S&P Dow Jones Indices

A Division of S&P Global

# iBoxx EUR Breakeven Euro-Inflation France and Germany Index Methodology

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# 1 Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Index

The Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Index is designed to provide exposure to breakeven inflation by entering into a long position in Inflation-Linked Bonds (ILBs) issued by France and Germany and a short position in French and German sovereign bonds with adjacent durations. (*Note*: Sovereign bonds from other Eurozone countries could be considered in order to comply with the membership criterion of having to contain at least six inflation-linked bonds at each rebalancing as described in section 2.)

The Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Index shorts nominal sovereign bonds and invests in sovereign-only inflation-linked bonds from the eligible universe described in section 2.5.1. The base inflation index for the inflation-linked bonds is Euro HICP. In some exceptional cases, bonds could be linked to local reference inflation indices as described in section 2. The nominal-sovereign-bond position is constructed in such a way that duration for the Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Index is neutralized.

Exposure to any inflation-linked bond within the inflation-linked-bonds portion and to any nominal sovereign bond within the nominal-sovereign-bonds portion cannot exceed 30% at any rebalance date. In addition, the Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Index must contain six inflation-linked bonds and at least six nominal sovereign bonds at any point in time.

This document covers the index rules and calculation methodology.

# 2 Bonds selection rules

The following selection criteria are used to determine the index constituents:

- Bond type
- Credit rating
- Time to maturity
- Amount outstanding

### 2.1 Bond type

**Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Inflation-Linked Index**

The index is comprised of Euro- or legacy-currency-denominated sovereign inflation-linked bonds issued predominantly by France or Germany[1]. The base inflation index for the inflation-linked bonds is Eurozone HICP, unless otherwise specified in section 2.5.1 below. Bonds must have fixed coupons. Zero-coupon inflation-linked bonds are eligible.

**Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Sovereign Index**

The index is comprised of Euro or legacy currency denominated sovereign bonds issued predominantly by France or Germany[2]. T-bills and other money market instruments are not eligible. Bonds must have fixed coupons. Zero-coupon bonds are eligible.

[1] Inflation-linked bonds issued by other Eurozone countries may be included according to the eligibility scenarios described in section 2.5.1

[2] Countries of issuance of sovereign bonds must match the countries of issuance of inflation-linked bonds, and may therefore, at times, include Eurozone countries other than France and Germany in order to meet the membership criteria of at least six inflation-linked bonds at each rebalance time, as described in section 2.5.2.

### 2.2 Credit rating

All bonds in the Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Index must have an iBoxx Rating of investment grade. Ratings from the following three credit rating agencies are considered for the calculation of the iBoxx Rating:

- Fitch Ratings
- Moody's Investor Service
- S&P Global Ratings

Investment grade is defined as BBB- or higher from Fitch Ratings and S&P Global Ratings and Baa3 or higher from Moody's Investor Service. Bonds with an RD/SD rating are excluded from the Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Index.

If more than one of the above agencies rates a bond, then the iBoxx rating is the average of the provided ratings. The index consolidates ratings to the nearest rating grade and does not use rating notches. For more information on how the average rating is determined, please refer to the *iBoxx Rating Methodology* document available at https://www.spglobal.com/spdji/en/ under *Methodology*.

### 2.3 Time to maturity

All bonds must have a minimum remaining time to maturity of at least one year at the rebalance date. Bonds with a remaining life of less than one year are no longer eligible.

### 2.4 Amount outstanding

Bonds require a minimum outstanding par amount of €500 million in order to be eligible for the index.

### 2.5 Bond selection procedure

#### 2.5.1 Eligible universe for the Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Inflation-Linked Index

The eligible universe for the Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Inflation-Linked index is determined by considering one of the following five selection scenarios in order of priority from a) to e). The first of the five scenarios that results in an eligible universe of at least six inflation-linked bonds is selected. Note that all inflation-linked bonds must be selected according to the same selection scenario.

a) From the universe of the Markit iBoxx EUR inflation-linked Euro-inflation index (linked to Euro HICP), select all inflation-linked sovereign bonds issued by France or Germany with a remaining time to maturity of 2-10 years, with a minimum outstanding amount of €5 billion.

b) From the universe of the Markit iBoxx EUR inflation-linked Euro-inflation index (linked to Euro HICP), select all inflation-linked sovereign bonds issued by France or Germany with a remaining time to maturity of 2-10 years.

c) From the universe of the Markit iBoxx EUR inflation-linked Euro-inflation index (linked to Euro HICP), select the six inflation-linked sovereign bonds issued by France or Germany. If more than six bonds are available, ordering criteria are applied in order to rank the eligible bonds.

