Guide to the VDAX Volatility Indices

Formerly known as the Volatility Indices of Deutsche Börse

Version 3.2

Valid from October 2019

General Information

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

STOXX Ltd. develops, creates and calculates markets and publishes Indices for certain usages, 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 VDAX Volatility 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 the Equity Indices of Deutsche Börse AG as last amended with effect from 3 December 2018 (version 9.2.3).

In order to ensure the highest quality of each of its indices, STOXX Ltd. exercises the greatest care when compiling and calculating equity 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 VDAX Volatility 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.

Recent Amendments to the Rules

Effective 02/10/2019	Version 3.2	Clarifications relating to changes in the EONIA rate determination
Effective 16/08/2019	Version 3.1	Clarification relating to EU Benchmark Regulation and changes relating to the transfer of index administration to STOXX Ltd.
Effective 03/12/2018	Version 2.7	Removal of EURIBOR 2 and 9 month tenors Widening of conditions for increased maximum spreads from "Fast Market" to "Stressed Market" ion Filtering of Data Change of maximum spreads in Filtering of Data

1 Key Features

1.1 Concept

Volatility is a measure of the level of uncertainty prevailing in certain markets, or with respect to individual underlying instruments. In principle, there are two different approaches for the estimation of volatility: on the one hand, it is possible to determine historical volatility by measuring the standard deviation of prices for any particular security over a given period of time. On the other hand, volatility can be derived implicitly from option prices ('implied volatility'); this kind of volatility represents the expectations of market participants involved in a trade, on the basis of a given option price.

STOXX Ltd. calculates volatility indices that measure implied volatility using a model that has been jointly developed by Goldman Sachs and Deutsche Börse AG.The VDAX-NEW® indices are expressed in volatility percentage points.

The VDAX-NEW® computes the square root of implied variance across at- & out-of-the-money DAX® options of a given time to expiration. The main index (which is not linked to a specific maturity) has a fixed remaining time to expiration of 30 days. The VDAX-NEW® and its various sub-indices are updated every minute.[1]

1.1.1 Basis

The VDAX-NEW® indices measure the volatility implied by the options on the DAX index traded on Eurex.

The VDAX-NEW® is calculated on the basis of eight maturities with a maximum time to expiration of two years. Volatility represents the key risk factor for the price determination in options trading. The higher the estimation of volatility, the higher the price of an option.

Apart from the main index VDAX-NEW® (which represents the implied volatility for a fixed 30-day horizon), sub-indices for each maturity of the DAX® options ranging from one month up to two years are calculated and distributed for the VDAX-NEW® model. For options with a longer lifetime, no such sub-indices are currently available.

The various VDAX-NEW® sub-indices are calculated on the basis of a broad strip of options. The calculations are based on the best bid and best ask prices available for these options in the Eurex® system.

1.1.2 VDAX-NEW®

[1] DAX®, Eurex®, VDAX-NEW®, REX® and Xetra® are registered trademarks of STOXX Ltd.

The main index is determined by way of interpolation using the two sub-indices whose expirations are nearest to the remaining time to expiration of 30 days (VDAX-NEW®). The main index is therefore calculated for a constant time to expiration. This helps eliminate effects that typically result in strong volatility fluctuations close to expiration.

1.2 Selection of Input Data

During the calculation hours for the VDAX-NEW® and the sub-indices (9:15 a.m. to 5:30 p.m. CET), the following data is recorded every minute:

DAX® - DAX Index, calculated on the basis of Xetra® prices. For information regarding DAX cf. please refer to the "DAX Equity Indices".

ODAX® - Best bid, best ask, last trade and settlement price of all DAX options. STOXX Ltd. will exclude from their indices all options as soon as their delisting becomes known (e.g. direct notification from the market, or unavailability of a settlement price).

EONIA - Euro Overnight Index Average – overnight interest rate, calculated as the European short-term rate (€STR) + 8.5 bps.

