00	173,883.69
B	5.88	22,579	1.00	132,764.52
C	9.45	9,229	1.00	87,214.05
Total market value				393,862.26

Company	Share price ($)	Shares-in issue (m)	Free float factor	Free float market value ($m)
Index value	=	Total market value / Index divisor		
100.5	=	393,862.26 / 3,918.3		

Step two: adjust company A share price by USD 0.7

Company	Share price ($)	Shares-in issue (m)	Free float factor	Free float market value ($m)
A	2.13	61,443	1.00	**130,873.59**
B	5.88	22,579	1.00	132,764.52
C	9.45	9,229	1.00	87,214.05
				350,852.16

Step three: calculate new divisor

$$New\ Divisor = \frac{New\ Market\ Value}{Index\ Value}$$

$$New\ Divisor = \frac{350,852.16}{100.5} = 3491.07$$

Whilst the calculation of indices is straightforward, the determination of the capitalisation of each constituent company and any capitalisation adjustments applied to the index is more complex. An arbitrary value (e.g. 1,000) is chosen as the initial or base index value. On the base date, the divisor is calculated as the aggregate market capitalisation of the index constituents divided by the base index value. In order to prevent discontinuities in the index as a result of corporate actions or changes in constituents, the divisor is adjusted for any capital changes in the index constituents.

The adjustment used by FTSE is based on the Paasche methodology, which adjusts the index divisor as of the close on the day before a corporate action is effective. The implication of such adjustments for portfolio managers wishing to track the index is that they need to either invest or realise cash at the market open on the day the corporate action is effective. In practice, portfolio managers will sell/invest at the previous day's close.

Section 4

Total return indices

4. Total return indices

Total return indices measure the performance of capital plus reinvested dividend income.

4.1 Ex-dividend adjustment

The ex-dividend (XDt) adjustment represents the value of dividends declared by constituent companies on the XD date (t) expressed in index points.

The XD adjustment is applied to the capital index prior to the market open on the XD date and reflects the total value of dividends due on that date. The full amount of the dividend is reinvested at the adjusted (capital) index level.

4.2 The aggregate or index level cash dividend (Dt) represents the total dividend payments of all index constituents on day t. An adjustment may be applied to reflect country specific tax treatments applicable to dividends. Contact FTSE for further information on applicable tax rates.

$$D_t = \sum_{i=1}^{n} d_{i,t} \; x \; s_{i,t} \; x \; f_{i,t} \; x \; T_{i,t} \; x \; e_{i,t-1}$$

A currency conversion is applicable only to dividends paid in a currency other than that of the base currency of the index.

4.3 The market value of one index point is equal to the divisor since:

$Divisor_t = M_t^* / CI_{t-1}$

The aggregate dividend adjustment can therefore be expressed in terms of index points:

$$XD_t = \frac{D_t}{Divisor_t}$$

4.4 The net of tax dividend adjustment of stock i is calculated as:

$T_{i,t}$ = 1 – withholding tax rate t

Where the withholding tax rate at time t is applicable to dividends received by institutional investors who are not resident in the same country as the remitting company and who do not benefit from double taxation treaties.

4.5 Calculation of total return indices (TRI)

4.5.1 The total return index (TRI) measures the total return on the underlying index, combining capital performance and reinvested income. TRIs are calculated using declared dividends. In practice, there is a timing delay between the XD date and the receipt of dividends (payment date). It is preferable to assume all income is reinvested on the XD date rather than incur the complications of allowing a time lag before reinvestment of the declared dividends on the payment date. The formula for calculation of the current day's TRI based on the previous day's TRI and the XD adjustment is shown below:

The total return index calculation may be expressed as:

$TRI_t = TRI_{t-1} \times CI_t/(CI_{t-1} - XD_t)$

4.6 The following table illustrates the calculation of a total return index.

		Capital index (CI)	**XD adjust (XD)**	**TRI**
Day one		3,190	–	1,000.00*
Day two		3,200	–	1,003.13
Day three		3,220	5	1,010.98
*Starting value				
		Where no XD adjustment occurs:		
TRI	=	Previous TRI	x	Today's CI / Previous
Day two TRI	=	1,000.00	x	3,200 / 3,190
	=	1,003.13		
		Where XD adjustment occurs:		
TRI	=	Previous TRI	x	Today's CI / (Previous CI - XD)
Day three TRI	=	1,003.13	x	3,220 / (3,200 - 5)
	=	1,010.98		

Section 5

Dividend yield

5. Dividend yield

Dividend yield is a widely used measure of the income return on a stock or index. In calculating the dividend yield of an index, the number of the shares in issue of each index constituent is adjusted for free float. The yield calculation reflects dividends declared by a company, i.e. with no allowance for tax credits in the previous 12 months.