The following three criteria are applied:

1. Shorter time to maturity
2. Higher notional amount outstanding

These criteria are applied to each pair of inflation-linked bonds in the order stated above until a difference can be established (e.g. if two bonds have an identical time to maturity but one has a higher notional amount outstanding, then both criteria are applied). With the help of the ranking criteria, a bond hierarchy can be defined, with the bond that has the highest rating at the top of the hierarchy.

If there is still a tie after these criteria are applied, the bond with the higher ISIN (ranked in alpha-numerical order) is selected. The top six ranked bonds are selected for the index.

d) From the universe of the Markit iBoxx EUR inflation-linked Euro-inflation index (linked to Euro HICP), select six inflation-linked sovereign bonds issued by Eurozone countries. If more than six bonds are available, ordering criteria are applied in order to rank the eligible bonds.

The following three criteria are applied:

1. Higher rating
2. Shorter time to maturity

3. Higher notional amount outstanding

These criteria are applied to each pair of inflation-linked bonds in the order stated above until a difference can be established (e.g. if two bonds have an identical rating but one has a shorter time to maturity, then criteria 1 and 2 are applied, but 3 is not). With the help of the ranking criteria, a bond hierarchy can be defined, with the bond that has the highest rating at the top of the hierarchy.

If there is still a tie after these criteria are applied, the bond with the higher ISIN (ranked in alpha-numerical order) is selected. The top six ranked bonds are selected for the index.

e) Select six highest-ranked inflation-linked sovereign bonds issued by Eurozone countries (linked to Eurozone HICP or any other local reference inflation indices), based on the same ordering criteria described in d) above.

### 2.5.2 Eligible universe for the Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Sovereign Index

The eligible universe consists of nominal sovereign bonds issued by the countries identified in section 2.5.1 above.

### 2.5.3 Bond selection process

At each rebalance date, constituents are determined as follows:

1. Determine annual modified duration for all inflation-linked bonds that are part of the eligible universe described in section 2.5.1.
2. For each inflation-linked bond at least one "comparable" nominal sovereign bonds from the same country is identified as follows:
   a. Each inflation-linked bond is associated with two neighboring nominal sovereign bonds with closest annual modified duration to the duration of the inflation-linked bond (referred to as "comparable bonds").[1,2,3,4]
   b. In order to determine the amount of the "comparable" bond that needs to be shorted, the weighted distance ("distribution ratio") between the "comparable" bonds and the ILB bonds is calculated:
      1. If the inflation-linked bond can be paired with two nominal sovereign bonds, the distribution ratio is determined as follows;

$$\delta_{i,j,t-s} = 1 - \frac{abs(DUR^{ILB}_{i,t-s} - DUR^{NSov}_{i,j,t-s})}{DUR^{NSov}_{i,j+1,t-s} - DUR^{NSov}_{i,j,t-s}}$$

and

$$\delta_{i,j+1,t-s} = 1 - \delta_{i,j,t-s}$$

where

$$DUR^{NSov}_{i,j,t-s} \leq DUR^{ILB}_{i,t-s} \leq DUR^{NSov}_{i,j+1,t-s}$$ [2]

In this case, distribution ratios are between 0 and 1. The weights for the two sovereign bonds are calculated as follows[5] :

$$w^{NSov}_{i,j,t-s} = \frac{\delta_{i,j,t-s} w^{ILB}_{i,t-s} DUR^{ILB}_{i,t-s}}{DUR^{NSov}_{i,j,t-s}}$$

And

$$w^{NSov}_{i,j+1,t-s} = \frac{\delta_{i,j+1,t-s} w^{ILB}_{i,t-s} DUR^{ILB}_{i,t-s}}{DUR^{NSov}_{i,j+1,t-s}}$$

Therefore the following relationship will hold:

$$w_{i,t-s}^{ILB} DUR_{i,t-s}^{ILB} = w_{i,j,t-s}^{NSov} DUR_{i,j,t-s}^{NSov} + w_{i,j+1,t-s}^{NSov} DUR_{i,j+1,t-s}^{NSov}$$

2. If only one "comparable" bond is available, the distribution ratio is 1.The weight of the nominal sovereign bond is: $w_{i,j,t-s}^{NSov} = \frac{w_{i,t-s}^{ILB} DUR_{i,t-s}^{ILB}}{DUR_{i,j,t-s}^{NSov}}$