EURIBOR - Euro Interbank Offered Rates – money market reference rates (calculated once a day, 11:00 a.m. CET, by the European Banking Federation)

REX® - Yield of the 2-year REX (calculated from exchange-traded prices) as the longer-term interest rate. For information regarding REX cf. the "Guide to the REX Bond Indices".

Index name	Period	Code	ISIN
EONIA	1 day	EU1D	EU0009659945
EURIBOR 1 month	1 month	EU1M	EU0009659937
EURIBOR 3 months	3 months	EU3M	EU0009652783
EURIBOR 6 months	6 months	EU6M	EU0009652791
EURIBOR 12 months	12 months	EU12	EU0009652809
REX 2-YEAR (PRICE INDEX)	2 years	REX2	DE0008469149

1.3 Publication

VDAX-NEW® and the various volatility sub-indices are calculated on every Eurex® exchange trading day, during the period from 9:15 a.m. to 5:30 p.m. CET[2].

The calculation of a sub-index only commence when all required input data are available. The data required for the index calculation is described in the chapter for calculation (VDAX-NEW®, cf. chapter 2).

The dissemination of the main index begins as soon as two sub-indices are available for an interpolation.

The VDAX-NEW® utilizes data from the previous trading day (settlement prices) as long as no data from the current day is available.

In line with the expiration structure of DAX® options, each of the VDAX-NEW® sub-indices is assigned to a specific expiration, which can be directly identified from the respective code. There is a system of 120 codes and ISINs, of which are only eight in simultaneous use at any time (cf. chapter 3).

1.4 Historical Data

The following time series are available for the Guide to the VDAX Volatility Indices

1.4.1 VDAX-NEW

Index	Code	ISIN	Daily closing prices since
VDAX-NEW	V1X	DE000A0DMX99	02 Jan. 1992
VDAX-NEW sub-index 1 (1 mth)	V1mj	cf. 3.1	02 Jan. 1992
VDAX-NEW sub-index 2 (2 mth)	V1mj	cf. 3.1	02 Jan. 1992
VDAX-NEW sub-index 3 (3 mth)	V1mj	cf. 3.1	02 Jan. 1992
VDAX-NEW sub-index 4 (6 mth)	V1mj	cf. 3.1	02 Jan. 1992
VDAX-NEW sub-index 5 (9 mth)	V1mj	cf. 3.1	02 Jan. 1992
VDAX-NEW sub-index 6 (12 mth)	V1mj	cf. 3.1	18 Mar. 1996
VDAX-NEW sub-index 7 (18 mth)	V1mj	cf. 3.1	18 Mar. 1996

[2] VDAX-NEW® and the corresponding sub-indices have been calculated since 8:50 a.m. until 20 October 2006.

VDAX-NEW sub-index 8 (24 mth)	V1mj	cf. 3.1	18 Mar. 1996

m represents the respective expiry month (A=Jan, ..., L=Dec); j represents the respective year (0, ...; 9)

The VDAX-NEW® and its various sub-indices are calculated on a continuous basis since 18 April 2005. Historical time series for the main index and the first five sub-indices, based on daily settlement prices, date back to 2 January 1992. Long-term DAX® options (with time to expirations of 12, 18 and 24 months) and the corresponding VDAX-NEW® sub-indices have only been available since 18 March 1996.

The REUTERS overnight rate, the 1- to 12-month LIBOR rates, and the yield of the 2-year REX® were used as interest rates.

Since the beginning of 1999, all available monthly EURIBOR rates as well as EONIA are used in lieu of LIBOR and REUTERS overnight rates.

1.4.2 VDAX-NEW® Fixed Identifier Sub-Indices

As of 23 October 2006 additional eight sub-indices with a fixed ISIN are calculated. As opposed to the sub-indices with variable ISIN classification specified in chapter 1.4.1 the ISIN in this procedure refers to the remaining time to expiration of the option. Over a period of time the options move into a sub-index with the adequate time to expiration (compare following table).