5.1 Stock level dividend yield: $dy_{i,t}$

The annual stock level dividend yield of stock i:

$$dy_{i,t} = \frac{d_{i,t}^{12}}{p_{i,t}} \times 100$$

Where $d_{i,t}^{12}$ and $p_{i,t}$ are the annual trailing dividend and stock price of stock i at time t respectively. Note for the Americas, d_(i,t)^12 is the annualised most recently reported quarterly dividend.

5.2 Index level dividend yield: DY_t

The index level dividend yield in percent is:

$$DY_t = 100 \times \sum_{i=1}^{n} (d_{i,t}^{12} \times s_{i,t} \times f_{i,t} \times e_{i,t-1}) / M_t$$

5.3 Index level net of tax dividend yield: DYT_t

The index level net of tax dividend yield in percent is:

$$DYT_t = 100 \times \sum_{i=1}^{n} (d_{i,t}^{12} \times s_{i,t} \times f_{i,t} \times T_{i,t} \times e_{i,t-1}) / M_t$$

Section 6

Free float and investable weighting

6. Free float and investable weighting

Free float is the proportion of shares in issue that are deemed to be tradable. The investable weight of a stock is the more restrictive of free float and any applicable foreign ownership restriction. A buffer of ±3% is applied to limit changes to investable weights.

$r_{i,t}=s_{i,t}-nr_{i,t}$

$f_{i,t}=1-r_{i,t}/s_{i,t}$

$\Delta_{i,t}=f_{i,t}-iw_{i,t-1}$ rounded to nearest integer

If $\Delta_{i,t}>\pm 3\%$, *then* $f^{*}_{i,t}=f_{i,t}$, *else* $f^{*}_{i,t}=f_{i,t-1}$

If $for_{i,t-1}<f_{i,t-1}$ *and* $f^{*}_{i,t}>iw_{it-1}\pm 3\%$

then $iw_{i,t}=Min\left[f^{*}_{i,t}, for_{i,t}\right]$ *else* $iw_{i,t}=Min\left[f^{*}_{i,t-1}, for_{i,t}\right]$

The investable weight of a stock i is adjusted if its foreign headroom falls below a certain level.

FTSE defines “foreign headroom” as the percentage of shares available to foreign investors as a proportion of the underlying investability weight.

The investability weight of a stock is adjusted by the foreign headroom in increments of 10% at the quarterly reviews.

$$iw_{i,t} = iw_{i,t} \times 0.9$$

Further information on the definitions of free float and foreign headroom can be found in the document Free Float Restrictions and FTSE Global Equity Index Series Ground Rules, respectively.

Section 7

FTSE Global Equity Index Series algorithms

7. FTSE Global Equity Index Series algorithms

7.1 Country and regional indices

Regional indices and single country indices may consist of individual securities denominated in a range of currencies, necessitating the conversion of stock prices to a common currency.

$$CI^{\$}_{j,t} = \frac{\sum_{i=1}^{n} p_{i,t} \times s_{i,t} \times f_{i,t} \times e^{\$}_{i,t}}{Divisor^{\$}_{j,t}} \; i \in j$$

Where:

$e^{\$}_{i,t}$: *Exchange rate to USD of stock i on day t*

$CI^{\$}_{j,t}$:*USD capital index of country j on day t*

The US Dollar index may also be derived as:

$$CI^{\$}_{j,t}=CI^{x}_{j,t} \times e^{\$}_{x,t=0}/e^{\$}_{x,t}$$

Where $CI^{x}_{j,t}$ is country index j expressed in another currency (x) and $e^{\$}_{x,t=0}$ is the currency x to USD exchange rate on the index base date. Note the exchange rate is expressed in units of x per Dollar.

