Guide to the EUROGOV® Bond Indices

Formerly known as Guide to the Deutsche Börse EUROGOV® Indices

Version 3.2

October 2019

General Information

With effect to August 2019 Deutsche Börse AG has transferred the administration of the EUROGOV® Bond Indices formerly known as the EUROGOV® Indices of Deutsche Börse AG to its affiliate STOXX Ltd.

STOXX Ltd. develops, creates and publishes Indices for certain uses, e.g., the issuance of Financial Instruments. In general, an Index is any figure published or made available to the public that is regularly determined by the application of a formula (or any other method of calculation, or by an assessment) on the basis of the value of one or more underlying assets or prices, including estimated prices, actual or estimated interest rates, quotes and committed quotes, or other values or survey.

All EUROGOV® Bond Indices are governed by the respective index methodology applicable to the respective index or index family. Purpose of this Guide **"**Guide**"** is to provide for a comprehensible index methodology in continuity of the former Guide to EUROGOV® Indices of Deutsche Börse AG as last amended with effect from October 2018 (version 2.0).

In order to ensure the highest quality of each of its indices, STOXX Ltd. exercises the greatest care when compiling and calculating fixed income indices on the basis of the rules set out in this Guide.

However, STOXX Ltd. cannot guarantee that the various indices, or the various ratios that are required for index compilation and computation purposes, as set out in this Guide, are always calculated free of errors. STOXX Ltd. accepts no liability for any direct or indirect losses arising from any incorrect calculation of such indices or ratios.

The EUROGOV® Bond Indices in no way represent a recommendation for investment. In particular, the compilation and calculation of the various indices shall not be construed as a recommendation of STOXX Ltd. to buy or sell individual securities, or the basket of securities underlying a given index.

Contents

Changes to the Rules and Regulations:

All amendments listed with effect prior to August 2019 are amendments to the Rules and Regulations of the former Deutsche Börse EUROGOV Indices.

Amendments listed as of August 2019 are amendments to the Rules and Regulations of STOXX Ltd. in continuation of the Rules and Regulations of the former Deutsche Börse EUROGOV Indices.

March 2009	Introduction Deutsche Börse EUROGOV® Germany Indices
January 2011	Introduction Deutsche Börse EUROGOV® France Indices
Novermber 2011	Modification of calculation rules for Deutsche Börse EUROGOV® Germany Money Market Index in order to cap the average residual life of the Index to 6 months
October 2013	Introduction cost factor
December 2014	Clarification relating to IOSCO principles
October 2017	Include liquidity requirements
October 2018	Change of cap level, minimum requirements for cash in the Money Market Index and cost factor formula
August 2019	Clarification relating to EU Benchmark Regulation and changes relating to the transfer of index administration to STOXX Ltd.
October 2019	Clarifications relating to changes in the EONIA rate determination

1 EUROGOV® Indices – Overview

The EUROGOV® Bond Indices reflects the market for fixed income bonds denominated in Euro, is computed based on composite, non-binding quote based, market data from Tradeweb® which is a registered multilateral trading facility (MTF). The Tradeweb® market data is provided to STOXX Ltd. by Refinitiv, previously Financial and Risk business of Thomson Reuters, as data vendor. STOXX Ltd. is responsible for the calculation and distribution of the various indices. The indices are designed as selection indices and measure the investment performance in the market segment of highly liquid government bonds in the Eurozone.

In the field of German government bonds, the EUROGOV® Germany Money Market index measures the investment success for highly liquid government bonds of the Federal Republic of Germany in the money market segment.

The selection criteria for EUROGOV Germany indices guarantee high liquidity of the underlying bonds and easy replicability of the indices.

In the event of bond trading suspensions, the last available market data are used.

2 EUROGOV® Index Rules

2.1 Index Concept

For the EUROGOV® indices (except for Germany EUROGOV® Money Market) bonds with a maturity of at least one year are considered. Therewith, the medium- and long-term segments of the capital market are covered.

EUROGOV® Germany Money Market includes bonds with a remaining maturity of at least two months and a maximum of one year representing the money market segment.

For index admission, the minimum outstanding volume of bonds is €4bn. Zero bonds are excluded from the indices.

2.2 Calculated Indices

For all countries, the following maturity buckets[1] are calculated and distributed: 1-3, 1-10, 3-5, 5-10, and over 10 years.

For German government bonds, the maturity range between two months and one year (Money Market) is calculated additionally.

2.3 Basis

The base date of EUROGOV® indices is 31 January 1999 with a base value of 100.

2.4 Review of Index Composition

The composition of the EUROGOV® indices is reviewed quarterly (end of January, April, July and October) except for the EUROGOV® Germany Money Market index which is adjusted monthly. The adjustment is carried out described as follows.

1. Selection of bonds

   All bonds that meet the index criteria at the rebalancing date (end of month) represent the universe of eligible bonds.

2. Adjustment of index composition

   Each bond is assigned to the corresponding indices according to the classification criteria. The eligibility for a selection index is determined on the basis of a ranking list. For each index, all eligible bonds are ranked according to outstanding nominal issue size. In case of equal outstanding issue sizes, priority is given to the newer bond. The EUROGOV® indices contain maximum the first 15 bonds of this ranking list. In case there are less than 15 bonds satisfying the inclusion criteria, they all are included in the index.

[1] Each inclusive maturity-minimum level and exclusive maturity-upper limit.

3. Adjustment of the weighting of bonds

A bond is weighted in the index based on its market capitalization. Changes of the outstanding nominal volume in the index are adjusted during the review of the index composition.

4. Cap Limit

Capping is a procedure that restricts the weighting of index constituents and prevents single bonds from dominating the index. The weight of a bond in the index is capped to 25 percent at the rebalancing date. In case 4 or fewer bonds satisfy the admission criteria of an index, included bonds are weighted equally.
For EUROGOV® Germany Money Market-Index special weighting rules apply. For details, see section 3.3.

