

# THOMSON REUTERS INDICES GOVERNMENT BOND INDICES

## USER GUIDE AND FORMULAS FOR ANALYTICAL VALUES

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# ABOUT THIS DOCUMENT

## Intended Readership

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# CONTENTS

About This Document	2
Intended Readership	2
Feedback	2
Introduction	3
Index Types	4
Index Constituents	6
Formulas	9

# INTRODUCTION

## Background

The Thomson Reuters Government Bond Indices are calculated by Datastream. Datastream has been calculating domestic government bond indices since 1985, based on the formulation recommended by EFFAS (European Federation of Financial Analysts Societies).

In 1990, stimulated by the difficulty of outperforming the Dutch Government Bond Indices because of the way in which serial redemption bonds were treated, EFFAS began a review of its methodology for calculating indices. An EFFAS sub-committee was formed including members of the EFFAS commission as well as representatives from the UK Institute of Actuaries, ISMA, the French Comité de Normalisation Obligataire, Datastream, and other international institutions involved in the calculation of bond indices. The Thomson Reuters Government Bond indices reflect the revised calculation methods recommended by the EFFAS sub-committee.

Thomson Reuters aims to offer as transparent and flexible a set of bond indices as possible. To this end, each index contains only those bonds that follow the rules agreed by the subcommittee and all indices have been rigorously back tested. All series were originally calculated to 30th December 1988, now most markets are calculated to an earlier start date.

## Purpose and Basic Principles

The main purposes of bond indices are to act as a benchmark for portfolio management, as an indicator of market performance and development, the basis on which market options and futures may be derived and a comparator for different markets.

Bond index calculations should abide by different basic principles. They should reflect the experience of the average holder in the sector, should have objective criteria for underlying selection and all calculations and selection criteria should be published.

Due to the various users of bond indices who all have different requirements there are 3 types of bond indices calculated. The All traded index is largely required by domestic investors as they are long term investors whose portfolio would tend to encompass both liquid and illiquid bonds. As price collection in some regions may be difficult, a proxy is needed for the all traded which depends on a sample of bonds, yet tracks the all traded well. This is referred to as the tracker index.

On the other hand international investors are often more interested in the more liquid bonds within the sector. These are known as the benchmark indices.

# INDEX TYPES

## All Bond, Tracker and Benchmark

There are three indices for the government bond sector in each market:

- Datastream All-bond index
- Datastream Tracker index
- Datastream Benchmark index

The majority of series are based to 100 on 31/12/88. However, where possible, histories have been calculated to an earlier date.

### Selection – All Bond Index

The All-bond index covers all traded bonds, irrespective of liquidity, and is primarily of interest to long term domestic investors with portfolios covering the complete sector.

### Selection – Tracker Index

The bonds used in calculating the Tracker index are selected from those in the equivalent All-Bond index in order of decreasing market value (clean price x amount outstanding/100) until:

- 20 or more bonds have been selected and at least 25% of the group by market value has been included,
- or
- more than 50% of the group by market value is included.
- The Tracker index also includes any bonds representing more than 5% of the market, and any bonds identical in size to the smallest selected.

The constituents of the Tracker are such that the resulting index closely tracks the performance of the All-bond index.

### Selection – Benchmark Index

Benchmark indices are based on single bonds. The bond chosen for each series is the most representative bond available for the given maturity band at each point in time. Benchmarks are selected according to the accepted conventions within each market. Generally, the benchmark bond is the latest issue within the given maturity band; consideration is also given to yield, liquidity, issue size and coupon. Unlike the Tracker and All indices, **new** bonds are reviewed daily for benchmark selection. At the beginning of each month **all** bonds and constituent lists re reviewed, and any changes made. Benchmark constituent lists from September 2005 are stored on a daily basis. A comprehensive set of Benchmark indices is available - in most markets 2, 3, 5, 7 and 10year series are available and where appropriate, longer maturities are covered. The following table gives availability for each market.