Similarly, a Pound Sterling index may be derived as:

$$CI^{£}_{j,t}=CI^{x}_{j,t} \times e^{£}_{x,t=0}/e^{£}_{x,t}$$

or

$$CI^{£}_{j,t}=CI^{\$}_{j,t} \times e^{£}_{\$,t=0}/e^{£}_{\$,t}$$

Where $e^{£}_{\$,t}$ is the number of USD Dollars per pound sterling at time t.

7.2 Local currency country indices

Local currency country indices are indices in which the effect of currency is removed. They are calculated in a similar manner to country indices, with the price of all stocks converted to a common domestic currency. For example, USD-denominated stocks within the Hong Kong and Russia country indices are converted to Hong Kong Dollars and Roubles respectively.

$$CI^{L}_{j,t}=\frac{\sum_{i=1}^{n} p_{i,t}\times s_{i,t}\times f_{i,t}\times e^{L}_{i,t-1}}{Divisor^{L}_{j,t}}\ i\in j$$

Where:

$e^{L}_{i,t}$: Local currency exchange rate of stock i on day t

$CI^{L}_{j,t}$: Local currency capital index of country j on day t

The currency effect is removed by holding exchange rates constant at the previous day's level.

$$Divisor^{L}_{j,t}=\sum_{i=1}^{n} p^{*}_{i,t}\times s_{i,t}\times f_{i,t}\times e^{L}_{i,t-1}\ \ i\in j$$

Where:

$p^{*}_{i,t}$: Price of stock i on day t-1 adjusted for corporate actions effective on day t

7.3 Local currency regional indices

Regional indices typically consist of constituent stocks are denominated in multiple currencies. The local currency version of such an index removes the effect of currency movements.

7.4 Weighted average of local currency country indices

A regional local currency index may be calculated as the weighted average of the local currency, component country index returns. The country weights are the USD market capitalisations at t-1 adjusted for corporate events effective on day t.

$$CI^{L}_{k,t}=\sum_{j=1}^{m}\left(\frac{M^{*\$}_{j,t}}{\sum_{j=1}^{m} M^{*\$}_{j,t}}\right)\left(\frac{CI^{L}_{j,t}}{CI^{L}_{j,t-1}}-1\right)\ j\in k$$

Where

$$^{*\$}_{j,t}=Divisor^{\$}_{j,t}=\sum_{i=1}^{n} p^{*}_{i,t}\times s_{i,t}\times f_{i,t}\times e^{L}_{i,t-1}\ \ i\in j$$

Equivalently, a regional local currency index may be calculated by aggregating the local market capitalisation of each component country after converting to a common currency, e.g. USD at a fixed exchange rate between t-1 and t.

$$CI^{L}_{k,t}=\frac{\sum_{j=1}^{m} M^{L}_{j,t}\times e^{\$}_{t-1}}{\sum_{j=1}^{m} M^{*L}_{j,t}\times e^{\$}_{t-1}}\times CI^{L}_{k,t-1}\ j\in k$$

Section 8

FTSE currency hedging algorithms

8. FTSE currency hedging algorithms

The FTSE currency hedging methodology allows exposure to the returns of the foreign assets in the index without being exposed to the volatility of the foreign exchange rates.

The currency hedged index will be calculated at the end of each working day and follow the underlying unhedged index holiday calendar.

The indices hedge each currency in two stages. The first stage calculates the impact of hedging for each country; the second stage applies this calculation to the hedged index.

Impact of hedging

$$\textit{Impact of Hedging} = \frac{\sum_{i=1}^{n} \left(Mcap_i C_{M-1} \times HF \times \left(\frac{S_{M-1}}{FIR_t} - \frac{S_{M-1}}{S_t} \right) \right)}{\sum_{i=1}^{n} Mcap_i C_{M-1}}$$

The impact of hedging weights each country by market capitalisation and calculates the hedged gain or loss at the current calculation date.

The hedging period is defined as the last working day (Monday to Friday) of the calendar month to the following last working day (Monday to Friday) of the calendar month.