   And the following relationship will hold:

   $$w_{i,t-s}^{ILB} DUR_{i,t-s}^{ILB} = w_{i,j,t-s}^{NSov} DUR_{i,j,t-s}^{NSov}$$

3. Once all the the inflation-linked bonds have been paired, the weight of each nominal sovereign bond is[6]: $w\prime_{j,t-s}^{NSov} = \sum_{i=1}^{m} w_{i,j,t-s}^{NSov}$

4. The amount that needs to be shorted is based on the cumulative weight of nominal sovereign bonds. The notional that needs to be shorted is determined at the bond selection date (*t-2)*. The scaling factor between the total inflation-linked bonds and the total “comparable” nominal sovereign bonds is calculated as: $\Delta_{t-s} = \frac{\sum_{j=1}^{n} w\prime_{j,t-s}^{NSov}}{\sum_{i=1}^{m} w_{i,t-s}^{ILB}}$

5. The weight of each nominal sovereign bond within the nominal sovereign bond index is calculated by normalizing the $w\prime_{j,t-s}^{NSov}$ weights.

[1] In the formulas, the comparable bond with lower duration than the ILB will be identified using the subscript j, while the comparable bond with higher duration than the ILB will be identified with the subscript j+1.

[2] Real annual modified duration is used for inflation-linked bonds, and nominal annual modified duration is used for nominal sovereign bonds.

[3] If two bonds have identical annual modified duration, the one with higher notional amount outstanding is prioritized. If there is still a tie, the bond with the higher ISIN (ranked in alpha-numerical order) is selected.

[4] There are instances when only one neighboring nominal "comparable" bond is available, either because;

- The inflation-linked bond has the longest tenor and there is no nominal sovereign bond with a higher duration, or
- The inflation-linked bond has the shortest tenor and there is no nominal sovereign bond with a lower duration.

[5] The total exposure to any nominal sovereign bond within the nominal sovereign bond position is monitored throughout the process to ensure compliance with the maximum weight rule described in section 3.7. If the weight capping restriction is breached at any point in time, the excess weight is allocated to the next available nominal sovereign bond with closest annual modified duration. The process is iterated until the weight threshold is met for all nominal sovereign bonds. As a result of the iterations, each inflation-linked bond can be ultimately paired with more than two nominal sovereign bonds.

[6] Weight before normalization.

# 3 Index calculation

The index is calculated and published as a total return index.

### 3.1 Static data

Information used in the index calculation is sourced from offering circulars and checked against standard data providers.

### 3.2 Bond prices

The index calculation is based on mid prices (calculation is based on bid prices prior to 30 September 2010).

For more details, please refer to the *iBoxx Pricing Methodology,* available at *www.spglobal.com/spdji*.

### 3.3 Total return calculation

The index is calculated and published as a total return index. Total return index level of the Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Index is calculated as follows:

$$(11) TR_t = TR_{t-1}[R^{ILB}_{t-1,t} - \Delta_{t-s}(R^{NSov}_{t-1,t} - \frac{days_{ACT}(t-1,t)}{360} r^{Repo}_{t-1} - 1)]$$

The total return for the inflation-linked and sovereign index is calculated based on the standard iBoxx calculation. The “repo return” is calculated as the difference between the Euro short-term rate+8.5 bps rate and the indicative market cost (“Indicative fee”) of borrowing the bonds:

$$(12) r^{Repo}_{t-1} = r^{EuroShort-termRate+8.5bps}_{t-1} - IndicativeFee^{NSov}_{t-s}$$

After the rebalancing, the index level for next month is adjusted for transaction costs as follows:

$$(13) TR_{t-s} = TR_{t-} * CostFactor$$

For specific index formulae please refer to Markit iBoxx Bond Calculus document, available on the Markit iBoxx Documentation page www.ihsmarkit.com under *Methodology*.

The following inputs are used for the index calculation:

**Euro short-term rate (€STR)**

The Euro short-term rate (€STR) as published by the European Central Bank plus 8.5 basis points.

**Indicative fee for the index**

The *Indicative fee* is calculated as the weighted-average indicative fee of the current index constituents bonds where an indicative fee is available from Markit Security Finance. The indicative fee is observed as the 10-day average over the period from 12 previous business days prior to month-end (T-12) to (T-3). The *Indicative fee* is published after the close of business two business days prior to month-end (T-2).