Index	Code	ISIN	Daily closing prices since
VDAX-NEW	V1X	DE000A0DMX99	02 Jan. 1992
VDAX-NEW sub-index 1 (1 mth)	V4F1	DE000A0G83V9	23 Oct. 2006
VDAX-NEW sub-index 2 (2 mth)	V4F2	DE000A0G83W7	23 Oct. 2006
VDAX-NEW sub-index 3 (3 mth)	V4F3	DE000A0G83X5	23 Oct. 2006
VDAX-NEW sub-index 4 (6 mth)	V4F4	DE000A0G83Y3	23 Oct. 2006
VDAX-NEW sub-index 5 (9 mth)	V4F5	DE000A0G83Z0	23 Oct. 2006
VDAX-NEW sub-index 6 (12 mth)	V4F6	DE000A0G8300	23 Oct. 2006
VDAX-NEW sub-index 7 (18 mth)	V4F7	DE000A0G8318	23 Oct. 2006
VDAX-NEW sub-index 8 (24 mth)	V4F8	DE000A0G8326	23 Oct. 2006

2 VDAX-NEW®

2.1 Calculation Method

The model for VDAX-NEW® aims at making pure volatility tradable – i.e. the index should be trackable by an options portfolio whose value is considered a measure of the implied volatility over the entire strike spectrum. The indices do not measure directly the implied volatility, but rather variance, or squared volatility. A portfolio of DAX® options with different exercise prices with a given weighting, as described below, meets this requirement. So, instead of using implied volatilities of the at-the-money options, implied variances of at-the-money as well as out-of-the-money options of a given time to expiration are considered.

The sub-indices are calculated according to the formula shown below:

(1) $\text{VDAX - NEW}_i = 100 \cdot \sqrt{\sigma_i^2}$

whereby:

(2) $$\sigma_i^2 = \frac{2}{T_i} \sum_j \frac{\Delta K_{i,j}}{K_{i,j}^2} \cdot R_i \cdot M(K_{i,j}) - \frac{1}{T_i}\left(\frac{F_i}{K_{i,0}} - 1\right)^2 \quad , \quad i=1,2,..8$$

and:

T_i = Time to expiration of the i^{th} ODAX®

F_i = Forward price derived from the prices of the i^{th} ODAX, for which the absolute difference between call and put prices (C and P) is smallest. Therefore:

(3) $F_i = K_{\min |C-P|} + R_i \cdot (C - P)$

(Note: If a clear minimum does not exist, the average value of the relevant forward prices will be used instead.)

$K_{i,j}$ = Exercise price of the j^{th} out-of-the-money option of the i^{th} ODAX expiry month both in ascending order

$\Delta K_{i,j}$ = Interval between the relevant exercise prices or half the interval between the one higher and one lower exercise price. On the boundaries, the simple interval between the highest and second highest exercise price (or lowest and second lowest exercise price) is used:

(4) $\Delta K_{i,j} = \frac{K_{i,j+1} - K_{i,j-1}}{2}$

$K_{i,0}$ = Highest exercise price below forward price F_i

R_i = Refinancing factor of the i^{th} ODAX

(5) $R_i = e^{ri \cdot Ti}$

r_i = Risk-free interest rate to expiration of the i^{th} ODAX interpolated from corresponding EONIA/EURIBOR rates

$M(K_{i,j})$ = Price of the option $K_{i,j}$, whereby $K_{i,j} \neq K_{i,0}$

$M(K_{i,0})$ = Average of the put and call prices at exercise price $K_{i,0}$

The sub-indices are calculated up until two days prior to expiration. Each new sub-index is disseminated for the first time on the second trading day[3] of the relevant DAX options.

The individual steps with regard to data extraction and filtering are explained in the following chapters, sometimes with examples, as is the calculation process for the various factors used.

