



FTSE Actuaries UK Gilts Index Series

v4.8



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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 Actuaries UK Gilts Index Series, as adopted by the FTSE Russell Policy Advisory Board. Copies of the Ground Rules are available from FTSE Russell. For further information on the indexes please visit the FTSE Russell website at www.ftserussell.com.

1.2 The FTSE Actuaries UK Gilts Index Series include the following:

Conventional Gilts

Index Code	Index
BG01	FTSE Actuaries UK Conventional Gilts up to 5 Years Index
BG02	FTSE Actuaries UK Conventional Gilts 5-15 Years Index
BG03	FTSE Actuaries UK Conventional Gilts over 15 Years Index
BG05	FTSE Actuaries UK Conventional Gilts All Stocks Index
BG06	FTSE Actuaries UK Conventional Gilts 5-10 Years Index
BG07	FTSE Actuaries UK Conventional Gilts 10-15 Years Index
BG08	FTSE Actuaries UK Conventional Gilts up to 15 Years Index
BG09	FTSE Actuaries UK Conventional Gilts up to 20 Years Index
BG0A	FTSE Actuaries UK Conventional Gilts 15-25 Years Index
BG0B	FTSE Actuaries UK Conventional Gilts over 25 Years Index
BG0C	FTSE Actuaries UK Conventional Gilts over 5 Years Index
BG0D	FTSE Actuaries UK Conventional Gilts over 10 Years Index

Fitted Yields for the following terms to maturity:

5, 10, 15, 20, 25, 30, 35, 40, 45, and 50 years

Index-linked Gilts

Index Code	Index
IL01	FTSE Actuaries UK Index-Linked Gilts All Stocks Index
IL02	FTSE Actuaries UK Index-Linked Gilts up to 5 Years Index
IL03	FTSE Actuaries UK Index-Linked Gilts over 5 Years Index
IL04	FTSE Actuaries UK Index-Linked Gilts 5-15 Years Index
IL05	FTSE Actuaries UK Index-Linked Gilts over 15 Years Index
IL06	FTSE Actuaries UK Index-Linked Gilts 15-25 Years Index
IL07	FTSE Actuaries UK Index-Linked Gilts 5-25 Years Index
IL08	FTSE Actuaries UK Index-Linked Gilts over 25 Years Index
IL09	FTSE Actuaries UK Index-Linked Gilts over 10 Years Index
IL10	FTSE Actuaries UK Index-Linked Gilts up to 15 Years Index

The yields are calculated assuming future inflation rates of 0%, 3%, 5% and 10%.

Please see Rules 4.3.2 and 4.3.3 for the detailed treatment of indexes incorporating gilts within a fixed range of outstanding terms or with terms greater than a specified minimum period or up to a specified maximum period.

- 1.3 The FTSE Actuaries UK Gilts Index Series does not take account of ESG factors in its index design.
- 1.4 The base currency of the benchmark is GBP.
- 1.5 The indexes are calculated at 12:00 UK time and at the end of each business day. The day on which they are calculated is referred to as the “calculation date”. Some calculations make use of the “settlement date”, which is normally the next following working day, e.g. normally Tuesday after a Monday, etc, and Monday after a Friday, but with exceptions at public holidays.
- 1.6 **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.
- 1.7 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.
- 1.8 Index users who choose to follow this index or to buy products that claim to follow this index should assess the merits of the index’s 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 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 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 Russell is responsible for the daily calculation, production and operation of the FTSE Actuaries UK Gilts Index Series and will:

- maintain records of all the constituents;
- be responsible for the addition and deletion of gilts and changes of nominal amounts, in accordance with the Ground Rules.

2.2 FTSE EMEA Fixed Income Advisory Committee

2.2.1 The FTSE EMEA Fixed Income Advisory Committee has been established by FTSE Russell. The Committee may recommend changes to the Ground Rules for approval by the FTSE Russell Product Governance Board.

2.3 Amendments to these Ground Rules

2.3.1 These Ground Rules shall be subject to regular review 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.

2.3.2 In the event that the FTSE EMEA Fixed Income Advisory Committee or any Committee responsible for the operation and administration of the FTSE Actuaries UK Gilts Index Series consider that a change of principle or exceptions should be made to any of the Ground Rules, market participants will be provided with clear and significant notice. The issue will subsequently be discussed at the FTSE EMEA Fixed Income Advisory Committee and FTSE Russell will decide if a change to these Ground Rules is warranted. If a change is required this will be authorised by the FTSE Russell Product Governance Board.

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 Statement of Principles for FTSE Fixed Income Indexes (the Statement of Principles)

Indexes need to keep abreast of changing markets and the Ground Rules cannot anticipate every eventuality. Where the Rules do not fully cover a specific event or development, FTSE Russell will determine the appropriate treatment by reference to the Statement of Principles for FTSE Fixed Income Indexes 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 the FTSE Russell Product Governance Board.

The Statement of Principles for Fixed Income Indexes can be accessed using the following link:

[Statement of Principles Fixed Income Indexes.pdf](#)

3.2 Queries and Complaints

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

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

3.3 Recalculation Policy and Guidelines

The Recalculation Policy and Guidelines for Fixed Income Indexes document is available from the FTSE Russell website using the link below or by contacting info@ftserussell.com.

[Fixed Income Recalculation Policy and Guidelines.pdf](#)

3.4 Policy for Benchmark Methodology Changes

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

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

3.5 FTSE Russell Governance Framework

3.5.1 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

Conventional Gilts

4.0 Conventional Gilts

4.1 Gilts

- 4.1.1 All Conventional Gilts (i.e. those gilts that are not index-linked – see Section 5), denominated in GBP and quoted on the Stock Exchange, are considered for inclusion in the price indexes.
- 4.1.2 Gilts which are regarded by the Debt Management Office as “rump stocks” (i.e. too small an amount is in issue for an effective market) and are listed as such by the Debt Management Office are excluded from the indexes.
- 4.1.3 Partly-paid gilts are excluded from the indexes until they become fully paid.
- 4.1.4 The total market issuance of strippable gilts is included in the indexes as if the gilts had not been stripped.
- 4.1.5 Gilts issued by the Debt Management Office under their “special repo” or “standing repo” arrangements are not included in the indexes.

4.2 There are no liquidity requirements for entry to the FTSE Actuaries UK Gilts Index Series.

4.3 Sectors

- 4.3.1 For the price indexes there are 12 sectors: see Rule 1.2 for a full list of sectors. The sector in which each gilt is placed depends on the term from the date of calculation to the date of redemption of the gilt.
- 4.3.2 “Shorteners”: a gilt is moved, at its closing price, from one sector to a shorter sector after the close of business on the day when its redemption date is exactly 5, 10, 15, 20 or 25 years from the calculation date (when it is described as a “timeous shortener”). If this falls on a bank holiday or a weekend it will be on the first calculation date thereafter (when it is described as a “late shortener”).
- 4.3.3 If a gilt is due to be included in or excluded from an index defined under Rule 4.3.2 on a day when the market is closed, the stock will be included or excluded after the close on the last trading day before the appropriate anniversary so that it will be included in an index from the beginning of the first trading day for which it becomes eligible and excluded from an index from the beginning of the first trading day for which it becomes ineligible.