Where:

$Mcap,C_{M-1}$	=	Country index market capitalisation at the close of the previous hedging period. Using index constituent prices, shares in issue and investability weights at the close of business on the last working day (Monday to Friday) of the calendar month.
HF	=	Hedging factor (between 0 and 1) – this is the proportion of the country to be hedged
S_{M-1}	=	Spot exchange rate at the close of the previous hedging period
S_t	=	Spot exchange rate at the close of the current calculation date
FIR_t	=	Forward interpolated rate at the close of the current calculation date

The FTSE Currency Hedged Indices are based on a hedging factor of 1, with each underlying country constituent treated as having the same currency as its domestic index. For example, in the calculation a country that consists of constituents with multiple currencies will convert the constituent currencies into a common currency when determining the country (currency) weight to hedge.

Hedged capital index

$$\text{Hedged capital index} = HI_{M-1} \times \left(\frac{UI_t}{UI_{M-1}} + IH_t \right)$$

The capital hedged index is derived from the unhedged capital index performance (as outlined in the FTSE Global Equity Index Guide to Calculation Methods) and the impact of hedging at the current calculation date.

Where:

HI_{M-1} = Hedged capital index at the close of the previous hedging period

UI_{M-1} = Unhedged capital index at the close of the previous hedging period

UI_t = Unhedged capital index at the close of the current calculation date

IH_t = Impact of hedging at the close of the current calculation date

Hedged total return index

Hedged total return index = $HTRI_{M-1} \times \left(\frac{UTRI_t}{UTRI_{M-1}} + IH_t\right)$

The hedged total return index is derived from the unhedged total return index performance (as outlined in the FTSE Global Equity Index Guide to Calculation Methods) and the impact of hedging at the current calculation date.

Where:

$HTRI_{M-1}$ = Hedged total return index at the close of the previous hedging period

$UTRI_{M-1}$ = Unhedged total return index at the close of the previous hedging period

$UTRI_t$ = Unhedged total return index at the close of the current calculation date

IH_t = Impact of hedging at the close of the current calculation date

Forward rates and spot rates

FTSE will use one-month Refinitiv 16:00 London Time mid-price forward rates in its currency hedged indices calculation. All rates are the last working day of the relevant market month direct USD quotes. Spot rates that are used in the currency hedging calculation are Refinitiv Closing Spot Rates, compiled by The WM Company.

Where rates are not published by Refinitiv, the previous day's rates will be used in the index calculation. In the event of either the spot or forward rates being unavailable, both spot and forward rates of the previous day will be used.

Forward interpolated rates

Forward interpolated rates = $F_{M-1} + \left(\frac{(S_{M-1} - F_{M-1})(N_{d-t})}{N_d}\right)$

Forward interpolated rates enable FTSE to value a forward contract on a particular inter-month period. They do this by calculating the spot/forward discount/premium at the beginning of the contract period and then discount this over the life of the contract.

Where:

N_{d-t} = Number of days left of forward contract

N_d = Number of days of forward contract using calendar days, i.e. January will have 31 days

F_{M-1} = The forward contract (rate) bought at the close of the previous hedging period

S_{M-1} = Spot rate at the close of the previous hedging period

In the example below, an index has been created that comprises of Canada and the United States. The example is a capital index in Hong Kong Dollars, where each country is 35% hedged into Hong Kong Dollars. The index is based on a period of one calendar month.

Unhedged index values (Hong Kong Dollars)			
	31 October 2003	**14 November 2003**	**28 November 2003**
Unhedged index	100.0000	99.9985	100.9567

Country index market capitalisation (HKDm)	
	31 October 2003
Canada	3,350,967.3560
USA	78,576,567.7322

Spot rates			
	31 October 2003	**14 November 2003**	**28 November 2003**
HKD/CAD	0.1697	0.1678	0.1674
HKD/USD	0.1288	0.1289	0.1288

Forward interpolated rates		
	14 November 2003	**28 November 2003**
HKD/CAD	0.1699	0.1701
HKD/USD	0.1288	0.1289

Impact of hedging (intra-month calculation)

The example below is based on calculating the impact of hedging for 14 November.