5. Liquidity requirements

For the bond indices, no explicit liquidity filter is applied. The applied selection criteria of the index constituents facilitate the selection of liquid constituents due to filtering by issuer, country as well as minimum nominal amount outstanding for a bond. Consequently, stricter constraints on the selection criteria favour the selection of the most liquid constituents for the index.

2.5 Index Calculation

2.5.1 Calculation Times and Frequency

The indices are calculated and distributed every minute between 9 a.m. and 5 p.m. CET. Index calculation is based on the Xetra® trading calendar.

2.5.2 Settlement Convention

All EUROGOV® indices are calculated assuming t+0 settlement.

2.5.3 Publication

STOXX Ltd. publishes daily closing index levels and analytics at www.dax-indices.com.

All data related to the new index composition is published online in the evening of the index rebalancing.

2.5.4 Calculation Correction

This section outlines the rules and procedures applicable in case of a calculation error, meaning the provision of index values, usage of index constituents or other elements or the application of weightings, capping, or other aspects of the index methodology in a manner that is not in line with this index methodology, e.g. due to a mistake, incorrect input data, etc.

2.5.4.1 Rule-based Correction

STOXX Ltd. corrects a Calculation Error without delay on the dissemination day it occurred, provided that STOXX Ltd. becomes aware of such Calculation Error before 15:30 CET of that

dissemination day and insofar as technically and operationally feasible. STOXX Ltd. does not change intraday index composition of an index.

If STOXX Ltd. became aware of a Calculation Error at or after 15:30 CET, STOXX Ltd. aims at correcting the Calculation Errors as of the end of the next dissemination day, including corrections to index constituents.

STOXX Ltd. amends without undue delay previous incorrect index values or input data only if they are required for the subsequent index values calculation. Incorrect real-time index values disseminated before the effective time of the correction are not restated.

2.5.4.2 Non-rule based Correction

If the above-outlined rule-based error correction cannot be applied, the IGC assesses without undue delay:

- if and how the Calculation Error should be corrected, including if the index shall be restated, and/or
- if the dissemination of index values shall be suspended (Discretionary Rule, see Section 7.5).

An index should be restated, when the performance of the index (other than Selection Indices) can no longer be replicated. A suspension of index dissemination is triggered when IGC decides that the correction will take significant time during which misleading index values could lead to financial, legal and reputational risks (Discretionary Rule, see Section 7.5).

STOXX Ltd. suspends the dissemination of an index at the latest at the end of the dissemination day after it became aware of a Calculation Error, if the Calculation Error has not been corrected by then.

STOXX Ltd. will resume the dissemination of the index as soon as the correct index calculation is feasible, and the correct historical values are available.

2.5.4.3 Notifications

In general, notifications take the form of an announcement on the DAX website (http://www.dax-indices.com). Announcements can (but need not, depending on the decision of STOXX Ltd.) be published via relevant financial media.

With regard to Calculation Errors, STOXX Ltd. issues notifications in accordance with the following rules:

- STOXX Ltd. will publish a notification before correcting a Calculation Error. Notifications are effective immediately following their issuance, unless otherwise specified in the notification.
- The notification will specify if a Calculation Error will be corrected retrospectively. In case of retrospective correction, STOXX Ltd. will publish the notification using the new end of day closing price.
- If STOXX Ltd. decides under Section 2.5.4.2 that index dissemination is suspended until the Calculation Error is corrected, a resume notification is published specifying the point in time when index dissemination is resumed and the correction will take place.

STOXX Ltd. will refrain from the issuance of a notification if it reaches the view that the issuance of a notification is not in line with the applicable laws and may decide to issue such Notification

at a later point in time when such reasons have lapsed (Discretionary Rule, see Section 7.5). By reason of force majeure or other events beyond the control of STOXX Ltd. it might become impossible for STOXX Ltd. to issue a notification in due time or by the means set out herein. In such cases STOXX Ltd. may exceptionally issue the notification either subsequently immediately following such event or in any case by other means (Discretionary Rule, see Section 7.5).

2.5.5 Index Termination Policy

For termination of an index or an index family that underlie financial products issued on the market, to the knowledge of STOXX Ltd., a market consultation will be conducted by STOXX Ltd. in advance of the termination. The length of the consultation period will be defined in advance based on the specific issues of each proposed termination subject to STOXX Benchmark Transition Policy (Discretionary Rule, see Section 7.5). During the consultation period, clients and third parties will have the chance to share their concerns regarding the termination of the index or index family. Based on the collected feedback, STOXX Ltd. may rethink its decision to terminate an index or an index family (Discretionary Rule, see Section 7.5). At the end of the consultation period, STOXX Ltd. will publicly announce its final decision about the termination. A transition period will be granted in the event of termination (Discretionary Rule, see Section 7.5).

For termination of an index or an index family that do not underlie financial products issued on the market, no market consultation will be conducted.

3 Index Formula

The EUROGOV® indices are calculated as so-called basket indices, implying that each index is based on real bonds. This makes it easy to track the index performance[2].

The indices are based on a volume weighted summation concept that analyzes relative changes in value compared to a reference date. The composition and volume of the index portfolio are adjusted at this date. Therefore, corresponding adjustments to index tracking portfolios are only required only at the respective reference date. The outstanding issue size of each bond is used for index weighting.

To ensure the continuous update of the indices, STOXX Ltd. calculates price and total return indices based on bid quotes. Newly issued bonds enter the indices with the last known binding ask quote from the previous month. These bid and ask quotes are binding, non-indicative quotes and provide high quality information about the current price level.