**Rebalancing costs**

To incorporate costs at rebalancing, which might occur, the following procedure is applied. The cost factor is split into cost that might occur due to rebalancing in the ILB component of the index and the nominal sovereign component of the index.

The index is always evaluated at mid prices. For the inflation-linked portfolio, bonds are sold at bid price and bought at ask price; for the nominal sovereign portfolio, short positions of bonds are reduced at ask price and increased at bid price. Hence, portfolio prices can be determined by bond weight difference before rebalancing and after rebalancing.

For a detailed description of the cost factor calculation please see Appendix.

### 3.4 Reinvestment of cash

Payments from coupons, scheduled partial and unscheduled full redemptions are held as cash, without interest, until the next rebalancing. Any cash is then reinvested in the index.

### 3.5 Rebalancing process

The Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Index is rebalanced monthly on the last business day of the month after the close of business.

From the 6th day of the month (or the next index publication day if the 6th calendar day falls on a non-business day), a preliminary membership list is published. This list contains preliminary information on ratings and amounts outstanding for all bonds.

Three business days before the end of each month, a preliminary membership list is published on the FTP server.

Two business days before the end of each month, a membership list with the final amount outstanding for each bond is published. This list contains the constituents for the next month. The indicative fee for the following month is also published on this day.

On the last business day of each month, Markit publishes the final membership with closing prices for the bonds, and various bond analytics based on the index prices of the bonds.

### 3.6 Index weights

The inflation-linked bonds within the inflation-linked-bonds portion are market value weighted. Exposure to any inflation-linked bond within the inflation-linked-bonds portion and to any nominal sovereign bond within the nominal-sovereign-bonds portion cannot exceed 30% at any rebalance date. In addition, the Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Index must contain at least six inflation-linked bonds and at least six nominal sovereign bonds at any point in time.

### 3.7 Index history

The Index history starts on 31 December 2006. The index has a base value of 100 on that date.

### 3.8 Settlement conventions

All iBoxx indices calculate using the assumption of T+0 settlement days.

### 3.9 Calendar

S&P DJI publishes an index calculation calendar available on https://www.spglobal.com/spdji/en/ under *iBoxx Indices Calendars*. This calendar provides an overview of the index calculation holidays of the iBoxx bond index families each year.

### 3.10 Publication of the Index

All indices are calculated as end-of-day and distributed once daily. The publication schedule is presented in the iBoxx Indices SFTP Guide, available at www.spglobal.com/spdji. The indices are calculated every day on which the Euro short-term rate (€STR) is expected to be published by the European Central Bank.

In addition, the indices are calculated on the last calendar day of each month if that day is not a trading day as well as on common bank holidays as published in the iBoxx index calculation calendar. This index calculation calendar is available at *www.spglobal.com/spdji*. Index data is also available from the main information vendors.

### 3.11 Data publication and access

The table below summarizes the publication of the Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Index at https://www.spglobal.com/spdji/en/ for registered users and on the FTP server.

*In addition to the indices detailed in this methodology, other indices covered by this document may be available. For a list of available indices, please refer here.*

*Table 1:* ***Frequency, file type and access***

| Frequency | File Type | Access |
|---|---|---|
| Daily | Underlying files – Bond level | FTP Server |
| | Indices files – Index level | FTP Server / website / Bloomberg for index levels only |
| Daily from the 6th calendar day of the month (or the next index publication day if the 6th calendar day falls on a non-business day) | Forward Files | FTP Server |
| Monthly | End of Month Components | FTP Server / website |
| | XREF files | FTP Server |

The index identifiers for the publication channels are:

| Index Name | Return Type | SEDOL | ISIN | Ticker | RIC |
|---|---|---|---|---|---|
| Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Index | TRI | BYVXCZ4 | GB00BYVXCZ47 | IBXXEBF1 | .IBXXEBF1 |

### 3.12 Annual index review

In addition to the daily governance of indices and maintenance of index methodologies, at least once within any 12-month period, the Index Committee reviews the methodology to ensure the indices continue to achieve the stated objectives, and that the data and methodology remain effective. In certain instances, S&P Dow Jones Indices may publish a consultation inviting comments from external parties.

# 4 Index Governance

**Index Committee**

An S&P Dow Jones Indices Index Committee maintains the indices. All committee members are full-time professionals at S&P Dow Jones Indices. Meetings are held regularly. The Index Committee oversees the management of the indices, including determinations of intra-rebalancing changes, maintenance and inclusion policies, and other matters affecting the maintenance and calculation of the indices.