4.4 Price Indexes

- 4.4.1 Each of the Price Indexes is an arithmetically weighted index based on the gross or dirty price (see Rule 8.2), and weighted by the nominal amount outstanding (see Rule 8.3).

- 4.4.2 In addition to the Price Index for each sector other values are calculated.
- 4.4.3 The gilts that are used for the calculation of the number of gilts and the weight of the sector on any day include those gilts that have been in the sector during the course of that day, and exclude those gilts that are entering the sector after close of business on that day (see Rule 11.2.2).

The gilts that are used for the calculation of gross redemption yield, duration, convexity and modified duration include those gilts that have been in the sector during the course of that day. It excludes those gilts that are entering the sector after the close of business on that day (see Rule 11.2.2).

4.5 Fitted Conventional Yield Indexes

- 4.5.1 All conventional gilts in the indexes are considered for inclusion in the yield curve calculation from which the fitted yields for specific terms to maturity are derived.
- 4.5.2 Convertibles with outstanding conversion options, gilts with substantial sinking funds, gilts with special tax status and gilts with less than one year to redemption are excluded from the yield indexes.
- 4.5.3 The gilts that are used for the calculation of the yield curve on any day include those gilts that have been in the Indexes during the course of that day, and exclude those gilts that are entering the Indexes after the close of business on that day (see Rule 11.2.2). Gilts with less than one year to maturity are excluded from the calculation.
- 4.5.4 Yields are calculated by fitting a curve to the zero coupon yields for all eligible gilts (see Rule 9.8).
- 4.5.5 In addition to the zero coupon yield, the par and the forward yields are also calculated.
- 4.5.6 The redemption yield for each gilt is calculated using the gross price (see Rule 9.1). The redemption yields are gross yields, calculated taking account of the coupon frequency (currently always half-yearly) and then quoted convertible half-yearly.
- 4.5.7 Yields for terms of 5, 10, 15, 20, 25, 30, 35, 40, 45 and 50 years are calculated.



Section 5

Index-linked Gilts

5.0 Index-linked Gilts

5.1 Gilts

- 5.1.1 All Index-linked Gilts, denominated in GBP and quoted on the Stock Exchange are considered for inclusion in the price indexes. This comprises index-linked gilts with either an 8-month or 3-month indexation lag to the Retail Price Index (RPI) or to the Consumer Price Index (CPI).
- 5.1.2 Gilts which are regarded by the Debt Management Office as “rump stocks” (i.e. too small an amount is in issue for an effective market) and are listed as such by the Debt Management Office are excluded from the indexes.
- 5.1.3 Convertible index-linked gilts with outstanding conversion options are excluded from the indexes.
- 5.1.4 If any other index-linked gilts were to be issued with conditions which were significantly different from those of the existing index-linked gilts (e.g. linked to an Earnings Index or to a Limited Price Indexation index), they would be excluded from the indexes.
- 5.1.5 Gilts issued by the Debt Management Office under their “special repo” or “standing repo” arrangements are not included in the indexes.

5.2 Sectors

- 5.2.1 There are eight sectors: see Rule 1.2 for a full list of sectors. The sector in which each gilt is placed depends on the term from the date of calculation to the date of redemption of the gilt.
- 5.2.2 “Shorteners”: a gilt is moved, at its closing price, from one sector to a shorter sector after the close of business on the day when its redemption date is exactly 5, 10, 15 or 25 years from the calculation date (when it is described as a “timeous shortener”). If this falls on a bank holiday or a weekend it will be on the first calculation date thereafter (when it is described as a “late shortener”).

Please see Rules 4.3.2 and 4.3.3 for the treatment of “Shorteners”.

5.3 Price Indexes

- 5.3.1 Each of the Price Indexes is an arithmetically weighted index based on the gross or dirty price (see Rule 8.2), and weighted by the nominal amount outstanding (see Rule 8.3).
- 5.3.2 In addition to the Price Index for each sector other values are calculated.

5.3.3 The gilts that are used for the calculation of the number of gilts and the weight of the sector on any day include those gilts that have been in the sector during the course of that day, and exclude those gilts that are entering the sector after the close of business on that day (see Rule 11.2.2).

5.4 Yields Indexes

5.4.1 All gilts in the Price Indexes are included in the yield calculations.

5.4.2 “Real yields” are calculated for each sector (see Rule 10.2). Since the real yield on index-linked gilts depends on the future rate of inflation assumed, four yields are calculated for each sector, assuming future annual inflation rates of 0%, 3%, 5% and 10% uniformly from the date of the last published value of the Retail Prices Index.

5.4.3 In addition the duration, and modified duration (see Rule 10.4) and convexity (see Rule 10.6) for each sector on each inflation assumption are calculated.

5.4.4 The gilts that are used for the calculation of the number of gilts and the weight of the sector on any day include those gilts that have been in the sector during the course of that day, and exclude those gilts that are entering the sector after close of business on that day (see Rule 11.2.2).

The gilts that are used for the calculation of gross redemption yield, duration, convexity and modified duration include those gilts that have been in the sector during the course of that day. It excludes those gilts that are entering the sector after the close of business on that day (see Rule 11.2.2).

5.4.5 No yield curve is calculated for the index-linked indexes.



Section 6

Prices

6.0 Prices

- 6.1** From 24 July 2017, the prices used in the calculation of the end-of-day indexes are the Tradeweb FTSE Gilt Closing prices. These prices are administered by FTSE International Limited with Tradeweb Europe Limited acting as calculation agent.
- 6.2** The Tradeweb FTSE Gilt Closing Prices were selected as reference prices for gilts, strips and Treasury bills following the announcement by the UK Debt Management Office that it intended to withdraw from its role as the provider of reference prices in January 2015. A review - the Independent Reference Price Review chaired by Professor Miles CBE - was commissioned to recommend the successor arrangements and the proposal jointly submitted by Tradeweb and FTSE was selected.
- 6.3** The mid-day indexes are based on prices received from Tradeweb. These prices are not considered to be reference prices.
- 6.4** The Guide to the Calculation of the Tradeweb FTSE Gilt Closing Prices can be downloaded using the following link:
[Guide to the Calculation of Tradeweb FTSE Gilt Closing Prices.pdf](#)
and a Statement of Principles with respect to the Calculation of the Tradeweb FTSE Gilt Closing Prices is available using the following link:
[Statement of Principles for the Administration of the Tradeweb FTSE Gilt Closing Prices.pdf](#)
- 6.5** Prior to 24 July 2017 the prices used for the calculation of the end of day indexes were the GEMMA prices compiled and distributed by the Debt Management Office each day on behalf of GEMMA. The midday indexes were based on the composite intra-day prices compiled by the DMO.
- 6.6** The indexes are calculated using gross or “dirty” prices, i.e. these prices include accrued interest for all gilts (see Rule 8.2).