Bonds which are already in the index and whose weight increases as a result of rebalancing are valued at the bid price. In reality, if a portfolio manager would track the index, those bonds will be purchased at the ask price, which implies tracking cost. In order to offset this effect and to reflect the costs accordingly, a cost factor is applied to the price and total return indices.

3.1 Price Index

Price indices are calculated as follows:

$$PI_t = PI_{t-m} \cdot \frac{\sum_{i=1}^{n} P_{i,t} \cdot N_{i,t-k}}{\sum_{i=1}^{n} P_{i,t-s} \cdot N_{i,t-k}} \cdot CF_{PI}$$

Whereby: $$CF_{PI} = \frac{\sum_{i=1}^{n} N_i^+ \cdot P_i^B}{\sum_{i=1}^{n} N_i^- \cdot P_i^B} \cdot \frac{\sum_{i=1}^{n} N_i^- \cdot P_i^{B/A}}{\sum_{i=1}^{n} N_i^+ \cdot P_i^{B/A}}$$

$$P_i^{A/B} = \begin{cases} P_i^A, & \frac{N_i^+ \cdot P_i^B}{\sum_{i=1}^{n} N_i^+ \cdot P_i^B} > \frac{N_i^- \cdot P_i^B}{\sum_{i=1}^{n} N_i^- \cdot P_i^B} \Leftrightarrow w_i^+ > w_i^- \\ P_i^B, & \text{else} \end{cases}$$

2 The calculation methodology applied for EUROGOV® indices is in line with the standards laid down by the "European Federation of Financial Analysts Societies" (EFFAS). For a detailed overview, cf. Patrick J. Brown (2002): "Constructing and Calculating Bond Indices – A Guide to the EFFAS European Bond Commission Standardized Rules", 2nd Edition, Cambridge, England, 2002.

3.2 Total Return Index

For total return indices, the monthly adjustment involves the reinvestment of coupon payments in the overall portfolio at the reference date fixed for any adjustment of the index composition. Consequently, total return indices are calculated as follows:

$$TR_t = TR_{t-m} \cdot \frac{\sum_{i=1}^{n}\left(P_{i,t} + A_{i,t} + G_{i,t}\right)\cdot N_{i,t-k}}{\sum_{i=1}^{n}\left(P_{i,t-s} + A_{i,t-s}\right)\cdot N_{i,t-k}} \cdot CF_{TR}$$

Whereby: $$CF_{TR} = \frac{\sum_{i=1}^{n} N_i^{+}\cdot\left(P_i^{B} + A_i\right)}{\sum_{i=1}^{n} N_i^{-}\cdot\left(P_i^{B} + A_i\right)} \cdot \frac{\sum_{i=1}^{n} N_i^{-}\cdot\left(P_i^{B/A} + A_i\right)}{\sum_{i=1}^{n} N_i^{+}\cdot\left(P_i^{B/A} + A_i\right)}$$

$$P_i^{A/B} = \begin{cases} P_i^{A}, & \frac{N_i^{+}\cdot\left(P_i^{B} + A_i\right)}{\sum_{i=1}^{n} N_i^{+}\cdot\left(P_i^{B} + A_i\right)} > \frac{N_i^{-}\cdot\left(P_i^{B} + A_i\right)}{\sum_{i=1}^{n} N_i^{-}\cdot\left(P_i^{B} + A_i\right)} \Leftrightarrow w_i^{+} > w_i^{-} \\ P_i^{B}, & \text{else} \end{cases}$$

3.3 Special Calculation EUROGOV® Germany Money Market index

3.3.1 Weighting of EUROGOV® Germany Money Market Index

The weighted average time to maturity of EUROGOV® Germany Money Market index should not exceed 6 months. Whenever this happens and under consideration of the capping level of 25% per bond, the index requires further adjustments.

At each rebalancing, the EUROGOV® Germany Money Market index consist of minimum 16% cash.

The following weighting mechanism is implemented to fulfil both the residual life and weight constraints:

1. Selection of the first 15 bonds by notional outstanding

a. The weight of the cash component is set to 16%, the rest 84% are redistributed to the bond constituents:

$$w_{cash} = 16\%$$

$$w_i^{std} = \frac{N_{i,t-s}\cdot\left(P_{i,t-s}+A_{i,t-s}\right)}{\sum_i^n N_{i,t-s}\cdot\left(P_{i,t-s}+A_{i,t-s}\right)}\cdot\left(1 - w_{cash}\right)$$

b. The weight of each component is checked against the cap of 25%

$$w_i^{std} < 25\%$$

c. Check that the index YtM (Years to Maturity) does not exceed 0.5

$$YtM_{Index}^{std} < 0.5$$

$$YtM_{Index}^{std} = \sum_{i=1}^{n} w_i^{std} \cdot YtM_i$$

If both requirements are fulfilled the index weights are defined as $\boldsymbol{w_i^{std}}$; if **1.c.** is not fulfilled the mechanism continues with step **2.**; otherwise the mechanism continues with step **3,** where $w_i^* = w_i^{std}$.

