S&P Dow Jones Indices

A Division of S&P Global

Markit iBoxx GBP Liquid Corporates Large Cap Interest Rate Hedged Index Guide

May 2023

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1) Markit iBoxx GBP Liquid Corporates Large Cap Interest Rate Hedged Index

The Markit iBoxx GBP Liquid Corporates Large Cap Interest Rate Hedged Index is a strategy targeting to provide a duration hedge to the Markit iBoxx GBP Liquid Corporates Large Cap Index (“Underlying Index”) which reflects the performance of GBP denominated investment grade corporate debt. The index aims to achieve a neutral duration (i.e., duration equal to zero) by taking a long position in the Underlying Index and a short position in Gilt futures contracts.

The Underlying Index consists of investment grade GBP denominated bonds issued by corporate issuers from developed countries and rated by at least one of three rating services: Fitch Ratings, Moody’s Investors Service, or S&P Global Ratings. The eligible contract for the short position is the Long Gilt Futures contract.

The Markit iBoxx GBP Liquid Corporates Large Cap Interest Rate Hedged Index is rebalanced once a month at the month-end (the “rebalancing date”).

This document covers the index selection rules and calculation methodology.

2) Selection criteria for the Markit iBoxx GBP Liquid Corporates Large Cap Interest Rate Hedged Index

The index has long positions in the Markit iBoxx GBP Liquid Corporates Large Cap Index and a short position in the Long Gilt front month quarterly futures contracts.

Long Position

The Underlying Index in the long position consists of investment grade GBP denominated bonds issued by corporate issuers and rated by at least one of three rating services: Fitch Ratings, Moody's Investors Service, or S&P Global Ratings. Detailed methodology for the Markit iBoxx GBP Liquid Corporates Large Cap Index is available on www.ihsmarkit.com.

Short Position

The eligible front month contract for the short position is the Long Gilt futures contract. The contract follows a March quarterly cycle and expires in March, June, September and December.

The "Cheapest-To-Deliver" bonds ("CTD") for each futures contract are determined at every rebalancing.

3) Index calculation

3.1) Bond and futures prices

Futures prices are taken from Euronext-Liffe from 4:14 to 4:15 p.m. London.

For more details on the bond prices, please refer to the “Markit iBoxx Pricing Rules” document, publicly available under Methodology on www.ihsmarkit.com.

3.2) Index rebalancing

The Markit iBoxx GBP Liquid Corporates Large Cap Interest Rate Hedged indices are rebalanced monthly on the last business day of the month after the close of business.

The Markit iBoxx GBP Liquid Corporates Large Cap Interest Rate Hedged index strategy uses futures contracts to fully hedge the duration of the Underlying Index. The hedge positions are reset to achieve target duration of zero at each monthly rebalancing day.

A preliminary membership list is published on the 6th calendar day of the month (moved to the next business day in case of holiday/weekend).

Three business days before the end of each month an updated membership list is published.

On the last business day of each month, IHS Markit publishes the final membership.

Rebalancing procedure

On each rebalancing day the following steps are taken to ensure that the index has a target duration of zero.

The rebalancing process follows 3 steps as follows:

- Calculating the duration of the long position
- Determining the Cheapest-To-Deliver bond (CTD) for the Gilt futures contract
- Determining the number of futures contracts to hedge the sub-indices

3.3) Long position

The market value of the long position on day t is calculated as below:

$$MV_t^I = \sum_i MV_{i,t}$$

The annual modified duration of the Underlying Index is calculated as below:

$$MD_{t-s}^I = \frac{\sum_i MV_{i,t-s} \cdot MD_{i,t-s}}{\sum_i MV_{i,t-s}}$$

where	
MD^I_{t-s}	denotes the annual modified duration of the Underlying Index on the rebalancing day $t-s$
i	denotes the i-th bond constituent of Underlying Index on the rebalancing day $t-s$
$MV_{i,t-s}$	denotes the market value of the i-th bond constituent in the Underlying Index on the rebalancing day $t-s$
$MD_{i,t-s}$	denotes the annual modified duration of the i-th bond constituent in the Underlying Index on the rebalancing day $t-s$

3.4) Determining Cheapest-To-Deliver bond

The CTD bond is the least expensive bond that can be delivered upon expiry to satisfy the requirements of a futures contract.

