

MSCI Fixed Income Data Methodology

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1 MSCI Fixed Income Data Methodology Overview

This document provides information about the fixed income data, models, methods, formulas, and statistics that are used in the construction of fixed income universe supporting MSCI products such as the MSCI Fixed Income Indexes.

The following list outlines each section and gives a basic overview of the topics covered.

Opportunity Set and Eligibility Criteria: this section introduces the key attributes of the various fixed income instruments that are considered when classifying and defining their eligibility in each relevant MSCI fixed income universe.

Asset Pricing: this section summarizes the pricing models, both bond and option pricing, used across the various asset types.

Reference curves: this section details the various interest rate reference curves required by the pricing models and used for the calculation of Single Security Analytics (SSAs). These curves are also used in the MSCI quality assurance processes.

Single Security Analytics (SSA): this section provides an overview of the security level statistics computed by MSCI's RiskServer calculation engine using best practice modeling defined by the MSCI Pricing and Model Validation Research team. Statistics such as duration, convexity, option-adjusted spread, accrued interest, and yield are detailed in this section.

Corporate Events: the handling of corporate events and all changes in terms and conditions is critical for the maintenance of the opportunity set and universe selection. Information about how daily changes to corporate structures are reflected and their impact to issued bonds is described in this section.

Forward Looking Information covers prospective corporate events that result in an asset status change or amount outstanding change for all active assets received from vendor in the MSCI fixed income universe.

Additional Published Reference Data: covers additional reference data points including derived methodology supporting index calculations.

Market Conventions: information about the calendars and settlement conventions which impact cashflows and return calculations is covered in this section, as well as details about data collection times for different markets and regions.

Data Sources and Quality Assurance: this section describes the methodology and rules governing the daily review of reference and terms and conditions as well as pricing data.

Data Governance: provides information on the committees helping oversee the Fixed Income Data Methodology.

2 Opportunity Set and Eligibility Criteria

This section introduces the key attributes of the various instruments that are considered when classifying and defining their eligibility in each relevant MSCI Fixed Income Universe referred to as “Index Universe.”

2.1 Currency

The currency of denomination for a bond’s principal and interest payments is a key characteristic used by investors to segment the global fixed income market. Within the Index Universe it is used not only for defining the eligibility of a bond, but also to identify the relevant interest rate reference curves (Government, Swap and At-the-Money Swaption) used to compute all the single security analytics of a security.

Dual currency bonds are not considered as eligible assets for the Index Universe.

2.2 Asset Classification

Fixed income assets can be classified into five universally accepted asset categories. They reflect the distinct characteristics of the assets as well as the investment processes, allocation decisions and specialization of investors within the respective categories.

- Sovereign bonds
- Sub-sovereign bonds¹
- Supranational bonds
- Corporate bonds
- Securitized Products

MSCI currently considers Sovereign, Supranational and Corporate bonds as eligible assets for the Index Universe. Bonds issued by sub-sovereign entities such as government agencies, non-U.S. municipalities and provinces are considered eligible. Bonds issued by U.S. municipalities are excluded from the Index Universe.

¹ Sub-sovereign entities include government agencies and sub-national political entities, including municipalities and provinces.

2.3 Credit Quality

Rating agencies are the main providers of credit ratings, which are commonly used to define credit quality. There is usually a clear distinction between investment grade bonds (BBB-/Baa3 and above) and High Yield bonds (BB+/Ba1 through C-/C3) reflected in asset allocation decisions, as well as investment management specialization. These two credit rating categories also require different pricing quality assurance methods as detailed in section 10.2 Pricing Data Quality Assurance.

MSCI currently uses Standard and Poor's Rating Services (S&P), Moody's Investor Service (Moody's) and/or Fitch Rating Services to calibrate various credit assessments, including MSCI Bond Credit Rating, MSCI Sovereign and Quasi-sovereign Issuer credit rating, MSCI Aggregate Rating, and MSCI Average Rating. These ratings are widely used in defining the eligibility of an asset in the Index Universe.

When all three ratings are available from respective rating agencies, MSCI applies the middle rating to assess an asset's eligibility for inclusion. If only two ratings are provided, the lower of the two will be used. In cases where a bond is rated by only one agency, that rating will be considered as the minimum available rating for eligibility purposes.