2. The selection from point **1.)** undergoes a bucketing process based on Years to Maturity (2 buckets, for YtM above or below 0.5)

a. YtM (YtM_B) for left and right bucket ($\boldsymbol{B} = \{\boldsymbol{L}, \boldsymbol{R}\}$) are calculated, as well as their share of the total market value of the index (w_B).

$$YtM_B = \frac{\sum_{i \in B} N_{i,t-s} \cdot \left(P_{i,t-s} + A_{i,t-s}\right) \cdot YtM_i}{\sum_{i \in B} N_{i,t-s} \cdot \left(P_{i,t-s} + A_{i,t-s}\right)} \cdot (1 - w_{cash})$$

$$w_B = \frac{\sum_{i \in B} N_{i,t-s} \cdot \left(P_{i,t-s} + A_{i,t-s}\right)}{\sum_{i}^{n} N_{i,t-s} \cdot \left(P_{i,t-s} + A_{i,t-s}\right)}$$

b. A scaling ratio of the two buckets is calculated in order to set the average YtM of the index to 0.5

$$wgt_L = \frac{0.5 - YtM_R}{YtM_L - YtM_R}$$

$$wgt_R = 1 - wgt_L$$

c. The selection is rescaled using the respective factors calculated in 2.b. and the adjusted weights, $\boldsymbol{w_i^*}$, are calculated. After that step **3.** is implemented.

$$w_i^* = \frac{w_i^{std} \cdot wgt_B}{w_B}$$

3. The rescaled selection undergoes the capping process if necessary:

a. Each bond's weight is checked and the need for capping is determined

($IsCappedBond_i$).

$$IsCappedBond_i = \begin{cases} 1, & if\ w_i^* > 25\% \text{ (cap to individual bond's weight)} \\ 0, & otherwise \end{cases}$$

b. For each bucket, the sum of weights of the bonds to be capped ($\boldsymbol{SumWeightExceedingBonds_B}$) and the number of bonds being capped is calculated ($\boldsymbol{NrCappedBonds_B}$).

$$SumWeightExceedingBonds_B = \sum_{i \epsilon B} w_i^* \cdot IsCappedBond_i$$

$$NrCappedBonds_B = \sum_{i \epsilon B} IsCappedBond_i$$

$i \in B$ bond i, element of bucket B

c. Within each bucket, the excess weight ($\boldsymbol{ExceedingWeight_B}$) is proportionally redistributed across the bonds not being capped ($\boldsymbol{w_i^{**}}$) through an $\boldsymbol{AdjFactor_B}$.

$$ExceedingWeight_B = wgt_B.(1 - w_{cash}) - SumWeightExceedingBonds_B$$

$$AdjFactor_B = 1 + \frac{SumWeightExceedingBonds_B - Cap \cdot NrCappedBonds_B}{ExceedingWeight_B}$$

$$w_i^{**} = \begin{cases} Cap, if\ IsCappedBond_i = 1 \\ w_i^* \cdot AdjFactor_B, otherwise \end{cases}$$

This step is iteratively repeated until all bonds in the bucket have a weight not exceeding the cap.

Any residual weight that cannot be allocated without breaching the cap, will be invested in EONIA[3]: this operation is included in step **4**.

4. To ensure that index YtM does not exceed 6 months (could be a consequence of point **3.**), final weights ($\boldsymbol{w_i^{***}}$) are calculated and residual weight is allocated to EONIA ($\boldsymbol{w_{cash}^{***}}$)

$$YtM_{Index}^{**} = \sum_{i=1}^{n} w_i^{**} \cdot YtM_i$$

$$w_i^{***} = w_i^{**} \cdot min\left\{1, \frac{0.5}{YtM_{Index}^{**}}\right\}$$

$$w_{cash}^{***} = 1 - \sum_{i=1}^{n} w_i^{***}$$

$$cash_{t-s} = w_{cash}^{***} \cdot \sum_{i=1}^{n} N_{i,t-s} \cdot \left(P_{i,t-s} + A_{i,t-s}\right) \cdot 100$$

Where:

$i = 1, \ldots, n$

$B = \{L, R\}$ Set of bonds that belong to the bucket with residual YtM up to and including 6 months (L) or above 6 months (R)

[3] Calculated as the European short-term rate (€STR) + 8.5 bps.

$$L = \{i: YtM_i \leq 0.5\}$$

$$R = \{i: YtM_i > 0.5\}$$

3.3.2 Calculation of the EUROGOV® Germany Money Market Price Index

The Price Index is calculated taking into account the cash component ($\boldsymbol{cash_{t-s}}$) determined in section 3.3.1.

$$PI_t = PI_{t-m} \cdot \frac{\sum_{i=1}^{n} P_{i,t} \cdot N_{i,t-s} + cash_{t-s}}{\sum_{i=1}^{n} P_{i,t-s} \cdot N_{i,t-s} + cash_{t-s}} \cdot CF_{PI}$$

Whereby: $$CF_{PI} = \frac{\sum_{i=1}^{n} N_i^+ \cdot P_i^B + cash_{t-s}^+}{\sum_{i=1}^{n} N_i^- \cdot P_i^B + cash_{t-s}^-} \cdot \frac{\sum_{i=1}^{n} N_i^- \cdot P_i^{B/A} + cash_{t-s}^-}{\sum_{i=1}^{n} N_i^+ \cdot P_i^{B/A} + cash_{t-s}^+}$$

$$P_i^{A/B} = \begin{cases} P_i^A, & \frac{N_i^+ \cdot P_i^B}{\sum_{i=1}^{n} N_i^+ \cdot P_i^B + cash_{t-s}^+} > \frac{N_i^- \cdot P_i^B}{\sum_{i=1}^{n} N_i^- \cdot P_i^B + cash_{t-s}^-} \\ & \Leftrightarrow w_i^+ > w_i^- \\ P_i^B, & \text{else} \end{cases}$$

3.3.3 Calculation of the EUROGOV® Germany Money Market Total Return Index

For total return index, the monthly adjustment involves the reinvestment of coupon payments in the overall portfolio at the reference date fixed for any adjustment of the index composition. Although the cash component in the index is invested for a period of 1 month until the next rebalancing date (EONIA rate), the change in its value is partially reflected in the daily index performance. Consequently, the Total Return Index is calculated as follows:

$$TR_t = TR_{t-m} \cdot \frac{\sum_{i=1}^{n}\left(P_{i,t} + A_{i,t} + G_{i,t}\right) \cdot N_{i,t-s} + cash_{t-s} \cdot \left(1 + r_{t-s}^{1d} \cdot \frac{days_{t-m,t}}{360}\right)}{\sum_{i=1}^{n}\left(P_{i,t-s} + A_{i,t-s}\right) \cdot N_{i,t-s} + cash_{t-s}} \cdot CF_{TR}$$