Section 7

Addition, Removal and Alterations to Constituents

7.0 Addition, Removal and Alterations to Constituents

The following Rules apply to both conventional gilts and index-linked gilts as appropriate except where noted.

7.1 Addition of constituents

- 7.1.1 New issues that are issued fully paid by auction are included in full in the indexes at the close of the day when the auction takes place. New issues that are issued partly paid are included at the market price at the close of the day when they become fully paid, at the closing market price.
- 7.1.2 New issues that are issued by syndicated offering are included in the indexes at the close of business on the day of pricing (i.e. with effect from start of trading on the following business day), at the closing market price.
- 7.1.3 Conversion and switch auction gilts are added at their market price at the close of business on the day on which the operation takes place (see Rules 7.2.3 and 7.3.2).
- 7.1.4 New issues not issued through an auction process or additional issues of existing gilt, "taps", are added to the indexes at the closing price at the close of business on the day the tap issue takes place.

7.2 Removal of constituents

- 7.2.1 Gilts are removed from the indexes on their redemption dates at the closing price on the previous day. If a gilt with a spread of redemption dates is redeemed early it too is removed from the indexes on the announced redemption date at the closing price on the previous day; the two redemption dates for such a gilt are both altered to the announced redemption date when such an announcement is made.
- 7.2.2 Gilts are removed from the indexes at the close of business on the day they join the Debt Management Office's list of rump gilts.
- 7.2.3 Gilts which convert wholly into another gilt are removed from the indexes on the conversion date at the closing price on the previous day (see Rules 7.1.2 and 7.3.2).

7.3 Alterations to constituents

- 7.3.1 Alterations to nominal amounts outstanding are adjusted at the close of business on the day the Debt Management Office announces the change in nominal, or the day that FTSE Russell becomes aware of the change.

7.3.2 Changes in the nominal to both gilts (i.e. both positive and negative) following a conversion option are made at the closing prices of the relevant gilts and are not based on the conversion ratio (see Rules 7.1.2 and 7.2.3).

Section 8

Formulae and Calculation Methods Applying to both Conventional and Index-linked Gilts

8.0 Formulae and Calculation Methods Applying to both Conventional and Index-linked Gilts

The Rules in this Section and in Section 9 (Conventional) and 10 (Index-linked) show the normal formulae, when there are no complications. Section 11 gives details of what happens when there are capital changes, "shorteners", etc.

8.1 Notation

- 8.1.1 Data relating to individual Gilts are subscripted by the letter i ; data relating to Sectors are subscripted by the letter s ; data relating to a particular Day are subscripted by the letter t . Thus P_{it} represents the (Dirty) Price of Gilt i on Day t . If a formula relates for example only to one Gilt on one Day, or one Sector on one Day relevant subscripts may be omitted.
- 8.1.2 The previous Calculation Day is denoted by y ("yesterday"), where t may be read as "today". Y is often equal to $t - 1$ day, but may be as much as five days beforehand, if a holiday and a weekend intervene.
- 8.1.3 Σ_i indicates the summation of the succeeding items for each Gilt i in the relevant Sector.
- 8.1.4 Σ_{days} indicates the summation of the succeeding items for each day in the current calendar year up to day t .

8.2 Accrued Interest for each Gilt

- 8.2.1 The "Clean" Price (i.e. excluding Accrued Interest) is collected for each Gilt i for each Day t (see Section 6). Accrued Interest per cent nominal for each Gilt i for each Day t , $AI_{i,t}$, is calculated in accordance with current market conventions, which are denoted "actual/actual", or more precisely, in the normal case, as:

If the gilt is not 'xd':

$$AI_{i,t} = \text{Coupon/frequency} \times (S - L)/(N - L)$$

and if the gilt is 'xd':

$$AI_{i,t} = - \text{Coupon/frequency} \times (N - S)/(N - L)$$

where

$frequency = 2$ (since interest is payable half-yearly)

S = the settlement date

L = the last coupon date

N = the next coupon date

and all differences are measured in days (as applies throughout).

8.2.2 Accrued Interest is added to the "Clean" Price to give the "Dirty" Price, $P_{i,t}$, which is used hereafter.

8.2.3 Special calculations apply during the initial irregular interest period of a Gilt, as follows.

(1) If the gilt has a short first interest period (less than half a year):

If the gilt is not 'xd':

$$AI_{i,t} = \text{Coupon}/\text{frequency} \times (S - I)/(N - L)$$

and if the gilt is 'xd':

$$AI_{i,t} = - \text{Coupon}/\text{frequency} \times (N - S)/(N - L)$$

where

S = the settlement date

I = the issue date

N = the next (i.e. first) interest date

L = the interest date prior to the issue date (on which no interest was paid)

Note that the actual first interest payable is calculated by the Debt Management Office as:

$$\text{Actual first interest} = \text{Coupon}/\text{frequency} \times (N - I)/(N - L)$$

rounded in accordance with current conventions

(2) If the gilt has a long first interest period (more than half a year):

In the period up to the quasi-interest date, i.e. the interest date during the long first period on which interest is not paid, and during which the gilt cannot be xd:

$$AI_{i,t} = \text{Coupon}/\text{frequency} \times (S - I)/(Q - L)$$

where

S = the settlement date

I = the issue date

Q = the quasi-interest date

L = the interest date prior to the issue date (on which no interest was paid)

In the period after the quasi-interest date:

If the gilt is not 'xd':

$$AI_{i,t} = \text{Coupon}/\text{frequency} \times \{(Q - I)/(Q - L) + (S - Q)/(N - Q)\}$$

and if the gilt is 'xd':

$$AI_{i,t} = - \text{Coupon}/\text{frequency} \times (N - S)/(N - Q)$$

where

Q = the quasi-interest date

I = the issue date

L = the interest date prior to the issue date (on which no interest was paid)

S = the settlement date

N = the next (first) interest date

Note that the actual first interest payable is calculated as:

$$\text{Actual first interest} = \text{Coupon/frequency} \times \{(Q - I)/(Q - L) + 1\}$$

rounded in accordance with current conventions

8.3 Index Value for a Sector

8.3.1 The Index Value for Sector s for day t , $I_{s,t}$, is calculated as

$$I_{s,t} = (\sum_i N_{i,t} \times P_{i,t}) / \text{divisor}_{s,t}$$

where

$N_{i,t}$ = the Nominal Amount issued of Gilt i on day t , divided by 100 (to give the number of nominal 100s, since prices per cent are used)

$P_{i,t}$ = the "Dirty" Price per cent nominal of Gilt i at the close of day t .