2.2 Extracting Data

During the calculation hours from 9:15 a.m. to 5:30 p.m. CET, the respective best bid and best ask prices of all DAX® options contracts listed on Eurex® along with the various interest rates mentioned under 1.2 are extracted from the stream of data generated by the Eurex system. To this end, a snapshot is taken at one minute intervals.

2.3 Filtering of Data

a) Option price data is subject to filtering. All option prices that are one-sided – i.e. with either a bid or an ask price only – are disregarded.The same applies to options without any price data.

b) Another filter verifies whether the remaining options are quoted within the established maximum spreads for Eurex® market-makers. The maximum spread is derived from bid prices as shown in the table below:

Bid (index points)	Maximum Spread
0 – 25	2
25 – 300	8%
> 300	24

Example: Bid = 45.32 and ask = 54.3
Max. spread: 45.32 · 0.08 = 3.6256 => both prices (bid and ask) are rejected.

[3] Generally, the second trading day after the option series expiry day is a Tuesday (Exception: Bank holiday).

If Eurex® activates Stressed Market status, permitting market-makers to increase their quotation spreads under very turbulent trading conditions, maximum spreads are doubled accordingly. The above mentioned spreads for the calculation of the VDAX-NEW® are also doubled accordingly.

2.4 Preparing Data

a) Determining the prices used

The mid price is calculated for the remaining option prices, using the respective best bid and best ask.

The most recent among the following is used in the index calculation:

- Last traded price
- Mid price
- Settlement price (previous day)

Example (Call options):

Underlying	Settlement	Bid (time)	Ask (time)	Mid (time)	Last-traded (time)	Price
4,000	383.30	--	--	--	383.5	**383.30**
4,050	333.40	--	--	239.70	383.5 (09:05)	**383.50**
4,100	283.50	287.1 (09:04)	290.0 (09:05)	288.55 (09:05)	--	**288.55**
4,150	233.70	237.2 (09:03)	240.2 (09:05)	239.70 (09:05)	237.2 (09:01)	**239.70**

b) Cutting the wings

A filter ensures that the various prices used (settlement, mid and last traded price) do not fall short of a minimum value of 0.5 index points. If there are two or more options with different strikes and mid prices that exactly equal the minimum value of 0.5, just the one closer to the at-the-money point is taken into considerationOptions that are far out-of-the money are thus filtered out.

c) Determining the time to expiration T_i

(6) $T_i = T_{Settlement\text{-}Calculation}/T_{Year}$

$T_{Settlement\text{-}Calculation}$ = Seconds between index calculation and settlement

T_{Year} = Seconds per annum

Example: Index calculation: 25 November 2004 at 11:00 a.m. CET

Expiration (i = 1): 17 December 2004 at 1:00 p.m. CET

$$T_1 = \frac{1{,}908{,}000}{365 \cdot 60 \cdot 60 \cdot 24} = 0.0605022831$$

d) Determining risk-free interest rates

Linear interpolation is used to determine interest rates, the terms of which match the time to expiration of the ODAX®.

$$(7)\ r_i \equiv r(T_i) = \frac{T_{k+1} - T_i}{T_{k+1} - T_k} r(T_k) + \frac{T_i - T_k}{T_{k+1} - T_k} r(T_{k+1}); \quad T_k \le T_i < T_{k+1}$$

Example: $r(T_k)$ = 2.05% (EONIA)

$r(T_{k+1})$ = 2.18% (EURIBOR, 1 month)

$r(T_i)$ = 2,14%

e) The refinancing factor R_i is determined according to equation (5)

Example: $R_1 = e^{r \cdot t} = 1.001298$

2.5 Calculation Example

2.5.1 Determining the Forward Price F_i and the Exercise Prices $K_{i,0}$

The forward price of the i^{th} expiry month is derived from the ODAX® options, for which the difference (in absolute terms) between call and put prices is smallest. The forward price F_1 of the 1^{st} expiry month is subject to the following:

$$F_i = K_{\min|C-P|} + R_i \cdot (Call_i - Put_i)$$

Example: R_1 = 1.001298

$K_{\min|C-P|}$ = 4,150

F_1 = 4,151.401817

In case multiple pairs of calls and puts with identical differences exist, a forward price will be calculated for each of the corresponding exercise prices. $K_{i,0}$ is accordingly defined as the closest exercise price below the simple average of these forward prices.