Whereby: $$CF_{TR} = \frac{\sum_{i=1}^{n} N_i^+ \cdot \left(P_i^B + A_i\right) + cash_{t-s}^+}{\sum_{i=1}^{n} N_i^- \cdot \left(P_i^B + A_i\right) + cash_{t-s}^- \cdot \left(1 + r_{t-s}^{1d} \cdot \frac{days_{t-m,t}}{360}\right)} \cdot \frac{\sum_{i=1}^{n} N_i^- \cdot \left(P_i^{B/A} + A_i\right) + cash_{t-s}^- \cdot \left(1 + r_{t-s}^{1d} \cdot \frac{days_{t-m,t}}{360}\right)}{\sum_{i=1}^{n} N_i^+ \cdot \left(P_i^{B/A} + A_i\right) + cash_{t-s}^+}$$

$$P_i^{A/B} = \begin{cases} P_i^A, & \dfrac{N_i^+ \cdot \left(P_i^B + A_i\right)}{\sum_{i=1}^n N_i^+ \cdot \left(P_i^B + A_i\right) + cash_{t-s}^+} > \dfrac{N_i^- \cdot \left(P_i^B + A_i\right)}{\sum_{i=1}^n N_i^- \cdot \left(P_i^B + A_i\right) + cash_{t-s}^- \cdot \left(1 + r_{t-s}^{1d} \cdot \frac{days_{t-m,t}}{360}\right)} \\ & \Leftrightarrow w_i^+ > w_i^- \\ P_i^B, & \text{else} \end{cases}$$

4 Index Analytics

There are several analytics that are calculated in addition to the index values. The following analytics are calculated and distributed for each index separately:

4.1 Average Yield

The average yield is calculated, weighting the yield of each bond by the corresponding market capitalization and duration of the respective bond.

$$RY_t = \frac{\sum_{i=1}^{n} Y_{i,t} \cdot \left(P_{i,t} + A_{i,t}\right) \cdot N_{i,t-s} \cdot D_{i,t}}{\sum_{i=1}^{n} \left(P_{i,t} + A_{i,t}\right) \cdot N_{i,t-s} \cdot D_{i,t}}$$

4.2 Average Duration

The average duration is calculated, weighting the duration of each bond by the corresponding market capitalization of the respective bond.

$$DU_t = \frac{\sum_{i=1}^{n} D_{i,t} \cdot \left(P_{i,t} + A_{i,t}\right) \cdot N_{i,t-s}}{\sum_{i=1}^{n} \left(P_{i,t} + A_{i,t}\right) \cdot N_{i,t-s}}$$

4.3 Average Modified Duration

Calculation of the average modified duration is in line with the previously-described calculation process for the average duration.

$$MDU_t = \frac{\sum_{i=1}^{n} MD_{i,t} \cdot \left(P_{i,t} + A_{i,t}\right) \cdot N_{i,t-s}}{\sum_{i=1}^{n} \left(P_{i,t} + A_{i,t}\right) \cdot N_{i,t-s}}$$

4.4 Average Convexity

Calculation of the average convexity is in line with the previously described calculation process for the average duration and average modified duration.

$$CX_t = \frac{\sum_{i=1}^{n} X_{i,t} \cdot \left(P_{i,t} + A_{i,t}\right) \cdot N_{i,t-s}}{\sum_{i=1}^{n} \left(P_{i,t} + A_{i,t}\right) \cdot N_{i,t-s}}$$

4.5 Average Coupon

The average coupon is calculated, weighting the coupon of each bond by its outstanding issue size.

$$CO_t = \frac{\sum_{i=1}^{n} C_{i,t} \cdot N_{i,t-s}}{\sum_{i=1}^{n} N_{i,t-s}}$$

4.6 Average Remaining Years to Maturity

Calculation of the average remaining years to maturity is in line with the previously-described calculation process for the average coupon (i.e. weighting on the basis of outstanding issue size).

$$LF_t = \frac{\sum_{i=1}^{n} L_{i,t} \cdot N_{i,t-s}}{\sum_{i=1}^{n} N_{i,t-s}}$$

4.7 Nominal Value

The cumulated nominal value of all bonds at time t is calculated as follows:

$$NV_t = \sum_{i=1}^{n} N_{i,t-s}$$

4.8 Market Value

The cumulated market value of all bonds at time t is calculated as follows:

$$MV_t = \sum_{i=1}^{n} \left(P_{i,t} + A_{i,t} + XD_{i,t-s} \cdot CP_{i,t}\right) \cdot N_{i,t-s}$$

4.9 Base Market Value

The cumulated base market value (i.e. market value as at the base date) of all bonds is calculated as follows:

$$MV_0 = \sum_{i=1}^{n} \left(P_{i,t-s} + A_{i,t-s} + XD_{i,t-s} \cdot CP_{i,t-s}\right) \cdot N_{i,t-s}$$

5 Bond Analytics

There are several bond analytics that are calculated in addition to the index values and index analytics.

5.1 Yield

The yield of a bond at time t is calculated as follows:

$$P_{i,t} + A_{i,t} = \sum_{j=1}^{k} CF_{i,j} \cdot (1+Y_{i,t})^{-L_{i,t,j}}$$

The Newton iteration method is used to solve the equation for $Y_{i,t}$.