$\text{divisor}_{s,t}$ (also called the "base value") = a figure which was originally set equal to the total market value of Sector s at the base date divided by the starting Index Value at that date (often 100.00), but which has subsequently been adjusted to allow for changes in the constituents of the Sector and the nominal amounts of the constituent Gilts, so as keep the Index Value "chain-linked" (see Section 11).

The numerator of the expression for the Index Value is equal to the market value of the Gilts in Sector s on Day t .

8.4 Days change %

8.4.1 The "Day's change %" is calculated as:

$$100 \times (I_{s,t} / I_{s,y} - 1)$$

8.5 Accrued Interest for a Sector

8.5.1 The Accrued Interest for Sector s for Day t , $AI_{s,t}$, is calculated as

$$AI_{s,t} = (\sum_i N_i \times AI_i) / \text{divisor}_{s,t}$$

where

AI_i = Accrued Interest for Gilt i calculated as in Rule 8.2.

8.6 XD Adjustment

8.6.1 The XD Adjustment for Sector s for Day t , $XD_{s,t}$, is calculated as

$$XD_{s,t} = (\sum_i N_i \times XD_i) / \text{divisor}_{s,y}$$

where

XD_i = quantum of interest per cent nominal for Gilt i that has gone "ex div" between the last day on which the indexes were calculated, y , and the opening of the day of calculation, t , (thus including all "ex div" dates over weekends and holidays).

Note that the divisor for the previous day of calculation, $\text{divisor}_{s,y}$, is used.

The published figure for Sector s for Day t is the XD Adjustment for the year to date, $XD\ ytd_{s,t}$, which is calculated as:

$XD\ ytd_{s,t} = \sum_{days} XD_{s,day}$, where the summation is over days of calculation from 1 January of the current year up to Day t .

8.7 Total Return Index for a Sector

8.7.1 The Total Return Index for Sector s for Day t , $R_{s,t}$, is calculated from the Sector Index Value and the XD Adjustment:

$$R_{s,t} = R_{s,y} \times I_{s,t} / (I_{s,y} - XD_{s,t})$$

Note: if a Total Return Index for a Gilt were required, it would be calculated in a similar way, with I for the Sector replaced by P for the Gilt.

8.8 Weight % of a Sector

8.8.1 The Weight % for Sector s for Day t , $W_{s,t}$, is calculated from the Total Market Value for the Gilts in the Sector, $M_{s,t}$, and the Total Market Value for the Gilts in the All Gilts Sector, $M_{A,t}$, where:

$$M_{s,t} = \sum_i N_i \times P_i, \text{ summed over the Gilts in Sector } s$$

$$M_{A,t} = \sum_i N_i \times P_i, \text{ summed over the Gilts in the All Gilts Sector}$$

$$\text{Then } W_{s,t} = 100 \times M_{s,t} / M_{A,t}$$

Section 9

Formulae and Calculation Methods: Conventional Gilts

9.0 Formulae and Calculation Methods: Conventional Gilts

9.1 Redemption Yield

9.1.1 The Redemption Yield for Gilt i for Day t , $y_{i,t}$, is calculated by solving an equation of value. The "root", v_i , of the equation is the value of v which makes the present value of future payments of interest and capital for the Gilt, denoted $V_i(v)$, and calculated using a uniform discount factor, v , equal to the Price of the Gilt, P_i , i.e. the value that solves:

$$F_i(v) = V_i(v) - P_i = 0$$

where:

$$V_i(v) = v^f \times \{C_0 + C \times (v + v^2 + \dots + v^n) + R \times v^n\}$$

time is measured in *periods* between interest dates, so a period is a half year for Gilts with interest payable half-yearly, as all gilts in the Indexes currently are

f is the fraction of a period until the next interest date, calculated normally as g/h

g is the number of days from the settlement date (S) to the next interest date (N)

h is the number of days from the last interest date (L) to the next interest date (N); for half-yearly gilts this is always between 181 and 184 inclusive

$$\text{thus } f = (N - S)/(N - L)$$

C_0 is the coupon per cent payable at the next interest date, which is zero if the Gilt is already "ex div"

C is the normal coupon per cent payable at each future due date, which equals the annual coupon rate divided by the *frequency*

frequency = 2 for half-yearly

n is the number of complete periods until the redemption date of the Gilt

R is the amount per cent payable on redemption (100 for all British Government Gilts)

v is a discounting factor per period. $v = 1/(1+y/2)$ for semi-annual compounding

9.1.2 Special calculations for the fraction f apply during the initial irregular interest period of a Gilt, as follows.

If the gilt has a short first interest period (less than half a year):

$$f = (N - S)/(N - L)$$

where

N = the next (first) interest date

S = the settlement date

L = the interest date prior to the issue date (on which no interest was paid)

(This is the same as the normal calculation, with an appropriate definition of L .)

If the gilt has a long first interest period (more than half a year):

In the period up to the quasi-interest date, i.e. the interest date during the long first period on which interest is not paid:

$$f = (Q - S)/(Q - L) + 1$$

where

Q = the quasi-interest date

S = the settlement date

L = the interest date prior to the issue date (on which no interest was paid)

In the period after the quasi-interest date:

$$f = (N - S)/(N - Q)$$

where

N = the next (first) interest date

S = the settlement date

Q = the quasi-interest date

(This is the same as the normal calculation, with Q substituted for L .)

9.1.3 The expression in parentheses in the middle of the function in 9.1.1 can be simplified:

$$v + v^2 + \dots + v^n = v \times (1 - v^n) / (1 - v)$$

9.1.4 Then the Redemption Yield per cent convertible half-yearly for Gilt i for Day t , $y_{i,t}$, is calculated as:

$$y_{i,t} = 200 \times (1/v_i - 1) \text{ since interest on the Gilt is payable half-yearly.}$$

- 9.1.5 The above formulae apply to gilts with more than one coupon payment left. When a gilt is in its final coupon payment period, a simple interest formula is used:

$$y_{i,t}^{\text{last}} = ((C_{i,t} + R_{i,t}) / P_{i,t} - 1) / f_{i,t}^{\text{last}}$$

where:

$P_{i,t}$ = gross price (i.e. clean price plus accrued interest) of gilt i at time t

$y_{i,t}^{\text{last}}$ = annualised redemption yield for gilt i at time t

$C_{i,t} + R_{i,t}$ = final cash flow (coupon and principal) for gilt i at time t

$f_{i,t}^{\text{last}}$ = fraction of a year to maturity

9.2 Redemption Yield for a Sector

- 9.2.1 The Redemption Yield for Sector s for Day t , $y_{s,t}$, is calculated from the root, v_s , of the corresponding equation:

$$F_s(v) = \sum_i N_i \times F_i(v) = 0$$

Where

$F_i(v)$ for Gilt i is as defined in Rule 9.1, but calculated at the same discount factor for all Gilts in Sector s .