2.5.2 Determining the Option Price $M(K_{i,j})$

The price $M(K_{i,j})$, which is used for the j^{th} out-of-the-money option of the i^{th} expiry month, is determined as follows:

$$M(K_{i,j}) = \begin{cases} \text{Put} & : K_{i,j} < K_{i,0} \\ \dfrac{\text{Put} + \text{Call}}{2} & : K_{i,j} = K_{i,0} \\ \text{Call} & : K_{i,j} > K_{i,0} \end{cases}$$

2.5.3 Determining the Sub-Indices

$$\text{VDAX - NEW}_i = 100 \cdot \sqrt{\sigma_i^2}$$

$$\sigma_i^2 = \frac{2}{T_i} \sum_j \frac{\Delta K_{i,j}}{K_{i,j}^2} \cdot R_i \cdot M(K_{i,j}) - \frac{1}{T_i}\left(\frac{F_i}{K_{i,0}} - 1\right)^2$$

Exercise Price $K_{i,j}$	$\Delta K_{i,j}$	Call	Put	|Call – Put|	$M(K_{i,j})$	$\frac{\Delta K_{i,j}}{K_{i,j}^2} R_i M(K_{i,j})$
~~3,350~~	~~50~~	~~793.90~~	~~0.30~~	~~793.60~~	~~0.30~~	
3,400	50	734.70	0.60	734.10	0.60	0.0000025985
3,450	50	684.80	0.80	684.00	0.80	0.0000033649
3,500	50	635.00	0.90	634.10	0.90	0.0000036782
3,550	50	585.30	1.10	584.20	1.10	0.0000043698
3,600	50	535.60	1.20	534.40	1.20	0.0000046355
3,650	50	486.00	1.70	484.30	1.70	0.0000063883
3,700	50	436.60	1.80	434.80	1.80	0.0000065825
3,750	50	387.40	2.90	384.50	2.90	0.0000103242
3,800	50	355.00	2.90	352.10	2.90	0.0000100543
3,850	50	290.10	5.50	284.60	5.50	0.0000185765
3,900	50	249.00	6.40	242.60	6.40	0.0000210656
3,950	50	202.90	10.50	192.40	10.50	0,0000336913
4,000	50	165.70	15.20	150.50	15.20	0.0000475605
4,050	50	120.50	24.80	95.70	24.80	0.0000756946
4,100	50	90.00	38.70	51.30	38.70	0.0001152567
4,150	50	59.00	57.60	1.40	58.30	0.0001694710
4,200	50	36.20	85.00	48.80	36.20	0.0001027385
4,250	50	20.30	130.00	109.70	20.30	0.0000562654
4,300	50	11.10	174.80	163.70	11.10	0.0000300545
4,350	50	6.00	212.75	206.75	6.00	0.0000158743
4,400	75	3.00	267.50	264.50	3.00	0.0000116367
4,500	100	1.20	365.60	364.40	1.20	0.0000059335
~~4,600~~	~~100~~	~~0.40~~	~~497.70~~	~~497.30~~	~~0.40~~	
					Σ	0.0007558154

$$\sigma_i^2 = 0.024984689 - 0.000001886 = 0.024986576$$

$$\text{VDAX - NEW}_1 = 100 \cdot \sqrt{0.024986576} = 15.8071$$

2.6 Constructing the Volatility Index

Apart from the sub-indices for the various individual time to expiration, the VDAX-NEW® is determined as the main index with a constant remaining time to expiration of 30 days (this index is not linked to a specific time to expiration). The VDAX-NEW® is determined by interpolation of the sub-indices which are nearest to a remaining time to expiration of 30 days. If there are no such surrounding sub-indices, the VDAX-NEW® is calculated using extrapolation. In this case, the two nearest available indices are used, which are as close to the time to expiration of 30 calendar days as possible.