The CTD bond is used as the proxy of a futures contract in determining the number of contracts required to fully hedge the index.

3.5) Determining the number of futures contracts

There are two steps to determine the number of future contracts required for each sub-index.

- **Step 1: Calculate the market value required for the "CTD" of the Gilt futures contract** $MV^{CTD,*}_{t-s} = \frac{MD^I_{t-s} MV^I_{t-s}}{MD^{CTD}_{t-s}}$
- **Step 2: Calculate the number of futures contracts**

In theory, the number of futures contract required on rebalancing day is determined as below:

$$f_{t-s} = \frac{MV^{CTD,*}_{t-s} CF^{CTD}}{P^{CTD}_{t-s} FCS}$$

The number of Gilt futures contract (F_{t-s}) on rebalancing day $t-s$ is rounded to the nearest integer, i.e., F_{t-s} = Round (f_{t-s}).

The market value of the underlying short position on the rebalancing day $t-s$ is then calculated as below:

$$MV^F_{t-s} = F_{t-s} \cdot P^F_{t-s} \cdot FCS$$

where:	
MV^{CTD}_{t-s}	denotes the annual modified duration of the CTD for the Gilt futures contract on the rebalancing day $t-s$
$MV^{CTD,*}_{t-s}$	denotes the market value required for the CTD for the Gilt futures contract on the rebalancing day $t-s$
MV^I_{t-s}	denotes the annual modified duration of the Underlying Index on the rebalancing day

where:	
f_{t-s}	denotes the theoretical number of futures contract required for the Underlying Index on the rebalancing day $t-s$
P_{t-s}^{CTD}	denotes the dirty price of the CTD of the Gilt futures contract on the rebalancing day $t-s$
FCS	denotes the contract size of the Gilt futures
CF^{CTD}	denotes the conversion factor of the CTD for the Gilt futures contract
P_{t-s}^{F}	denotes the quote of the Gilt futures contract at the rebalancing day

3.6) Composing the Overall index

On the rebalancing day, the Underlying Index in long position and the Long Gilt futures contract in short position enter into the Markit iBoxx GBP Liquid Corporates Large Cap Interest Rate Hedged index as below:

The ratio of short position value to long position value on rebalancing day $t-s$ is calculated as below:

$$ShortRatio_{t-s} = \frac{MV_{t-s}^{F}}{MV_{t-s}^{I}}$$

3.7) Index calculation

The Markit iBoxx GBP Investment Grade Interest Rate Hedged index is calculated on every index business day.

The index level on index day t is calculated as below:

$$IndexLevel_t = IndexLevel_{t-s} IndexReturn_{t-s,t}$$

where	
$IndexLevel_t$	denotes the index level on day t
$IndexLevel_{t-s}$	denotes the index level on latest rebalancing day $t-s$ prior to day t

The index return on such day is calculated as below:

$$IndexReturn_{t-s,t} = LongReturn_{t-s,t} - ShortReturn_{t-s,t} ShortRation_{t-s}$$

where	
$LongReturn_{t-s,t}$	denotes the return of the long position in the period that starts from the rebalancing day $t-s$ and ends on (including) day t
$ShortReturn_{t-s,t}$	denotes the return of the short position in the period that starts from the rebalancing day $t-s$ and ends on (including) day t
$ShortRation_{t-s}$	denotes the ratio of short position value to long position value on the rebalancing day $t-s$