- 9.2.2 Then the Redemption Yield per cent, convertible half-yearly, for Sector s for Day t , $y_{s,t}$, is calculated as:

$$y_{s,t} = 200 \times (1/v_s - 1)$$

Note that at the sector level, no distinction is made between cash flows emanating from different gilts.

9.3 Duration for a Gilt

- 9.3.1 The (Macaulay) Duration for Gilt i for Day t , $D_{i,t}$, is calculated as:

$$D_{i,t} = A_i(v_i) / V_i(v_i)$$

where:

$$A_i(v) = [v^f \times \{C_0 \times f + C \times \{(f+1) \times v + (f+2) \times v^2 + \dots + (f+n) \times v^n\} + R \times (f+n) \times v^n\}] / \text{frequency}_i$$

$V_i(v)$ is as defined in Rule 9.1.

v_i is the root of the equation $F_i(v) = 0$ for Gilt i found previously.

- 9.3.2 The formula for $A_i(v)$ simplifies to:

$$A_i(v) = [f \times V_i(v) + v^f \times \{C_0 + C \times (v + 2v^2 + \dots + n \times v^n) + R \times n \times v^n\}] / \text{frequency}_i$$

- 9.3.3 The expression in parentheses in the middle of the above formula can be simplified:

$$v + 2v^2 + \dots + n \times v^n = \{v(1 - v^n) / (1 - v) - nv^{n+1}\} / (1 - v)$$

- 9.3.4 The Modified Duration for Gilt i for Day t , $ModD_{i,t}$, is calculated as:

$$ModD_{i,t} = D_{i,t} \times v_i$$

9.3.5 The Macaulay Duration and Modified Duration for a gilt within its last coupon payment period are calculated as:

$$D_{i,t} = f^{ast}_{i,t}$$

$$ModD_{i,t} = f^{ast}_{i,t} / (1 + y^{ast}_{i,t} \times f^{ast}_{i,t})$$

where $f^{ast}_{i,t}$ is the fraction of a year to maturity.

9.4 Duration for a Sector

9.4.1 The Duration for Sector s for Day t , $D_{s,t}$, is calculated as:

$$D_{s,t} = A_s(v_s) / V_s(v_s)$$

where

$$A_s(v) = \sum_i N_i \times A_i(v)$$

$$V_s(v) = \sum_i N_i \times V_i(v)$$

$A_i(v)$ and $V_i(v)$ for Gilt i are calculated using the discount factor, v_s , for Sector s .

v_s for Sector s is the root of the equation $F_s(v) = 0$ found previously in the calculation of the Redemption Yield for Sector s .

9.4.2 The Modified Duration for Sector s for Day t , $ModD_{s,t}$, is calculated as:

$$ModD_{s,t} = D_{s,t} \times v_s$$

9.5 Convexity for a Gilt

9.5.1 Macaulay Convexity

A. The Convexity for Gilt i for Day t , $C_{i,t}$, is calculated as:

$$C_{i,t} = B_i(v_i) / V_i(v_i)$$

where

$$B_i(v) = [v^f \times \{C_0 \times f^2 + C \times \{(f+1)^2 \times v + (f+2)^2 \times v^2 + \dots + (f+n)^2 \times v^n\} + R \times (f+n)^2 \times v^n\}] / frequency_i^2$$

$V_i(v)$ is as defined in Rule 9.1

v_i is the root of the equation $F_i(v) = 0$ for Gilt i found previously.

B. The Convexity for a gilt within its last coupon payment period is calculated as:

$$C_{i,t} = (f^{ast}_{i,t})^2$$

where $f^{ast}_{i,t}$ is the fraction of a year to maturity.

9.5.2 Modified Convexity

A. The Modified Convexity for Gilt i for Day t , $ModC_{i,t}$, is calculated as:

$$ModC_{i,t} = \frac{C_{i,t}}{\left(1 + \frac{y_{i,t}}{\text{frequency}}\right)^2} + \frac{ModD_{i,t}}{\text{frequency} + y_{i,t}}$$

Where:

$ModC_{i,t}$ = Modified Convexity of the Gilt

$C_{i,t}$ = Macaulay Convexity of the Gilt, which is currently calculated

$ModD_{i,t}$ = Modified Duration of the Gilt, which is currently calculated

$y_{i,t}$ = Redemption Yield of the Gilt

9.6 Convexity for a Sector

9.6.1 The Convexity (either Macaulay or modified) for Sector s for Day t , $C_{s,t}$, is calculated as:

$$C_{s,t} = B_s(v_s) / V_s(v_s)$$

where $B_s(v) = \sum_i N_i \times B_i(v)$

$V_s(v)$ is as defined in Rule 9.4

$B_i(v)$ and $V_i(v)$ for Gilt i are calculated using the discount factor, v_s , for Sector s

v_s for Sector s is the root of the equation $F_s(v) = 0$ found previously in the calculation of the Redemption Yield for Sector s .

9.7 Market value weighting

9.7.1 The redemption yield (rule 9.2), duration (rule 9.4) and convexity (rule 9.6) are aggregated at the sector level using the portfolio cashflow (PCF) method. FTSE also calculates sector yields, duration and convexity which are aggregated using the market value weighting (MVW) method. The MVW method weights the relevant metric of every bond in the sector based on its gross price, the modified duration (for redemption yield only) and the notional outstanding amount.

The MVW Redemption Yield for sector s for day t , $y_{s,t}$, is calculated as:

$$y_{s,t} = \frac{\sum_i N_{i,t} * P_{i,t} * D_{i,t} * y_{i,t}}{\sum_i N_{i,t} * P_{i,t} * D_{i,t}}$$

Where: $y_{s,t}$ = Redemption Yield of the index s at time t

$y_{i,t}$ = Redemption Yield of gilt i at time t

$N_{i,t}$ = Adjusted nominal value of gilt i today at time t

$P_{i,t}$ = Gross price of gilt i at time t

$D_{i,t}$ = Modified Duration of Gilt i at time t

Similarly, the MVW duration or convexity for sector S on day t , $M_{s,t}$, is calculated as:

$$M_{s,t} = \frac{\sum_i N_{i,t} * P_{i,t} * M_{i,t}}{\sum_i N_{i,t} * P_{i,t}}$$

Where: $M_{s,t}$ = Index duration or convexity (Macaulay or Modified) at time t

$M_{i,t}$ = Duration or convexity (Macaulay or Modified) of gilt i at time t

$N_{i,t}$ = Adjusted nominal value of gilt i at time t

$P_{i,t}$ = Gross price of gilt i at time t

9.8 Fitted Yields for Conventional Gilts

9.8.1 This section describes the methodology for the construction of the zero coupon yield curve, which is calculated daily, in order to produce a set of zero coupon, par and forward yields for conventional gilts.