5.2 Duration

The duration of a bond at time t is calculated as follows:

$$D_{i,t} = \frac{\sum_{j=1}^{n} CF_{i,j} \cdot L_{i,t,j} \cdot \left(1 + Y_{i,t}\right)^{-L_{i,t,j}}}{\sum_{j=1}^{n} CF_{i,j} \cdot \left(1 + Y_{i,t}\right)^{-L_{i,t,j}}} = \frac{1}{P_{i,t} + A_{i,t}} \cdot \sum_{j=1}^{n} CF_{i,j} \cdot L_{i,t,j} \cdot \left(1 + Y_{i,t}\right)^{-L_{i,t,j}}$$

5.3 Modified Duration

The modified duration of a bond at time t is calculated as follows:

$$MD_{i,t} = D_{i,t} \cdot \frac{1}{1 + Y_{i,t}}$$

5.4 Convexity

The convexity of a bond at time t is calculated as follows:

$$X_{i,t} = \frac{1}{P_{i,t} + A_{i,t}} \cdot \sum_{j=1}^{n} L_{i,t,j} \cdot \left(L_{i,t,j} + 1\right) \cdot CF_{i,j} \cdot \left(1 + Y_{i,t}\right)^{-\left(L_{i,t,j}+2\right)}$$

6 Limitations

This section applies in the event of Limitations that occur in case of

- insufficient rules meaning, the absence of a methodology rule, provision or procedure which leads to the failure of determining the respective index value or which leads to an index value that does not properly reflect the concept / nature of the index, e.g.:
  - performance of the index can no longer be physically replicated;
  - insufficiently available index constituents to fulfil the requirements of the Index Methodology; or
  - market disruption which results in the performance of the index being unable to be tracked,
- unclear rules, meaning a situation in which the rules leave multiple possible interpretations on how a certain rule shall be applied to a specific situation
- failing to produce index values as intended,
- data insufficiency, meaning a scenario in which the calculation of an index is no longer possible due to insufficient data quantity or quality, and
- extreme market events, meaning events that by their nature cannot be foreseen or whose impact on an index or the economic reality the index represented cannot be determined in advance. Examples may be, but are not limited to, the following: (i) a country announces changes to its currency convertibility or restrictions on capital flows; (ii) a country experiences a market disruption, an event that materially negatively influences the aggregated liquidity and market capitalization of entire markets.

If a Limitation has occurred, the IGC shall decide if and how the Limitation shall be rectified (Discretionary Rule, see Section 7.57.5). Any such rectification may comprise deviations from the index methodology which may apply as long as the Limitation persists (Discretionary Rule, see Section 7.5).

If a decision to deviate from the index methodology is taken, it will be communicated as soon as possible soon as possible in form of an Announcement or Press Release. STOXX Ltd. will refrain from the issuance of a notification if it reaches the view that the issuance of a notification is not in line with applicable laws and may decide to issue such notification at a later point in time when such reasons have lapsed (Discretionary Rule, see Section 7.5). By reason of force majeure or other events beyond the control of STOXX Ltd. it might become impossible for STOXX Ltd. to issue a notification in due time or by the means set out herein. In such cases STOXX Ltd. may exceptionally issue the notification either subsequently immediately following such event or in any case by other means.

Any measures will be implemented two dissemination days later and will enter into effect the next dissemination day after implementation, unless a different effective date is specified in the notification

7 Methodology Review

The purpose of the methodology review is to maintain integrity of the index, i.e. that the index methodology remains executable and results in an accurate and reliable representation of the market / economic realities the index seeks to measure.

7.1 Frequency of Review

In order to ensure the index integrity is maintained, the methodology is reviewed annually and ad hoc if a Limitation has occurred. If a Limitation cannot be addressed with by a methodology review, this may give rise to an index cessation or index transition. STOXX Ltd. shall not be liable for any losses arising from any decisions taken as part of a methodology review.

7.2 Review Procedure

7.2.1 Initiation of Methodology Review

The IMC proposes an annual methodology review schedule for approval by the IGC (Discretionary Rule, see Section 7.5Error! Reference source not found.).

The IMC is in charge of initiating ad hoc methodology reviews in case of a Limitation or based on recommendations to initiate a Methodology Review by other STOXX Ltd. Committees (Discretionary Rule, see Section 7.5).

7.2.2 Decision and Escalation

The following STOXX Ltd. Committees are responsible for making the decisions on amendments to an index methodology:

The IMC decides on changes to the index methodology, unless

a. a material change to the index methodology is proposed (see Section 7.3 below),
b. the change is triggered by an Unclear Rule or Insufficient Rule (as part of a Limitation, Section 6), or
c. financial products relating to the index have a notional value/notional amount of more than EUR 100 mn.

If the IMC is not in charge, the decision is taken by the IGC (i.e. in the cases set forth in a) to c) above).

7.3 Material Changes with Consultation

As described in the STOXX Changes to Methodology Policy, prior to proposed material changes to the index methodology a consultation will be performed.

A change to an index methodology shall be considered material in the event of

- a change in the index objective or market/economic reality the index aims to represent (e.g. market leader components vs. mid cap companies),
- a change which affects the composition and weighting rules of an Index,

- a change in the calculation methods and formulas,
- a change in the rules regarding the rebalancing of the weights of index constituents by application of the index methodology,
- a change in the rules regarding the review of index constituents and their respective weights by application of the index methodology, and/or
- rules regarding a change in the adjustment of the weights of the index constituents or the composition of the index constituents of Bond Indices due to certain issuer related events,

resulting in a significant change of the concept / nature of the index. The IMC determines whether an amendment is material as defined. In cases where the materiality cannot clearly be assessed the IMC is responsible for making the decision (Discretionary Rule, see Section 7.5).

STOXX Ltd. consults a proposed material change with reasonably affected licenses/investors. A licensee shall be considered affected if he has licensed the respective index. An investor shall be considered affected if he owns contracts or financial instruments that reference the respective index. Taking into account the principle of proportionality, STOXX Ltd. informs affected licenses/investors as follows:

- licensees either directly and/or via public consultation;
- investors either via licensees affected by the material change and/or via public consultation.