Datastream Benchmark Indices	
	Available maturities
Australia	2, 3, 5, 7, 10
Austria	2, 3, 5, 7, 10, 30
Belgium	2, 3, 5, 7, 10, 15, 30
Canada	2, 3, 5, 7, 10, 20, 30
Czech Republic	2, 3, 5, 7, 10, 15
Denmark	2, 3, 5, 7, 10, 20
Euroland	2, 3, 5, 7, 10, 15, 20, 30
Finland	3, 5, 10
France	2, 3, 5, 7, 10, 15, 20, 30, 50
Germany	2, 3, 5, 7, 10, 20, 30
Greece	2, 3, 5, 10, 15
Hungary	2, 3, 5, 10
Ireland	2, 3, 5, 7, 10, 15
Italy	2, 3, 5, 7, 10, 15, 30
Japan	2, 3, 5, 7, 10, 15, 20, 30

Netherlands	2, 3, 5, 7, 10, 30
New Zealand	2, 3, 5, 7, 10
Norway	5, 7, 10
Poland	2, 3, 5, 7, 10, 20
Portugal	2, 3, 5, 7, 10
South Africa	3, 5, 4, 10, 30
Spain	2, 3, 5, 7, 10, 15, 30
Sweden	2, 3, 5, 7, 10, 15
Switzerland	2, 3, 5, 7, 10
United Kingdom	2, 3, 5, 7, 10, 15, 20, 30, 50
United States	2, 3, 5, 7, 10, 30

# INDEX CONSTITUENTS

## Selection

Selection rules follow the recommendations made by the EFFAS sub-committee.

### Generally Included

Bullet bonds	Bonds with purchase funds
Callable bonds	Partly paid bonds (treated as if fully paid)
Bonds with serial redemptions	Graduated Rate bonds once the last coupon fixing has been applied

### Generally Excluded

Bonds with less than one year to maturity	Indexed bonds
Floating rate bonds	Puttable bonds - unless the option is in the past and has not been taken up
Securities from the same market sample which have inconsistent tax status	Extendable bonds
Convertible bonds	Bonds with sinking funds (where redeemed proportion is not fixed)
Bonds with attached warrants	Very small or illiquid bonds

Bonds to be included in the indices are selected on the last working day of the month prior to that being calculated. Once a bond has been included in a maturity band for that month, it remains in that index until the end of the month, unless the bond is called, is made fungible or becomes illiquid. Undated bonds are included in a specific Index band "UN", which is currently only available for the UK market.

If at any time there are insufficient bonds to calculate an index, calculation is suspended until sufficient bonds again exist. This accounts for different start dates for indices where there has been long term unavailability of sufficient bonds. Most government markets have specific bond types that are to be included into the index. There are also many specific market rules to consider when making index selections. The table on the next page gives an idea as to some of these specific market rules.

	Included	Excluded
Australia	Selection of Commonwealth bonds	Off the run issues
Austria	Anleihen	Floating rate notes; Zero coupon bonds; From 1st January 1993, withholding tax applies to bonds issued prior to 1st January 1984. These bonds are excluded from 1st January 1993
Belgium	OLOs Classical issues	Irredeemables; Lots
Canada	Canada issues	Callable bonds
Denmark	Selection of government bonds	Zero coupon bonds Variable rate bonds
Euroland	See member countries	
Finland	Selection of government	

	bonds	
France	OATs Emprunts d'Etat BTANs	Variable rate bonds; FELIN issues; ORT issues; Index linked; Perpetual bonds
Germany	Bundesanleihen Bundesobligationen Bundeschatzanweisungen Deutsche Einheit Treuhandanstalt	Floating rate notes; Unquoted issues/savings bonds
Greece	Government Issues	Floating rate notes
Hungary	Government Issues	Floating rate notes
Ireland	Government issues	
Italy	BTPs; CTOs	CCT; CTE; BTE
Luxembourg*	Selection of government bonds	FIPs
Japan	JGBs	Discount bonds; Private placements
Netherlands	DSLs	Callable bonds; Irredeemables; Issues with denominations less than 1000
New Zealand	Selection of New Zealand bonds	Off the run issues
Norway	Selection of government bonds	
Poland	Government Issues	Floating rate notes
Portugal	OTs	OTRVs
South Africa	GOVI	
Spain	Bonos del Estado Obligacion Estado	
Sweden	Statsobligationslan Statskuldvoxlar	
Switzerland	Staatsanleihen	
United Kingdom	Gilts	Index linked Bonds with amount in issue less than 100 million

Please note that the Luxembourg Bonds are only used for calculation within the Euroland series.