The "zero coupon yield curve" for gilts of term m to maturity is defined:

$$z(m) = b_0 + \sum_{x=1}^4 b_x \times \frac{(1 - e^{-c_x \times m})}{c_x \times m}$$

Where:

- $z(m)$ = Zero-Coupon Yield for the term t
- b_0 = Parameter produced by the optimisation routine
- b_x = Parameter produced by the optimisation routine where $x = 1, 2, 3$ and 4
- c_x = Constant value where $x = 1, 2, 3$ and 4
- m = Term to Maturity

The parameters of this yield curve, $b_0, b_1, b_2, b_3,$ and b_4 are found by minimising the sum of squares function:

$$SS(b) = \sum_1^i N_i \times (P_i - \hat{P}_i)^2$$

Where:

- $SS(b)$ = Weighted sum of the squares of the price differences
- N_i = Nominal Amount in Issue Gilt i
- P_i = Actual Gross Price for Gilt i
- \hat{P}_i = Gross Price of Gilt i derived from Zero Coupon Yield

that is, the sum of the squares of the differences between the actual gross price for each gilt minus the gross price derived from the zero coupon curve, weighted by the market value of the gilt.

The derived gross price of each gilt in the index must be calculated using the following formula:

$$\hat{P}_k = \sum_1^T \frac{C}{\text{freq}} \times e^{-z(t) \times t} + \text{PAR} \times e^{-z(T) \times T}$$

Where,

- \hat{P}_k = Derived gross price of the Gilt k
- T = Term to Maturity
- T = Term to remaining coupon payments
- C = Coupon Rate of the Gilt k
- PAR = Par value of the Gilt k which is always 100.
- freq = Frequency of Coupon payments
- $z(T)$ = Zero-Coupon yield for term to Maturity

Then Fitted Yields, using the formula for $y(m)$, for terms $m = 5, 10, 15, 20, 25, 30, 35, 40, 45$ and 50 are published.

9.9 Technical Note on Duration, Modified Duration and Convexity

9.9.1 Duration and modified duration can be defined in terms of differential calculus. Consider a zero-coupon gilt of unit face value of term n years. Its present value, discounted at the continuously compounded rate (or “force”) of interest r is:

$$V(r) = \exp(-nr).$$

The derivative of V with respect to r is:

$$dV/dr = -n (\exp(-nr)).$$

The proportionate sensitivity, or “volatility”, of V to changes in r is:

$$-1/V \times dV/dr = -(-n (\exp(-nr)) / \exp(-nr)) = n.$$

This is also the Macaulay Duration (or just Duration) of the gilt, first defined by F. R. Macaulay in *Some theoretical problems suggested by the movements of interest rates, bond yields and gilt prices in the United States since 1856*, published by the New York National Bureau of Economic Research, 1938 and reprinted by UMI Books on Demand, Ann Arbor, Michigan, 2000. The sensitivity with respect to the continuously compounded rate r is seen to equal the term of the zero-coupon gilt.

9.9.2 If the gilt is discounted at a rate of interest convertible half-yearly, i , then its present value is

$$V(i) = (1 + i/2)^{-2n}.$$

The derivative of V with respect to i is:

$$dV/di = -2n (1 + i/2)^{-2n-1} / 2 = -n (1 + i/2)^{-2n-1}$$

The proportionate sensitivity of V to changes in i is:

$$-1/V \times dV/di = -(-n (1 + i/2)^{-2n-1} / (1 + i/2)^{-2n}) = n (1 + i/2)^{-1} = n/(1 + i/2)$$

This is the Modified Duration of the zero-coupon gilt, which is the sensitivity with respect to changes in the rate compounded half-yearly, i .

Putting v , the half-yearly discount factor, $= 1/(1 + i/2)$, we see that

$$\text{Modified Duration} = n/(1 + i/2) = nv = \text{Duration} \times v.$$

9.9.3 For a coupon gilt, all the calculations are similar, with the numerators and denominators containing sums of the zero-coupon gilts that are the equivalent of the coupon gilts. Suppose that the coupon gilt is equivalent to a series of N zero-coupon gilts, with amounts A_j due at terms n_j , for $j=1$ to N . Then the present value of the gilt is, discounted at the continuously compounded rate of interest r is:

$$V(r) = \sum_j A_j \exp(-n_j r).$$

The derivative of V with respect to r is:

$$dV/dr = -\sum_j A_j n_j \exp(-n_j r).$$

The proportionate sensitivity, or “volatility”, of V to changes in r is:

$$-1/V \times dV/dr = (\sum_j A_j n_j \exp(-n_j r)) / \sum_j A_j \exp(-n_j r).$$

This is the (Macaulay) Duration of the coupon gilt. The sensitivity of the coupon gilt is seen to be the average value of the terms of the constituent zero-coupon gilts, weighted by the discounted present values of the constituent parts. It is therefore also known as the “discounted mean term” (see Redington, F. M. “Review of the principles of life office valuations”, *Journal of the Institute of Actuaries*, **78**, 286, 1952). The duration of a coupon gilt varies with the discount rate r , whereas the duration of a zero-coupon gilt of term n is always equal to n . However, the Modified Duration of a zero-coupon gilt varies with r .

9.9.4 As for the zero-coupon gilt, for the coupon gilt we have:

Modified Duration = Duration \times v .

9.9.5 Convexity is equal to:

Convexity = $(\sum_j A_j n_j^2 \exp(-n_j r)) / V = 1 / V \times d^2 V / dr^2$

Convexity is therefore equivalent to the second moment of the terms about zero.

Section 10

Formulae and Calculation Methods: Index-linked Gilts

10.0 Formulae and Calculation Methods: Index-linked Gilts

10.1 "Real" Redemption Yield for an Index-linked Gilt

10.1.1 The Real Redemption Yield for Index-linked Gilt i for Day t , $ry_{i,t}$, is found as follows:

First, the rate of inflation assumed is denoted i , e.g. $i = 0.05$ for 5% inflation.

Then we put $r = (1 + i)^{1/12}$, the monthly ratio for inflation.

Then values of the Retail Prices Index for each past month m are denoted $Q(m)$, and the most recent month for which the value of the Retail Prices Index is available is denoted M .

Then projected values of the Retail Prices Index, using the rate of inflation assumed, for month m from month $M + 1$ onwards, are calculated as $Q^l(m) = Q(M) \times r^{(m-M)}$.

Then the projected nominal amount of each future payment of interest and redemption amount, indexed according to the rules for the Gilt, is calculated, using the past values of the RPI, $Q(m)$, up to month M and the future projected values, $Q^l(m)$, from month $M + 1$ onwards. The indexed interest payments are denoted $C_0^l, C_1^l, C_2^l, \dots$ and the indexed redemption amount is denoted R^l . In each case the projected amount, say I^l , payable in month m is calculated by multiplying the corresponding nominal amount X by $Q(m - 8)$ or $Q^l(m - 8)$, as appropriate, and dividing by $Q(B - 8)$ (assuming an 8-month lag, and a base month B).