Or equivalently the index return is calculated as below:

$$IndexReturn_{t-s,t} = \frac{MV_t^I + Cash_{t-s,t}^I}{BMV_{t-s}^I} - \frac{MV_t^F}{MV_{t-s}^F}\frac{MV_{t-s}^F}{MV_{t-s}^I}$$

where	
BMV_{t-s}^I	denotes the base market value of the constituent in long position on the rebalancing day $t-s$
MV_t^I	denotes the market value of the long position on day t
MV_{t-s}^I	denotes the market value of the long position on rebalancing day $t-s$
$Cash_{t-s,t}^I$	denotes the cash accumulated in the period that starts from the rebalancing day $t-s$ and ends on (including) day t
MV_t^F	denotes the market value of the short position on day t
MV_{t-s}^F	denotes the market value of the short position on rebalancing day $t-s$

3.8) Roll process

At the rebalancing day prior to the delivery month the futures contract is rolled into the new front month quarterly futures contract.

3.9) Monthly reinvestment

P/L from the index is reinvested in the Underlying Index.

3.10) Index history

The Index history starts on 30 September 2009. The index has a base value of 100 on that date.

3.11) Settlement conventions

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

3.12) Calendar

IHS Markit publishes an index calculation calendar in the *iBoxx Calendars* section of the iBoxx Documentation page on www.ihsmarkit.com. This calendar provides an overview of the index calculation holidays of the iBoxx bond index families in a given year.

3.13) Publication of the index

All indices are calculated as end-of-day and distributed once daily after close of UK markets. The indices are calculated every day on which the Markit iBoxx GBP Liquid Corporates Large Cap Index is published.

In addition, the indices are calculated using the previous trading day's closing prices on the last calendar day of each month if that day is not a regular trading day as well as on common bank holidays as published in the iBoxx index calculation calendar. This index calculation calendar is available on www.ihsmarkit.com under *iBoxx Calendars*. Index data is also available from the main information vendors.

Bond and index analytical values are calculated each trading day and on London bank holidays using the daily bond closing prices and the prices from Euronext-LIFFE. Futures prices are taken as from 4:14 to 4:15 p.m. London time. Closing index values and key statistics are published at the end of each business day and on London bank holidays in the indices section on www.ihsmarkit.com for data subscribers.

3.14) Data publication and access

The table below summarizes the publication of Markit iBoxx GBP Liquid Corporates Large Cap Interest Rate Hedged Index in the *Indices* section of the IHS Markit website www.ihsmarkit.com for registered users and on the FTP server.

Table 1: Publication frequency, file types and access

Frequency	File Type	Access
Daily	Underlying file – Bond level	IHS Markit FTP Server
	Indices file – Index level	IHS Markit FTP Server / IHS Markit 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)	Forwards	IHS Markit FTP Server
Monthly	End of Month Components	IHS Markit FTP Server / IHS Markit website

Below is a summary of the IDs for each publication channel:

Index Name	Markit iBoxx GBP Liquid Corporates Large Cap Interest Rate Hedged Index
Return Type	TRi
SEDOL	BC5ZDY8
ISIN	GB00BC5ZDY87
Ticker	IBXXH2GB
RIC	.IBXXH2GB

3.15) Annual index review

The rules for the index are reviewed at least once per year during the public annual index review consultation process to ensure that the index provides a balanced representation of the GBP denominated debt market. Decisions made following feedback from market participants, the annual index review and External Advisory Committees (EAC) will be published on www.ihsmarkit.com shortly after the EAC meetings have been held. The publication will contain a detailed overview and timelines for implementation of any rules changes.

4) Governance and regulatory compliance

IHS Markit Benchmark Administration Limited (IMBA UK) is the Index Administrator of iBoxx indices. Information on IMBA UK's governance and compliance approach can be found here. This document covers:

- Governance arrangements, including external committees
- Input data integrity
- Conflicts of interest management
- Market disruption and Force Majeure
- Methodology changes and cessations
- Complaints
- Errors and restatements
- Reporting of infringements and misconduct
- Methodology reviews
- Business continuity

More details about IMBA UK can be found on the Administrator's website.