In fulfilling its responsibilities, the Index Committee has full and complete discretion to (i) amend, apply, or exempt the application of index rules and policies as circumstances may require and (ii) add, remove, or by-pass any bond in determining the composition of an index.

The Index Committee may rely on any information or documentation submitted to it or gathered by it that the Index Committee believes to be accurate. The Index Committee reserves the right to reinterpret publicly available information and to make changes to the indices based on a new interpretation of that information at its sole discretion. All Index Committee discussions are confidential.

The Index Committee is separate from and independent of other analytical groups at S&P Global. In particular, the Index Committee has no access to or influence on decisions by S&P Global Ratings analysts.

S&P Dow Jones Indices' Index Committees reserve the right to make exceptions when applying the methodology if the need arises. In any scenario where the treatment differs from the general rules stated in this document or supplemental documents, clients will receive sufficient notice, whenever possible.

In addition to the daily governance of indices and maintenance of index methodologies, at least once within any 12-month period, the Index Committee reviews the methodology to ensure the indices continue to achieve the stated objectives, and that the data and methodology remain effective. In certain instances, S&P Dow Jones Indices may publish a consultation inviting comments from external parties.

*For more information on index governance policies, please refer* here.

# 5 Changes to the Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Index

| | |
|---|---|
| **31 Mar 2025** | **Annual Index Review 2024**<br>• Update to minimum amount outstanding |
| **30 Jun 2022** | • Monthly forward start date updated from 10th calendar day to 6th calendar day |
| **15 Dec 2021** | • IHS Markit IBOR Transition - Migration of EONIA to €STR + 8.5 basis points |
| **01 Sep 2021** | • Monthly forward start date updated from 12th calendar day to 10th calendar day |
| **31 Mar 2021** | • Governance and Regulatory Compliance section added |
| **31 Oct 2020** | • Changes on ranking criteria implemented following consultation |
| **29 Feb 2016** | • Launch of the Markit iBoxx EUR Breakeven Euro-Inflation France and Germany Index |

# 6 Appendix

To determine the cost factor at each rebalancing the following information is used:

**Transaction cost summary for the long portfolio**

| Region | Description | Portfolio price[1] | Index Price | New Portion | Old Portion | Cost |
|---|---|---|---|---|---|---|
| **1** | Bond drops out | Bid | Mid | 0 | $f^-$ | Yes |
| **2** | Bond needs to be sold partially | Bid | Mid | $f^+$ | $f^-$ | Yes |
| **3** | ($2^-$) Bond does not need to be purchased | Mid | Mid | $f^+$ | $f^-$ | No |
| | ($2^+$) Bond has to be purchased[2] | Ask | Mid | $f^+$ | $f^-$ | Yes |
| **4** | New bond to the index | Ask | Mid | $f^+$ | 0 | Yes |

**Transaction cost summary for the short portfolio**

| Region | Description | Portfolio price[1] | Index Price | New Portion | Old Portion | Cost |
|---|---|---|---|---|---|---|
| **1** | Bond drops out | Ask | Mid | 0 | $f^-$ | Yes |
| **2** | Short position needs to be reduced partially | Ask | Mid | $f^+$ | $f^-$ | Yes |
| **3** | ($2^-$) Bond's position does not change | Mid | Mid | $f^+$ | $f^-$ | No |
| | ($2^+$) short position has to be increased[2] | Bid | Mid | $f^+$ | $f^-$ | Yes |
| **4** | New bond to the index | Bid | Mid | $f^+$ | 0 | Yes |

[1] For the change in amount outstanding during the rebalancing.

[2] 2+: Region of all bonds with a weight increase in the portfolio: f+ > f-

The cost factor in formula (15) below is calculated as follows:

$$(14) \quad CostFactor = (1 - Cost_{t-s}^{ILB})(1 - Cost_{t-s}^{SovLong})(1 - Cost_{t-s}^{SovShort})$$

$$(15) \quad Cost_{t-s}^{ILB} = 1 - \frac{w_{cash,t-}^{ILB+} + \sum_{i=1}^{m} \frac{P_i^P + A_i}{P_i^I + A_i} w_{i,t-}^{ILB}}{w_{cash,t+}^{ILB+} + \sum_{i=1}^{m} \frac{P_i^P + A_i}{P_i^I + A_i} w_{i,t+}^{ILB}}$$

where:

(16)[1,2] $w_{i,t-}^{ILB} = w_{i,t-s}^{ILB} LCR_{i,t-}^{M}$

(17) $Cost_{t-s}^{NSov} = 1 - \frac{w_{cash,t-}^{NSov+} + \sum_{i=1}^{n} \frac{P_i^P + A_i}{P_i^I + A_i} w_{i,t-}^{NSov}}{w_{cash,t+}^{NSov+} + \sum_{i=1}^{n} \frac{P_i^P + A_i}{P_i^I + A_i} w_{i,t+}^{NSov}}$

where:

(18)[1,2] $w_{j,t-}^{Nsov} = w_{j,t-s}^{NSov} LCR_{j,t-}^{M}$

(19) $cost_{t-s}^{SovShort} = BidOffer_{long} Max(\frac{R_t^{SovLong}}{R_{t-s}^{SovLong}} - 1; 0)$

[1] $w_{i,t-}^{ILB}$ and $w_{j,t-}^{Nsov}$ is normalised

[2] In the formula, since it is right before rebalancing, t-s stands for the last calendar day of the previous month. For example, if calculation date is Aug 31st, t-s in the formula of is Jul 31st.

where:

(20) $BidOffer_{long} = \sum_{j=1}^{n} w_{j,t-}^{NSov} BidOffer_j^{NSov}$

**Calculation of cost factor weights**

For any index, the weighting per bond before and after rebalancing can be described as follows:

Before: (21) $w_i^- = \frac{(P_i^I + A_i) f_i^-}{M^-}$

After: (22) $w_i^+ = \frac{(P_i^I + A_i) f_i^+}{M^+}$

The same applies to cash. Solving for $f_i^-$ and $f_i^+$ leads to:

Before: (23) $f_i^- = \frac{w_i^- M^-}{P_i^I + A_i}$

After: (24) $f_i^+ = \frac{w_i^+ M^+}{P_i^I + A_i}$

The market value using index prices can be expressed using the new amount:

(25) $M^- = \sum_{i=1}^{n} (P_i^I + A_i) f_i^-$

And using transaction prices:

$$(26) \quad M_P^+ = \sum_{i=1}^{n}((P_i^I + A_i)f_i^- + (P_i^p + A_i)(f_i^+ - f_i^-))$$

Since no cash is added or taken from the portfolio at the rebalancing, the assumption of no further cash addition leads us to the following equation:

$$M^- = M_P^+$$

That is the market value of the portfolio before the rebalancing equals the market value after rebalancing using transaction prices.

Combining the formulas above:

$$(27) \quad \sum_{i=1}^{n}(P_i^I + A_i)f_i^- = \sum_{i=1}^{n}((P_i^I + A_i)f_i^- + (P_i^p + A_i)(f_i^+ - f_i^-))$$

Or simplified:

$$(28) \quad 0 = \sum_{i=1}^{n}(P_i^p + A_i)(f_i^+ - f_i^-)$$

$f_i^-$ and $f_i^+$ can be replaced in the previous formula:

$$(29) \quad 0 = \sum_{i=1}^{n}(P_i^p + A_i)(\frac{w_i^+ M_I^+}{P_i^I + A_i} - \frac{w_i^- M_I^-}{P_i^I + A_i})$$

Solving for $M_I^+$ gives:

$$(30) \quad M_I^+ = \frac{\sum_{i=1}^{n} \frac{P_I^P + A_i}{P_i^I + A_i} w_i^-}{\sum_{i=1}^{n} \frac{P_I^P + A_i}{P_i^I + A_i} w_i^+} M^-$$

Cost means the relative difference between market value of the portfolio using transaction prices to the portfolio valued with index prices:

$$(31) \quad M_I^+ = M_P^+(1 - cost)$$

Since $M^-$ = $M_P^+$ leads to

$$(32) \quad cost = 1 - \frac{\sum_{i=1}^{n} \frac{P_I^P + A_i}{P_i^I + A_i} w_i^-}{\sum_{i=1}^{n} \frac{P_I^P + A_i}{P_i^I + A_i} w_i^+}$$

| | |
|---|---|
| $A_i$ | Accrued interest for bond i |
| $BidOffer_i^N Sov$ | Bid-offer spread of nominal sovereign bond j |