Then the root v_i is found of the equation

$$F_i(v) = V_i(v) - P_i = 0$$

where

$$V_i(v) = v^f \times \{C_0^l + C_1^l \times v + C_2^l \times v^2 + \dots + C_n^l \times v^n + R^l \times v^n\}$$

and other terms are as defined in Rule 9.1 for UK gilts.

Then the Real Redemption Yield $ry_{i,t}$ is calculated as:

$$ry_{i,t} = 200 \{1 / (v_i \times r^6) - 1\} \text{ (for half-yearly Gilts as all Index-linked Gilts are).}$$

10.2 "Real" Redemption Yield for an Index-linked Sector

10.2.1 The Real Redemption Yield for Index-linked Sector s for Day t , $ry_{s,t}$, is calculated using the methodology for Gilts described in Rule 10.1 and the methodology for Sectors described in Rule 9.2.

Thus for Sector s the Real Redemption Yield is calculated from the root, v_s , of the equation:

$$F_s(v) = \sum_i N_i \times F_i(v) = 0$$

where

$F_i(v)$ for Gilt i is as defined in Rule 10.1, but calculated at the same discount factor for all Gilts in Sector s .

and the Real Redemption Yield is calculated as:

$$ry_{s,t} = 200 \{1 / (v_s \times r^6) - 1\} \text{ (all Index-linked Gilts being payable half-yearly).}$$

10.3 Duration for an Index-linked Gilt

10.3.1 The Duration for Index-linked Gilt i for Day t , $D_{i,t}$, is calculated as:

$$D_{i,t} = A_i(v_i) / V_i(v_i)$$

where

$$A_i(v) = [v^f \times \{C_0^1 \times f + C_1^1 \times (f+1) \times v + C_2^1 \times (f+2) \times v^2 + \dots + C_n^1 \times (f+n) \times v^n + R^1 \times (f+n) \times v^n\}] / \text{frequency}_i$$

$V_i(v)$ is as defined in Rule 10.1.

v_i is the root of the equation $F_i(v) = 0$ for Gilt i found previously.

10.3.2 The Modified Duration for Gilt i for Day t , $ModD_{i,t}$, is calculated as:

$$ModD_{i,t} = D_{i,t} \times v_i$$

10.4 Duration for an Index-linked Sector

10.4.1 The Duration for Index-linked Sector s for Day t , $D_{s,t}$, is calculated as:

$$D_{s,t} = A_s(v_s) / V_s(v_s)$$

where

$$A_s(v) = \sum_i N_i \times A_i(v)$$

$$V_s(v) = \sum_i N_i \times V_i(v)$$

$A_i(v)$ and $V_i(v)$ for Gilt i are calculated using the discount factor v_s for Sector s

v_s for Sector s is the root of the equation $F_s(v) = 0$ found previously in the calculation of the Real Redemption Yield for Index-linked Sector s .

10.4.2 The Modified Duration for Sector s for Day t , $ModD_{s,t}$, is calculated as:

$$ModD_{s,t} = D_{s,t} \times v_s$$

10.5 Convexity for an Index-linked Gilt

10.5.1 The Convexity for Index-linked Gilt i for Day t , $C_{i,t}$, is calculated as:

$$C_{i,t} = B_i(v_i) / V_i(v_i)$$

where

$$B_i(v) = [v^f \times \{C_0^1 \times f^2 + C_1^1 \times (f+1)^2 \times v + C_2^1 \times (f+2)^2 \times v^2 + \dots + C_n^1 \times (f+n)^2 \times v^n + R^1 \times (f+n)^2 \times v^n\}] / \text{frequency}^2$$

$V_i(v)$ is as defined in Rule 10.1

v_i is the root of the equation $F_i(v) = 0$ for Gilt i found previously.

10.6 Convexity for an Index-linked Sector

10.6.1 The Convexity for Index-linked Sector s for Day t , $C_{s,t}$, is calculated as:

$$C_{s,t} = B_s(v_s) / V_s(v_s) \times \text{frequency}^2$$

where

$$B_s(v) = \sum_i N_i \times B_i(v)$$

$V_s(v)$ is as defined in Rule 10.4

$B_i(v)$ and $V_i(v)$ for Gilt i are calculated using the discount factor v_s for Sector s

v_s for Sector s is the root of the equation $F_s(v) = 0$ found previously in the calculation of the Real Redemption Yield for Index-linked Sector s .

Section 11

Formulae and Calculation Methods: Capital changes

11.0 Formulae and Calculation Methods: Capital changes

11.1 Changes to constituents

11.1.1 There are changes in the constituents of the indexes from time to time and for each Sector the *divisor* in the expression in Rule 8.3 (the "base value") must be adjusted so as to "chain-link" the indexes appropriately. The possible types of change that are considered for the price indexes are:

- A. New issues, brought in on the day of issue at the closing price on the day of issue.
- B. Late entrants, such as partly-paid new issues, which are brought in at the closing price when fully paid, and conversion gilts, brought in at or near an appropriate conversion date at the closing price.
- C. Amalgamations of further tranches of an existing gilt (A or B gilts), which take place normally on the first ex-dividend date of the A or B gilt, after which the gilts are identical.
- D. Alterations of nominal amount outstanding, such as: for gilts with a sinking fund, brought in from time to time as the information is available; for taps (small additional issues of an existing gilt, brought in at the close of business on the day the tap issue takes place at the closing price); for reductions of the amount outstanding for convertible gilts and increases of the amount outstanding for conversion gilts, where the nominal amounts are altered in accordance with the conversion terms, but the prices are the closing prices on the day the alteration is made (and not based on the conversion ratio).
- E. Redemptions, taken out on the redemption date at the closing price on the previous day, which always in practice equals the redemption amount.
- F. Early leavers, such as various gilts which have been almost wholly repurchased by the Government in exchange for a different gilt from time to time, and were deleted from the indexes; and convertible gilts, once it is estimated that almost all the outstanding issue has been converted; also any gilts whose outstanding amount becomes so small that it gets onto the Debt Management Office's list of rump gilts.

11.1.2 The above changes can apply to any gilts in any of the price indexes. In addition a gilt may be transferred from one of the sectors to another depending on the time from the date of calculation to the date of redemption of this gilt. The possible further changes are:

- G. "Shorteners": a gilt is moved, at its closing price, from one sector to a shorter sector after the close of business on the day when its redemption date is exactly 5, 10, 15, 20 or 25 years from the calculation date (when it is described as a "timeous shortener"). If this falls on a bank holiday or a weekend it will be on the first calculation date thereafter (when it is described as a "late shortener").
- H. If a gilt is due to be included in or excluded from an index defined under Rule 4.3.2 on a day when the market is closed, the stock will be included or excluded after the close on the last trading day before the appropriate anniversary so that it will be included in an index from the beginning of the first trading day for which it becomes eligible and excluded from an index from the beginning of the first trading day for which it becomes ineligible.