5) Changes to the Markit iBoxx GBP Liquid Corporates Large Cap Interest Rate Hedged Index

30 Jun 2022	• Monthly forward start date updated from 10th calendar day to 6th calendar day
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
01 Oct 2014	• Index restatement, complaints sections added
31 Jul 2013	• Launch of Markit iBoxx GBP Liquid Corporates Large Cap Interest Rate Hedged Index

6) Appendix: Cheapest-to-Deliver methodology

At expiry of a contract, the seller of a futures contract has the option to choose a bond from a list of bonds to be delivered in return for the final futures price. The seller of the contract will generally choose to deliver a bond that is to his/her advantage, or that maximises his/her profit, i.e. the one that requires the least amount of money relative to the payout from the futures contract. This bond is called the Cheapest-to-Deliver (**CTD**).

The **CTD** Analysis is based on the hypothetical situation of being short one futures contract and long the bond (cash) to be delivered. The goal is to find the bond with the maximum positive difference between the two positions. The calculations consider three elements, the current price and accrued interest of the future and the bonds on the settlement date, the accrued interest on the delivery date, and any cash flows between the two dates. A simplified calculation is available if no cash flows occur between the settlement date and the delivery date.

If the settlement date and the delivery date are on and the same day, the analysis is simple, as everything is known and immediate, however, there are several different ways to look at this situation. Commonly used criteria are:

- Gross basis – the difference between the futures position and the cash position without any discounting
- Net basis – the difference between the futures position and the cash position, where the cash flows are discounted/accrued using the current repo rate
- Implied repo rate – the repo rate (similar to the net calculation) which would result in the current value of the discounted gross futures position being equal to the value of the gross cash position

Note that these calculations only fully apply to futures whose expiry is in the near future (< 1 year).

1. Gross basis

The Gross Basis is the simple difference between the futures position and the cash position at delivery:

$$BA_{i,t}^{Gross} = DFP_{i,t}CF_{i,t} + AI_{i,T} - (P_{i,t} + AI_{i,T})$$

2. Net basis

The Net basis is the difference between the futures and the cash position, but the bond values are compounded to the delivery date using the current repo rate:

$$BA_{i,t}^{Net} = DFP_{i,t}CF_{i,t} + AI_{i,T} - (P_{i,t} + AI_{i,t})\left(1 + r_{t,T}^{Repo}\frac{days(t,T)}{n}\right) + C_{i,t^*}\left(1 + r_{t^*,T}^{Repo}\frac{days(t^*,T)}{n}\right)$$

3. Implied repo rate

The implied repo rate is the rate at which both positions are equal in value:

$$r_{i,t}^{implied} = \frac{DFP_{i,t}CF_{i,t} + AI_{i,T} - (P_{i,t} + AI_{i,t} - C_{i,t^*})}{(P_{i,t} + AI_{i,t})\frac{days(t,T)}{100n} - C_{i,t^*}\frac{days(t^*,T)}{100n}}$$

4. Ranking

All deliverable bonds can be ranked according to the implied repo rate. The higher the implied repo rate, the cheaper the current bond is in relation to the futures contract. Therefore the bond with the highest implied repo rate should be chosen as the cheapest to deliver.

Annotations	
$AI_{i,t}$	Accrued interest of the bond i on date t
$AI_{i,T}$	Accrued interest of the bond i on date T
C_{i,t^*}	Accrued interest of the bond i on date t, with t^* being between t and T, otherwise 0
$days(t,T)$	Number of calendar days between t and T
n	Day count basis (actual)
$P_{i,t}$	Clean price of the bond i on date t
$r_{t,T}^{Repo}$	Market repo rate from t to T
$DFP_{i,t}$	Futures contract price on date t
$CF_{i,t}$	Conversion factor of the bond i on date t

7) Further information

Glossary of key terms

The Markit iBoxx Glossary document of key terms is available in the *Methodology* section of the iBoxx *Documentation* page on www.ihsmarkit.com.

Contractual and content issues

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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.

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Where applicable, S&P Dow Jones Indices and its index-related affiliates ("S&P DJI") defines various dates to assist our clients in 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. 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.

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