Sovereign Issuer and Quasi-sovereign Issuer Credit rating are published at both the local currency and foreign currency level for qualified issuers, providing a more comprehensive and accurate creditworthiness. Sovereign issuers typically consist of national governments or government-related entities, while quasi-sovereign issuers are entities that, though not direct parts of the government, are owned or significantly controlled by sovereign entities. These ratings, while not applied to individual debt securities, serve as strong indicators of the creditworthiness of debt issued by such entities. Debt issued by sovereign and quasi-sovereign entities is generally considered among the least risky in terms of credit risk, and such securities are typically highly liquid and actively traded in the debt markets.

Eligible bonds must be rated, except for bonds issued by sovereign or quasi-sovereign. These bonds are considered eligible regardless of rating status, provided the sovereign or quasi-sovereign issuer itself is rated by one of the major agencies (S&P, Moody's, or Fitch). Bonds issued by sovereign or quasi-sovereign entities which are not rated by at least one of these agencies are excluded from the Index Universe. Please refer to 12.1 MSCI Issuer Rating Methodology for more details on credit ratings applied to define eligibility.

2.4 Seniority

Seniority types cover two components:

- A ranking indicator: senior, subordinated (junior included).
- A collateral indicator: secured vs unsecured.

The ranking indicator defines the priority at which debt holders must be repaid in a bankruptcy event. Senior debt has a higher ranking compared to subordinated. As such, senior debt of an issuer is considered lower risk than subordinated debt.

The collateral indicator indicates whether the debt is backed or secured by the pledge of collateral, mortgage, or other lien in which case it is defined as a secured debt. Secured debt holders have a priority on claims of assets over unsecured debt holders in a bankruptcy event and are protected with specific collateral. Therefore, secured debt is considered lower risk than unsecured debt.

Except for the seniority types listed in Section 12.7.2, all issuances irrespective of their ranking indicator or collateral indicator are eligible assets for the Index Universe.

2.5 Bonds and Coupon Types

2.5.1 Eligible Bond Types

The following bond types are currently considered eligible for the Index Universe:

- Fixed-rate coupon bonds
- Fixed-to-Floating Rate bonds are eligible for inclusion during their fixed-rate term only
- Step-up/Step-down coupons
- Puttable and callable bonds
- Perpetual Bonds
- Bullet bonds
- Regulation S securities (RegS) ²
- Private placements
- Equity Clawbacks

² RegS issuances are treated as independent from their corresponding 144A issuances as their terms, corporate events and pricing details might differ slightly.

- Hybrid securities with deferrable interest payments that *have not* been deferred
- Corporate Sukuk Instruments

2.5.2 Non-Eligible Bond Types

The following bond types are not currently eligible for the Index Universe:

- Floating-rate coupon bonds
- Zero-coupon bonds
- Defaulted bonds
- Inflation protected bonds
- Payment-in-Kinds (PIKs) and sinking funds
- Strips (Interest Only/Principal Only)
- Hybrids including bonds with equity features (convertible, warrants, preferred)
- Hybrid securities whose interest payments *have been* deferred by the issuer
- Exchange-traded notes
- Dual currency
- Excluded instrument types³
- Excluded seniority types⁴
- Sovereign Sukuk Instruments

2.6 Amount Outstanding

2.6.1 Issuer Amount Outstanding Calculation

The issuer amount outstanding is an important statistic to quantify the size of an issuer. In addition, it serves as a proxy measure for the liquidity of assets associated with an issuer. These are two important considerations for defining inclusion in the Index Universe.

The calculation of the issuer amount outstanding is performed at the issuer level and accounts for all the active outstanding bonds of the issuer using the issuer (entity) to issue mapping provided by the reference data vendor. This calculation only includes

³ Excluded instrument types can be found in Section 12.7.1

⁴ Excluded seniority types can be found in Section 12.7.2

bonds for which terms and conditions data is available but excludes assets in the securitized products and bank loan asset categories. The issuer amount outstanding will be calculated for all issuers in the Index Universe. It includes all issuer debt in the calculation regardless of whether the debt meets the eligible universe criteria or not. In this calculation, Regulation S (RegS) and N-Receipts issues are excluded to avoid double counting, whereas private placements are included. Strips that consist of the interest or principal component only are also excluded. The issuer amount outstanding is accrued by currency. This means, for instance, that the issuer amount outstanding in USD for an entity will accrue debts in USD only, without considering debts in other currencies listed under this entity.