11.2 Adjustments to base values

11.2.1 On any one day there may be up to three adjustments to the "base value", i.e. the denominator of the expression in Rule 8.3:

- (1) Redemptions are taken out at "yesterday's" prices. Thus the base value is multiplied by (total market value yesterday of all gilts except redemptions) and divided by (total market value yesterday of all gilts).
- (2) All remaining changes are allowed for at today's closing prices. Thus the third adjustment factor is (total market value at today's prices of gilts after changes, i.e. including new issues etc) divided by (total market value at today's prices of gilts before changes).

11.2.2 In all calculations that relate to those gilts in a sector or in the indexes as at the close of business on any day, such as calculations of yields, durations, etc, the gilts that are used include those gilts that have been in the sector during the course of that day, including those gilts that are leaving the sector after the close and excluding those gilts that are entering the sector after the close of business on that day. Thus redemptions and "shorteners", which have been allowed for in adjustments (1) and (2) above, are assumed to have happened before the relevant calculations, whereas all other changes, those which are allowed for in adjustment (3) above, are assumed to take place after the closing calculations have been done (see Rules 4.4.3, 4.5.3, 5.3.3 and 5.4.4).

11.3 Normal calculations

11.3.1 The above description in words will now be repeated in a precise mathematical formulation. The same notation as defined in Rule 8.1 is used. The nominal amounts (in suitable units) for Gilt i in issue on the previous calculation date, denoted "yesterday", y , and the current calculation date, "today", t , are denoted by $N_{i,y}$ and $N_{i,t}$ respectively. Usually these are the same. "Capital changes" occur when these are different for any gilt.

11.3.2 On a day when there are no capital changes, $N_{i,t} = N_{i,y}$ for all gilts. The market value of all gilts in the sector index yesterday was calculated as $M_y = \sum_i N_{i,y} \times P_{i,y}$. The market value of these same gilts today is calculated as $M_t = \sum_i N_{i,t} \times P_{i,t}$. The "base value" for the index yesterday is denoted by B_y and the index yesterday was calculated as $I_y = M_y / B_y$.

11.3.3 Since it is being assumed that there are no capital changes today, the base value for the index today is unchanged from yesterday, so $B_t = B_y$, and the index value today is calculated as $I_t = M_t / B_t = M_t / B_y$.

11.3.4 But $B_y = M_y / I_y$, so $I_t = I_y M_t / M_y$, showing that the change in the index from yesterday to today is proportional to the change in the market value of the gilts that are constituents of the index.

11.4 Capital changes

11.4.1 On a day when there are capital changes the calculations are more complicated. The base value needs to be adjusted, and this is done in three stages. Three ratios are calculated. These are denoted r_1 , r_2 and r_3 , and the new base value is calculated from the old as $B_t = B_y \times r_1 \times r_2 \times r_3$.

- 11.4.2 Each ratio is the quotient of a numerator and a denominator. Thus $r_1 = N_1/D_1$, $r_2 = N_2/D_2$ and $r_3 = N_3/D_3$.
- 11.4.3 The denominator, D_1 , of the first ratio is the same as M_y , the market value of all gilts in the index yesterday.
- 11.4.4 The numerator, N_1 , of the first ratio is the same as D_1 , but with the exclusion of gilts that have just gone out of the index entirely (redemptions and "early leavers").
- 11.4.5 Thus the ratio $r_1 = N_1/D_1$ reflects the first adjustment described in Rule 11.2.1 above, under (1). Adjustment (2) is dealt with similarly.
- 11.4.6 The contributions made to the numerators and denominators for different types of change are shown in Table A. The numerators and denominators used in the calculation of the ratios are the totals for all relevant gilts of the appropriate contributions. The subscript i denoting the Gilt is omitted.
- 11.4.7 In Table A "Replacements" refer to cases where the recorded gilt details are to be changed, perhaps to correct an error; where the nominal amount is unchanged the effect of lines (c) and (d) combined is the same as line (a), no change.
- 11.4.8 For the amalgamation of an A gilt with the main gilt, where the nominal for the combined gilt is the sum of the previous nominals, the effect of lines (d) and (e) combined is also the same as line (a), no change.
- 11.4.9 It is possible, at least theoretically, though very seldom in practice, for multiple changes to apply to one gilt on one day. A gilt might "shorten" between sectors on the same day as the nominal amount is changed or an amalgamation occurs.

11.4.10 The mean prices, $P_{i,m}$, used for the calculations for “shorteners”, are calculated as

$$P_{i,m} = (1 - k)(P_{y,i} - XD_{i,t}) + kP_{i,t}$$

where the interpolation factor, k , is calculated as

$$k = \{\Sigma(N_{i,y} \times E_{i,t}) - \Sigma N_{i,y} \times (P_{i,y} - XD_{i,t})\} / \{\Sigma(N_{i,y} \times P_{i,t}) - \Sigma(N_{i,y} \times (P_{i,y} - XD_{i,t}))\}$$

where the summations are for all shorteners in the sector today, and $XD_{i,t}$ is the ex-dividend interest amount (if any), defined Rule 8.6.

Table A

Contributions to the numerators and denominators of the adjustment factors made by gilts subject to different types of change.

	D_1	N_1	D_2	N_2	D_3	N_3
(a) Gilts not changing today						
($N_t = N_y$ so numerators equal corresponding denominators)						
	$N_y \times P_y$	$N_y \times P_y$	$N_y \times P_m$	$N_y \times P_m$	$N_y \times P_t$	$N_t \times P_t$
(b) Redemptions and early leavers and shorteners out						
	$N_y \times P_y$	0	0	0	0	0
(c) Late shorteners in						
	0	$N_y \times P_y$	$N_y \times P_m$	$N_y \times P_m$	$N_y \times P_t$	$N_t \times P_t$
(d) New issues, entrants, replacements in and shorteners in						
	0	0	0	0	0	$N_t \times P_t$
(e) Amalgamations (A gilt), replacements out and shorteners out						
	$N_y \times P_y$	$N_y \times P_y$	$N_y \times P_m$	$N_y \times P_m$	$N_y \times P_t$	0
(f) Changes of nominal amount, amalgamations (combined gilt)						
($N_t \neq N_y$)						
	$N_y \times P_y$	$N_y \times P_y$	$N_y \times P_m$	$N_y \times P_m$	$N_y \times P_t$	$N_t \times N_t$



Appendix A: Further Information

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

Further information on the FTSE Actuaries UK Gilts Index Series is available from FTSE Russell.

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