## Markets Available

Indices are currently calculated for the government sector in each of the following markets:

Market	Start Date	Index Types Available
Australia	27/02/87	All, Tracker & Benchmark
Austria	31/12/84	All, Tracker & Benchmark
Belgium	31/12/84	All, Tracker & Benchmark
Canada	31/12/84	All, Tracker & Benchmark
Czech Rep	31/07/98	All & Benchmark
Denmark	31/12/84	All, Tracker & Benchmark
Finland	30/12/88	All, Tracker & Benchmark
France	31/12/84	All, Tracker & Benchmark

Germany	31/12/79	All, Tracker & Benchmark
Greece	31/03/99	All & Benchmark
Hungary	29/01/99	All & Benchmark
Ireland	31/12/84	All, Tracker & Benchmark
Italy	30/12/88	All, Tracker & Benchmark
Japan	31/12/81	All, Tracker & Benchmark
Netherlands	31/12/79	All, Tracker & Benchmark
New Zealand	30/12/88	All & Benchmark
Norway	30/12/88	All & Benchmark
Poland	29/12/00	All, Tracker & Benchmark
Portugal	31/12/92	All, Tracker & Benchmark
South Africa	31/08/00	All & Benchmark
Sweden	31/12/84	All, Tracker & Benchmark
Spain	30/12/88	All, Tracker & Benchmark
Switzerland	28/11/80	All, Tracker & Benchmark
United Kingdom	31/12/79	All, Tracker & Benchmark
United States	31/12/79	All, Tracker & Benchmark
Euroland	01/01/99	All, Tracker & Benchmark

# FORMULAS

Notation			
$Z_t$	Value of criterion Z at time t	$Y$	Redemption yield to assumed maturity
$Z_{t-1}$	Value of criterion Z at time (t-1)	$L$	Life to assumed maturity
$Z_0$	Initial value of criterion Z	$D$	Duration
$Z_{i,t}$	Value of criterion Z for the ith security at time t	$X$	Convexity
$P$	Clean price of the bond (without accrued interest) Based on a middle price	$C$	Coupon rate%
$P_{i,t}$	Clean price of the ith bond at time t	$G_{i,t}$	Value of any coupon payment received from the ith bond at time t or since time (t-1). If none, the value = 0
$P_{i,t}^*$	Clean price of the ith bond at time t, adjusted for any partial serial redemptions. At all other times it is the same as the unadjusted price P	$R$	Redemption price of the bond
$A$	Accrued interest to the "normal" settlement date	$N$	Nominal value of amount outstanding is known, otherwise the issued amount
$P^*$	<p>For serial bonds: When a serial bond is partly redeemed the price of the bond may jump as a result of the rump of the issue being quoted ex the partial redemption. Market convention assumes that the part of the bond being called for redemption is now worth the redemption price, and on the premise that the investor should not gain or lose money on this partial redemption, the current price is adjusted according to the following formula:</p> <p>Where: <math>NC_t</math> is the amount called for redemption at time t</p> <p><math>N_t</math> is the amount remaining in issue (ex the amount called) at time t</p> <p><math>R_t</math> is the redemption price of the bonds being called at time t</p> <p>Note. This assumes any moneys from the partial redemption are available for reinvestment on the ex date as opposed to the actual early redemption date.</p> <p>At other times <math>P^*</math> is the same as <math>P</math>.</p>		

Clean Price Index

$$CI_0 = 100$$

$$CI_t = CI_{t-1} * \frac{\sum_i P_{i,t} * N_{i,t}}{\sum_i P_{i,t-1} * N_{i,t-1}}$$

Gross Price Index (PI)

The accrued interest (AI) in the gross price is given by:

$$AI_t = \frac{\sum_i A_{i,t} * N_{i,t}}{\sum_i P_{i,t} * N_{i,t-1}}$$

where the summations are over the bonds currently in the index. For some indices the values currently go back to 12/30/1988.