$$\text{VDAX-NEW} = 100 \cdot \sqrt{\left[T_i \cdot \sigma_i^2 \cdot \left[\frac{N_{T_{i+1}} - N_T}{N_{T_{i+1}} - N_{T_i}} \right] + T_{i+1} \cdot \sigma_{i+1}^2 \cdot \left[\frac{N_T - N_{T_i}}{N_{T_{i+1}} - N_{T_i}} \right] \right] \cdot \frac{N_{365}}{N_T}}$$

$$= \sqrt{\left[T_i \cdot \text{VDAX-NEW}_i^{\,2} \cdot \left[\frac{N_{T_{i+1}} - N_T}{N_{T_{i+1}} - N_{T_i}} \right] + T_{i+1} \cdot \text{VDAX-NEW}_{i+1}^{\,2} \cdot \left[\frac{N_T - N_{T_i}}{N_{T_{i+1}} - N_{T_i}} \right] \right] \cdot \frac{N_{365}}{N_T}}$$

N_{Ti} = Time to expiration of the i^{th} ODAX

N_{Ti+1} = Time to expiration of the $i+1^{th}$ ODAX

N_T = Time for next x days

N_{365} = Time for a standard year

2.7 Calculation of Settlement Index

VDAX-NEW® future settlement price is calculated 30 calendar days before the maturity date of the DAX® option. For this purpose, the equally weighted mean of all index values of VDAX-NEW® between 12:30 p.m. and 1:00 p.m. CET is determined.

3 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 line with this index methodology, e.g. due to a mistake, incorrect input data, etc.

3.1 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.

3.2 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 **Error! Reference source not found.**).

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 **Error! Reference source not found.**).

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.

3.3 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 financial relevant 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 Calculation Correction (Section 3.2) 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 **Error! Reference source not found.**). 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 Error! Reference source not found.).

4 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;
  - insufficient 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 Error! Reference source not found.). Any such rectification may comprise deviations from the index methodology which may apply as long as the Limitation persists (Discretionary Rule, see Section Error! Reference source not found.).

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 Error! Reference source not found.). 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.

5 Methodology Review

The purpose of the methodology review is to ensure 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.

5.1 Frequency of Review

In order to ensure the index integrity is maintained at all times, the methodology is reviewed annually and ad hoc if a Limitation has occurred. If a Limitation cannot be properly dealt 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.

5.2 Review Procedure

5.2.1 Initiation of Methodology Review

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

5.2.2 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 5.3 below),
b. the change is triggered by an Unclear Rule or Insufficient Rule as part of a Limitation, (see Section 4), 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).

5.3 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 of the rules regarding the rebalancing of the weights of index constituents by application of the index methodology,
- a change of 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 weights of the index constituents or the compositions of the index constituents (as applicable) of equity indices due to Corporate Actions

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 **Error! Reference source not found.**).

STOXX Ltd. consults a proposed material change with reasonably affected licenses/investors. A licensee shall be considered affected if they hold a license for the respective index. An investor shall be considered affected if they own contracts or financial instruments that reference the respective index. Considering 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 **Error! Reference source not found.**). The IGC may decide to shorten the 1-month period (Discretionary Rule, see Section **Error! Reference source not found.**) 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 Corporate Action Adjustment, or
- any other similar cases.

The IGC, in accordance with details in this Section 5.3 will consider the feedback received and decide whether the material change shall become effective (Discretionary Rule, see Section **Error! Reference source not found.**). 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 **Error! Reference source not found.**). 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 **Error! Reference source not found.**). 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.

5.4 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 Error! Reference source not found.). 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 **Error! Reference source not found.**). 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.

5.5 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.

5.5.1 Exercise of Discretion

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 regarding 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

6 Contact

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

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