| | |
|---|---|
| $w_{i,j,t-s}^{NSov}$ | Weight of sovereign bond j assigned from its pairing inflation-linked bond i at last rebalancing |
| $wt_{i,j,t-s}^{NSov}$ | Total weight (before normalisation) of sovereign bond j at last rebalancing |
| $DUR_{i,t-s}^{ILB}$ | Annual modified duration in real term for inflation-linked bond i at last rebalancing |
| $DUR_{i,j,t-s}^{NSov}$ | Annual modified duration for nominal sovereign bond j at last rebalancing which paired with inflation linked bond i |
| $f_i$ | Amount invested for bond i |
| $f_i^+$ | Amount invested per bond after the rebalancing |
| $f_i^-$ | Amount invested per bond before the rebalancing |
| $i$ | Bonds in the inflation-linked portfolio |
| $j$ | Bonds in the nominal sovereign portfolio |
| $LCR_{i,t-}^{M}$ | Month to date local return for bond i before the rebalancing |
| $m$ | Number of bonds in the inflation-linked portfolio |
| $M^-$ | Market value of the breakeven inflation portfolio before the rebalancing |
| $M_I^+$ | Market value of the breakeven inflation portfolio after rebalancing based upon index prices |
| $M_P^+$ | Market value of the breakeven inflation portfolio after rebalancing based upon transaction prices |
| $MV_{i,t}$ | Market value of bond i at date t |
| $MV_t$ | Market value of all bonds in the index at time t |
| $MV_i^+$ | Market value of bond i after rebalancing |
| $MV_i^-$ | Market value of bond i before rebalancing |
| $n$ | Number of bonds in the nominal sovereign portfolio |
| $P_i^I$ | Index price of bond i in the inflation-linked bond index |
| $P_i^P$ | Portfolio price of bond i in the inflation-linked bond index |
| $P_j^I$ | Index price of bond j in the nominal sovereign bond index |
| $P_j^P$ | Portfolio price of bond j in the nominal sovereign bond index |
| $R_{t-1,t}^{ILB}$ | Daily total return of the inflation-linked portfolio |
| $R_{t-1,t}^{NSov}$ | Daily total return of the nominal sovereign portfolio |
| $TR_t$ | Total return index level at time t |
| $TR_{t-}$ | Total return index level right before rebalancing |
| $TR_{t-s}$ | Total return index level at last rebalancing |

| | |
|---|---|
| $w_{i,t-s}^{ILB}$ | Weight of bond i in the inflation-linked index at last rebalancing |
| $w_{i,t-}^{ILB}$ | Weight of bond i in the inflation-linked index right before rebalancing |
| $w_{i,t+}^{ILB}$ | Weight of bond i in the inflation-linked index right after rebalancing |
| $w_{j,t-s}^{NSov}$ | Weight of bond j in the nominal sovereign index at last rebalancing |
| $w_{j,t-}^{NSov}$ | Weight of bond j in the nominal sovereign index right before rebalancing |
| $w_{j,t+}^{NSov}$ | Weight of bond j in the nominal sovereign index right after rebalancing |
| $w_{cash,t-}$ | Weight of cash in the index prior to the rebalancing |
| $w_{cash,t+}$ | Weight of cash in the index after the rebalancing |
| $\delta_{i,j,t-s}$ | Distribution ratio from inflation-linked bond i to the pairing nominal sovereign bond j at last rebalancing date |
| $\Delta_{t-s}$ | Scaling factor for the short nominal sovereign index at last rebalancing |

# 7 Further information

**Client support**

For client support please contact index_services@spglobal.com.

**Formal complaints**

Formal complaints should be emailed to spdji_compliance@spglobal.com.

Please note: spdji_compliance@spglobal.com should only be used to log formal complaints.

**General index inquiries**

For general index inquiries, please contact index_services@spglobal.com.

# A ESG Disclosures

| EXPLANATION OF HOW ENVIRONMENTAL, SOCIAL & GOVERNANCE (ESG) FACTORS ARE REFLECTED IN THE KEY ELEMENTS OF THE BENCHMARK METHODOLOGY [1] | | |
|---|---|---|
| 1 | **Name of the benchmark administrator.** | IHS Markit Benchmark Administration Limited (IMBA) |
| 2 | **Underlying asset class of the ESG benchmark. [2]** | N/A |
| 3 | **Name of the S&P Dow Jones Indices benchmark or family of benchmarks.** | iBoxx Benchmark Statement |
| 4 | **Do any of the indices maintained by this methodology take into account ESG factors?** | No |
| Appendix latest update: | | May 2023 |
| Appendix first publication: | | May 2023 |

[1] The information contained in this Appendix is intended to meet the requirements of the European Union Commission Delegated Regulation (EU) 2020/1817 supplementing Regulation (EU) 2016/1011 of the European Parliament and of the Council as regards the minimum content of the explanation of how environmental, social and governance factors are reflected in the benchmark methodology and the retained EU law in the UK (The Benchmarks (amendment and Transitional Provision) (EU Exit) Regulations 2019).