The Gross Price Index (PI) is then:  $PI_t = CI_t * (1 + AI_t)$

Total Return Index (RI)

$$RI_0 = 100$$

$$RI_t = RI_{t-1} * \frac{\sum_i (P_{i,t} + A_{i,t} + CP_{i,t} + G_{i,t}) * N_{i,t-1}}{\sum_i (P_{i,t-1} + A_{i,t-1} + CP_{i,t-1}) * N_{i,t-1}}$$

where the summations are over the bonds currently in the index.  $CP$  is an adjustment made for bonds which have ex-dividend periods - when a bond goes ex-dividend,  $CP$  has a value equal to the next coupon payment; outside the ex-dividend period  $CP = 0$ .

This compensates for the sharp drop in accrued interest when a bond goes ex-dividend. For any bonds currently in the index that have serial redemption features, an adjustment is made when  $t$  falls within the period between the drawing date and the next serial redemption date. For such bonds the calculation is:

$$RI_t = RI_{t-1} * \frac{\sum_i (P_{i,t} + A_{i,t}) * N_{i,t-1} + G_{i,t} (N_t + NC_{i,t}) + CP_{i,t} * (N_t + NC_{i,t}) + NC_{i,t} * (R_{i,t} + A_{i,t})}{\sum_i (P_{i,t-1} + A_{i,t-1}) * N_{i,t} + (R_t + A_{i,t-1}) * NC_t + CP_{i,t-1} * (N_t + NC_{i,t})}$$

Note: when  $t =$  drawing date,  $N_{i,t-1} = N_{i,t} + NC_{i,t}$

Interest Paid this Year (XD)

The interest paid this year calculation gives the accumulated income expressed as a percentage of the gross price index. It is reset at the start of each year. The interest paid calculation enables the total return index to be adjusted for portfolios subject to tax on income received.

$$XD_{ts} = 0$$

where  $ts =$  the time at the end of each calendar year

$$XD_t = xd_{t-1} + PI_{t-1} * \frac{\sum_i G_{i,t} * N_{i,t-1}}{\sum_i (P_{i,t-1} + A_{i,t-1}) * N_{i,t-1}}$$

where the summations are over the bonds currently in the index.

Average Coupon (CO)

$$CO_t = \frac{\sum_i C_{i,t} * N_{i,t}}{\sum_i N_{i,t}}$$

where the summations are over the bonds currently in the index.

### Average Life (L)

$$L_t = \frac{\sum_i L_{i,t} * N_{i,t}}{\sum_i N_{i,t}}$$

where the summations are over the bonds currently in the index.

### Average Duration (DU)

$$DU_t = \frac{\sum_i D_{i,t} * (P_{i,t} + A_{i,t}) * N_{i,t}}{\sum_i (P_{i,t} + A_{i,t}) * N_{i,t}}$$

where the summations are over the bonds currently in the index.

### Average Convexity (CX)

$$CX_t = \frac{\sum_i X_{i,t} * (P_{i,t} + A_{i,t}) * N_{i,t}}{\sum_i (P_{i,t} + A_{i,t}) * N_{i,t}}$$

where the summations are over the bonds currently in the index.

### Average Redemption Yield (RY)

$$RY_t = \frac{\sum_i Y_{i,t} * D_{i,t} * (P_{i,t} + A_{i,t}) * N_{i,t}}{\sum_i D_{i,t} * (P_{i,t} + A_{i,t}) * N_{i,t}}$$

where the summations are over the bonds currently in the index. Yields are compounded according to the conventions of the market (for example, semi-annually in the UK and USA and annually in France).

### Average Redemption Yield - Annualised (RA)

This is calculated according to the previous formula, except that all yields are compounded annually. This facilitates cross-country comparisons.

### Average Current Yield (IY)

$$IY_t = \frac{100 * \sum_i C_{i,t} * N_{i,t}}{\sum_i P_{i,t} * N_{i,t}}$$

The current yield of a bond is also known as a flat, running or interest yield. It is given by:

where the summations are over the bonds currently in the index.

Market Value (MV)

$$MV_t = \sum_i (P_{i,t} + A_{i,t}) * N_{i,t}$$

where the summations are over the bonds currently in the index. The value is expressed in local currency, in thousands.