STOXX Ltd. shall inform affected licensees and investors of the key elements of the index methodology that will in its view be impacted by a proposed material change and information on the rationale for any proposed material change including an assessment as to whether the representativeness of the index and its appropriateness for its intended use are put at risk in case the proposed material change is not put in place.

The consultation shall enable investors and licensees to submit comments. The standard consultation period shall be at least 1 month with the option to extend this period (Discretionary Rule, see Section 7.5). The IGC may decide to shorten the 1-month period (Discretionary Rule, see Section 7.5) in the following cases:

- in urgent cases, such as a situation in which the index cannot be replicated anymore;
- in situations where there is no known licensee / investor impact or only a limited number of affected licensees / investors;
- in order to align the effective date of a proposed changed with an Index Rebalancing, Index Review, and Issuer-related Adjustments, or
- any other similar cases.

The IGC in accordance with this Section 7.3 will consider the feedback received and decide whether the material change shall become effective (Discretionary Rule, see Section 7.5). The IGC is not bound by any feedback received. If the received feedback is ambiguous, the IGC may decide to conduct another consultation (Discretionary Rule, see Section 7.5). If no

licensee / investor participate in the consultation, the consulted material change shall enter into effect as outlined in the consultation material.

If the IGC decides that a material change shall become effective, STOXX Ltd. will communicate a timeline on the implementation of the material change, if not already communicated in the consultation material. The decision will be communicated as soon as possible in the form of an Announcement or Press Release. STOXX Ltd. will refrain from issuance of a notification if it reaches the view that the issuance of a notification is not in line with applicable laws and may decide to issue such Notification at a later point in time when such reasons have lapsed (Discretionary Rule, see Section 7.5). By reason of force majeure or other events beyond the control of STOXX Ltd. it might become impossible for STOXX Ltd. to issue a notification in due time or by the means set out herein. In such cases STOXX Ltd. may exceptionally issue the notification either subsequently immediately following such event or in any case by other means.

At the end of each consultation STOXX Ltd. will make available the feedback received from licensees / investors in the consultation together with a summary of its response to that feedback, except where confidentiality has been requested by the respective licensee / investor.

7.4 Non-Material Changes without Consultation

Non-material changes of the index methodology, including a description of the impact and the rationale, will be announced via Announcement or Press Release, effective immediately following publication, unless otherwise specified in the notification (Discretionary Rule, see Section 7.5). STOXX Ltd. will refrain from the issuance of a notification if it reaches the view that the issuance of a notification is not in line with applicable laws and may decide to issue such Notification at a later point in time when such reasons have lapsed (Discretionary Rule, see Section 7.5). By reason of force majeure or other events beyond the control of STOXX Ltd. it might become impossible for STOXX Ltd. to issue a notification in due time or by the means set out herein. In such cases STOXX Ltd. may exceptionally issue the notification either subsequently immediately following such event or in any case by other means.

7.5 Discretion

Save for the cases expressly described in this Guide, the index methodology is entirely rule-based and automatic. Discretion only applies if expressly stated and must be exercised as provided for in this Guide.

Discretion may only be exercised with a view to resolve issues arising in maintaining the prevailing index methodology in response to unanticipated events, with an overarching aim to accurately and reliably measure the market or economic realities as defined in this Guide.

In accordance with BMR, discretion shall be exercised in line with the following principles:

- The body or person(s) exercising discretion must not be affected by a conflict of interest;
- The body or person(s) exercising discretion must have the requisite skills, knowledge and experience to exercise such discretion;
- All facts and circumstances relevant for the exercise of discretion must have been established and properly documented prior to the exercise of discretion;
- The exercise of discretion must comply with all applicable laws and regulations;
- The body or person(s) exercising discretion must act on the basis of the relevant facts and circumstances only, must give proper weight to the various considerations and ignore irrelevant facts and circumstances;
- The body or person(s) exercising discretion must act with a view to maintain the integrity of the market or economic reality; and
- The body or person(s) exercising discretion must act honestly, reasonably, impartially and in good faith.

Discretionary Rule: *Any exercise of discretion must take into account the rationale of the index, the purpose of the rules with regard to which discretion is exercised, the objective to preserve market integrity and reliability of the index calculation to avoid undue market impact, the technical feasibility and economic reasonability, and the interest of licensees or investors.*

The cases in which STOXX Ltd. may exercise discretion regarding the index methodology and its application are noted in the respective rules of this Guide.

The following bodies are involved in the decision-making process relevant for the indices governed by this Guide:

- Product Initiation Committee (PIC),
- Product Approval Committee (PAC),
- Index Operations Committee (IOC),
- Index Management Committee (IMC),
- Index Governance Committee (IGC),
- Oversight Committee (OC),
- Management Board (MB).

The following table summarizes the cases in which STOXX Ltd. Committee(s) may exercise discretion with regard to the index methodology and its application:

Case	Responsible STOXX Committee
Index Termination	IGC
Non-rule based Correction	IOC, IMC, IGC
Deviation from notification procedure regarding Calculation Errors	IOC, IMC, IGC
Determination of expected price to new shares in case of Subscription Rights on Other Share Classes	IGC
Procedure for Subscription Rights on Instruments with Embedded Options	IGC
Limitations	IGC
Annual methodology review schedule	IGC
Initiation of ad hoc methodology reviews	IMC
Determination regarding materiality of changes to the index methodology	IMC
Deviation from standard consultation period in case of material changes of the index methodology	IGC
Decision whether material change shall become effective	IGC
Decision to conduct another consultation in case of material changes of the index methodology	IGC, OC
Deviation from notification procedure in case of material changes of the index methodology	IGC
Deviations from notification procedure in case of non-material changes of the index methodology	IMC