[2] The ‘underlying assets’ are defined in European Union Commission Delegated Regulation (EU) 2020/1816 supplementing Regulation (EU) 2016/1011 of the European Parliament and of the Council as regards the explanation in the benchmark statement of how environmental, social and governance factors are reflected in each benchmark provided and published.

# Disclaimer

**Performance Disclosure/Back-Tested Data**

Where applicable, S&P Dow Jones Indices and its index-related affiliates ("S&P DJI") defines various dates to assist our clients by providing transparency. The First Value Date is the first day for which there is a calculated value (either live or back-tested) for a given index. The Base Date is the date at which the index is set to a fixed value for calculation purposes. The Launch Date designates the date when the values of an index are first considered live: index values provided for any date or time period prior to the index's Launch Date are considered back-tested. S&P DJI defines the Launch Date as the date by which the values of an index are known to have been released to the public, for example via the company's public website or its data feed to external parties. For Dow Jones-branded indices introduced prior to May 31, 2013, the Launch Date (which prior to May 31, 2013, was termed "Date of introduction") is set at a date upon which no further changes were permitted to be made to the index methodology, but that may have been prior to the Index's public release date.

Please refer to the methodology for the Index for more details about the index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations.

Information presented prior to an index's launch date is hypothetical back-tested performance, not actual performance, and is based on the index methodology in effect on the launch date. However, when creating back-tested history for periods of market anomalies or other periods that do not reflect the general current market environment, index methodology rules may be relaxed to capture a large enough universe of securities to simulate the target market the index is designed to measure or strategy the index is designed to capture. For example, market capitalization and liquidity thresholds may be reduced. In addition, forks have not been factored into the back-test data with respect to the S&P Cryptocurrency Indices. For the S&P Cryptocurrency Top 5 & 10 Equal Weight Indices, the custody element of the methodology was not considered; the back-test history is based on the index constituents that meet the custody element as of the Launch Date. Also, the treatment of corporate actions in back-tested performance may differ from treatment for live indices due to limitations in replicating index management decisions. Back-tested performance reflects application of an index methodology and selection of index constituents with the benefit of hindsight and knowledge of factors that may have positively affected its performance, cannot account for all financial risk that may affect results and may be considered to reflect survivor/look ahead bias. Actual returns may differ significantly from, and be lower than, back-tested returns. Past performance is not an indication or guarantee of future results.

Typically, when S&P DJI creates back-tested index data, S&P DJI uses actual historical constituent-level data (e.g., historical price, market capitalization, and corporate action data) in its calculations. As ESG investing is still in early stages of development, certain datapoints used to calculate certain ESG indices may not be available for the entire desired period of back-tested history. The same data availability issue could be true for other indices as well. In cases when actual data is not available for all relevant historical periods, S&P DJI may employ a process of using "Backward Data Assumption" (or pulling back) of ESG data for the calculation of back-tested historical performance. "Backward Data Assumption" is a process that applies the earliest actual live data point available for an index constituent company to all prior historical instances in the index performance. For example, Backward Data Assumption inherently assumes that companies currently not involved in a specific business activity (also known as "product involvement") were never involved historically and similarly also assumes that companies currently involved in a specific business activity were involved historically too. The Backward Data Assumption allows the hypothetical back-test to be extended over more historical years than would be feasible using only actual data. For more information on "Backward Data Assumption" please refer to the FAQ. The methodology and factsheets of any index that employs backward assumption in the back-tested history will explicitly state so. The methodology will include an Appendix with a table setting forth the specific data points and relevant time period for which backward projected data was used. Index returns shown do not

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Index returns do not reflect payment of any sales charges or fees an investor may pay to purchase the securities underlying the Index or investment funds that are intended to track the performance of the Index. The imposition of these fees and charges would cause actual and back-tested performance of the securities/fund to be lower than the Index performance shown. As a simple example, if an index returned 10% on a US $100,000 investment for a 12-month period (or US $10,000) and an actual asset-based fee of 1.5% was imposed at the end of the period on the investment plus accrued interest (or US $1,650), the net return would be 8.35% (or US $8,350) for the year. Over a three-year period, an annual 1.5% fee taken at year end with an assumed 10% return per year would result in a cumulative gross return of 33.10%, a total fee of US $5,375, and a cumulative net return of 27.2% (or US $27,200).

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