Impact of Hedging = $\frac{\sum_{i=1}^{n} \left(Mcap_i C_{M-1} \times HF \times \left(\frac{S_{M-1}}{FIR_t} - \frac{S_{M-1}}{S_t} \right) \right)}{\sum_{i=1}^{n} Mcap_i C_{M-1}}$

Where:

$$\frac{\left(3{,}350{,}967.3560 \times 0.35 \times \left(\frac{0.1697}{0.1699} - \frac{0.1697}{0.1678}\right)\right) + \left(78{,}576{,}567.7322 \times 0.35 \times \left(\frac{0.1288}{0.1288} - \frac{0.1288}{0.1289}\right)\right)}{3{,}350{,}967.3560 + 78{,}576{,}567.7322}$$

$\frac{-14{,}660.6776 + 21{,}335.7632}{3{,}350{,}967.3560 + 78{,}576{,}567.7322}$ = 0.0001

Forward interpolated rates (inter-month calculation)

Forward Interpolated Rates = $F_{M-1} + \left(\frac{(S_{M-1} - F_{M-1})(N_{d-t})}{N_d} \right)$

Where:

N_{d-t} = 14

N_d = 28

F_{M-1} = HKD/CAD 0.1701

S_{M-1} = HKD/CAD 0.1697

Forward Interpolated Rates = $0.1701 + \left(\frac{(0.1697 - 0.1701)(14)}{28} \right)$ = 0.169

Hedged index (inter-month calculation)

Hedged Index = $HI_{M-1} \times \left(\frac{UI_t}{UI_{M-1}} + IH_t \right)$

= $100.0000 \times \left(\frac{99.9985}{100.0000} + 0.0001 \right)$

= 100.0085

Impact of hedging (end-of-month calculation)

The impact of hedging calculation below is based on the last working day of the calendar month.

$$\textit{Impact of Hedging} = \frac{\sum_{i=1}^{n} \left(Mcap_i C_{M-1} \times HF \times \left(\frac{S_{M-1}}{FIR_t} - \frac{S_{M-1}}{S_t} \right) \right)}{\sum_{i=1}^{n} Mcap_i C_{M-1}}$$

Where:

$$\frac{\left(3{,}350{,}967.3560 \times 0.35 \times \left(\frac{0.1697}{0.1701} - \frac{0.1697}{0.1674}\right)\right) + \left(78{,}576{,}567.7322 \times 0.35 \times \left(\frac{0.1288}{0.1289} - \frac{0.1288}{0.1288}\right)\right)}{3{,}350{,}967.3560 + 78{,}576{,}567.7322}$$

$\frac{-18{,}872.2674+(-21{,}335.7632)}{3{,}350{,}967.3560+78{,}576{,}567.7322}$ = -0.0005

Hedged index (end-of-month calculation)

$$\textit{Hedged index} = HI_{M-1} \times \left(\frac{UI_t}{UI_{M-1}} + IH_t \right)$$

$$= 100.0000 \times \left(\frac{100.9567}{100.0000} - 0.0005 \right)$$

$$= 100.9067$$

8.1 FTSE Russell also calculates FTSE indices using the Russell Currency Hedging Methodology (lseg.com), which are included in the table below:

Index Name	Index Code	Effective Date
FTSE Japan RIC Capped Hedged to USD Index	FTCRJPNH	January 2, 2024
FTSE Japan RIC Capped Hedged to USD Net Tax Index	FTCRJPHN	January 2, 2024

Appendix A

Stocks trading on a non-domestic exchange

1. **Stocks trading on a non-domestic exchange**

   The price source and nationality of constituent stocks is determined individually (see FTSE Global Equity Index Series Ground Rules). Therefore, constituents of a country index may price from non-domestic stock exchanges. Thus, a country index may reflect price and exchange rate movements when the domestic exchange is closed.

   Companies trading in a currency other than the currency of the domestic market or in markets that share currencies with other markets (e.g. Eurozone, Shanghai and Shenzhen stock markets for example) may cause index movements when the market is closed, due to fluctuations in the foreign exchange rate.

   FTSE monitors the relative liquidity of the foreign board and domestic quotes of Thai and Malaysian stocks, and uses most liquid line to price constituent stocks. Relative liquidity is assessed and changes implemented as part of the semi-annual regional review.

2. **Pricing of Brazilian constituents**

   Constituents of the FTSE Brazil All Cap Index which are priced in lots use the quote lot size, which may be altered from time to time by the Brazilian Stock Exchange.

Appendix B

Further information

A Glossary of Terms used in FTSE Russell's Ground Rule documents can be found using the following link:

Glossary.pdf

For further information and any other Ground Rules, please visit www.lseg.com/en/ftse-russell/ or contact info@ftserussell.com.

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