8 Appendix

8.1 Index Overview

Overview of the EUROGOV® indices

	Index	Alpha (TR)[4]	ISIN (TR)	Alpha (PR)	ISIN (PR)
Germany	Deutsche Börse EUROGOV® Germany Money Market	3LE2	DE000A0S3QB2	3LEV	DE000A0S3P50
	Deutsche Börse EUROGOV® Germany 1-10	3LE1	DE000A0S3QA4	3LEU	DE000A0S3P43
	Deutsche Börse EUROGOV® Germany 1-3	3LEW	DE000A0S3P68	3LEQ	DE000A0S3P01
	Deutsche Börse EUROGOV® Germany 3-5	3LEX	DE000A0S3P76	3LER	DE000A0S3P19
	Deutsche Börse EUROGOV® Germany 5-10	3LEY	DE000A0S3P84	3LES	DE000A0S3P27
	Deutsche Börse EUROGOV® Germany 10+	3LEZ	DE000A0S3P92	3LET	DE000A0S3P35
France	Deutsche Börse EUROGOV® France 1-10	7D5J	DE000A0YK025	4D0U	DE000A0YKZA4
	Deutsche Börse EUROGOV® France 1-3	7D5I	DE000A0YK017	4D0T	DE000A0YKY95
	Deutsche Börse EUROGOV® France 3-5	7D5K	DE000A0YK033	4D0V	DE000A0YKZB2
	Deutsche Börse EUROGOV® France 5-10	7D5L	DE000A0YK041	4D0W	DE000A0YKZC0
	Deutsche Börse EUROGOV® France 10+	7D5M	DE000A0YK058	4D0X	DE000A0YKZD8

8.2 List of Formula Notations and Abbreviations

A_i = Accrued interest of bond i on the rebalancing day

$A_{i,t}$ = Accrued interest of bond i at time t

$A_{i,t-s}$ = Accrued interest of bond i on the last trading day of previous month

$C_{i,t}$ = Coupon of bond i at time t

$cash_{t-s}$ = Cash at rebalancing (at the end of last month)

$cash_{t-s}^{+}$ = Cash at rebalancing with the new composition

$cash_{t-s}^{-}$ = Cash at rebalancing with the old composition

$CF_{i,j}$ = Cash flow of bond i within period j

CF_{PI} = Cost factor price index, valid since last rebalancing date

CF_{TR} = Cost factor total return index, valid since last rebalancing date

CO_t = Average coupon at time t

CX_t = Average convexity at time t

$days_{t-m,t}$ = Calendar days between last calendar day of previous month and t

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

DU_t = Average duration at time t

[4] TR = Total Return Index, PR = Price Index

$G_{i,t}$	=	Value of a coupon payment on bond i at time t, made at the coupon date or within the period s. If there has been no payment within the respective month, the value equals zero
i	=	bond i = 1,...,n
k	=	number of future cash flows
$L_{i,t}$	=	Remaining years to maturity of bond i at time t
$L_{i,t,j}$	=	Time (in years) between time t and the cash flow of bond i within period j
LF_t	=	Average remaining years to maturity at time t
$MD_{i,t}$	=	Modified duration of bond i at time t
MDU_t	=	Average modified duration at time t
MV_t	=	Cumulated market value of all bonds at time t
MV_0	=	Cumulated base market value of all bonds
n	=	Number of bonds in the index
N_i^+	=	Outstanding issue size of bond i after rebalancing
N_i^-	=	Outstanding issue size of bond i before rebalancing
$N_{i,t-k}$	=	Notional amount (after capping procedure) of bond i at the time of last rebalancing
NV_t	=	Cumulated nominal value of all bonds at time t
$P_i^{A/B}$	=	Either closing ask or bid quote of bond i depending on the change in the weight resulting from the re-composition
P_i^A	=	Closing ask quote of bond i on the rebalancing day
P_i^B	=	Closing bid quote of bond i on the rebalancing day
$P_{i,t}$	=	Price or quotation of bond i at time t
$P_{i,t-s}$	=	Closing price or closing quotation of bond i on the last trading day of previous month
PI_t	=	Price index value at time t
PI_{t-m}	=	Price index value on the last calendar day of the previous month
r_{t-s}^{1d}	=	EONIA rate published at the time of last rebalancing in respect of day preceding the rebalancing date
RY_t	=	Average yield at time t
t	=	Calculation date
t-k	=	Time of the last index rebalancing
t-m	=	Last calendar day of previous month
t-s	=	Last trading day of previous month

TR_t	=	Total return index value at time t
TR_{t-m}	=	Total return index value on the last calendar day of the previous month
w_i^+	=	Weight of bond i after rebalancing
w_i^-	=	Weight of bond i before rebalancing
w_i^{std}	=	indicates the uncapped weight of bond *i*
wgt_B	=	weighting factor of bucket *B*
$X_{i,t}$	=	Convexity of bond i at time t
$Y_{i,t}$	=	Yield of bond i at time t

8.3 Contact

- **Information on prices, index concepts and licenses**

  STOXX Ltd. – Customer Support

  Phone: +41 43430 - 7272

  E-mail: customersupport@stoxx.com

- **Press inquiries**

  Andreas von Brevern

  +49-(0) 69- 2 11-1 42 84

  Alexandra Reed

  +49-(0) 69- 2 11-1 7764

  E-mail: media-relations@deutsche-boerse.com

- **Wesbite**

  www.dax-indices.com

- **Mailing address**

  STOXX Ltd.

  Theilerstrasse 1a

  CH-6300 Zug

  P +41-(0)43 430 71 01

- **STOXX global representative offices**

  Frankfurt: +49 (0) 69 211 0

  Hong Kong: +852 2530 7862

  London: +44 (0) 207 862 7680

  New York: +1 646-876-2030

  Tokyo: +81-3-4578-6688