2.6.2 Minimum Issue Outstanding

A minimum amount for issue amount outstanding is required for inclusion in the Index Universe to obtain appropriate price coverage from vendors, adequate liquidity to investors as well as a critical issuance size for investment suitability.

The minimum amount for issue amount outstanding is defined for various markets, regions or currencies and asset classifications respectively, as detailed in the table below.

Currency / Market	Minimum Issue Outstanding
USD	USD 100 million
EURO	EUR 100 million
GBP	GBP 100 million
CAD	CAD 100 million
MXN	MXN 10 billion
CHF	CHF 100 million
DKK	DKK 10 billion
SEK	SEK 10 billion
NOK	NOK 10 billion
ILS	ILS 100 million
ZAR	ZAR 10 billion
AUD	AUD 100 million

JPY	JPY 10 billion
MYR	MYR 1 billion
CNY	CNY 10 billion
SGD	SGD 100 million

2.6.3 Country of Domicile

Issuer country of domicile is the current country of the issuer’s principal executive offices. Assets from Developed Markets and Non-developed Markets are considered eligible for Index Universe.

3 Asset Pricing

A pricing model is needed to compute single security analytics (SSAs), such as spread over riskless curve for fixed-rate bonds, option-adjusted spread (OAS) for callable bonds and statistics such as duration and convexity. We can separate the pricing components into the price of a non-callable bond and the price of a bond option, where the price of a callable bond is equal to the price of a non-callable bond minus the price of the call option.

3.1 Bond Pricing Model

Non-callable bonds are priced by discounting cash-flows using a suitable interest rate curve.

Using this pricing model, the (dirty) model value of a bond can be expressed as:

$$P_{model} = \sum_i^m K_i D(r_i, t_i) \tag{1}$$

Where:

m = remaining scheduled payments (including coupon payments and principal)

K_i = flow amount at each payment time t_i

D = discount factor for discount rate r_i at time t_i

r_i = discount rates corresponding to each payment time t_i

t_i = payment time $i = 1, \dots, m$

3.2 Option Pricing Model

Bonds with embedded optionality are priced using the Hull-White One-Factor (HW1F) model, which assumes that the interest rate curve is driven by a stochastic short rate that is normally distributed and mean-reverting. The model is calibrated using liquid swaption prices and involves two parameters: the short rate volatility σ , and the mean reversion rate α . Both the short rate volatility σ , and the mean reversion rate α are calibrated to a set of swaption prices in each currency. The model can be calibrated to exactly reproduce the expected discounted cashflows for bonds without embedded optionality and is therefore able to consistently model both callable and non-callable bonds.

4 Reference Curves and Reference Rates

The reference interest rate curves required by the bond pricing model and option pricing model, in each currency, are:

- Zero-Coupon Government Curve
- Zero-Coupon Swap Curve
- At-the-Money (ATM) Swaption Surface

These reference curves are a critical component for:

- Computing accurate SSAs, such as option-adjusted spread (OAS), effective duration, effective convexity, etc.
- Our Quality Assurance process, for assessing vendor price stability and validity

Please see 12.3 Currency Specific Model Definitions & Reference Curves for details and curves characteristics market-by-market.

4.1 Zero-Coupon Government Curve

The zero-coupon government curve in each currency determines the risk-free rate used in the bond pricing model. The constituent basket of bonds used in the estimation of a government curve consists of any government issued fixed-coupon bond with the following properties:

- Not inflation linked
- Not callable
- Not the On-the-Run

4.2 Zero-Coupon Swap Curve

A zero-coupon swap curve, determined by currency and reference rate, is necessary for the accurate pricing of fixed-to-floating rate bonds. The curve is used to establish a forward-looking expectation for the floating coupon payments which impact the pricing of fixed-to-float bonds.

4.2.1 Reference Rates

For fix-to-float bonds referencing an overnight indexed rate that settles in arrears, such as SOFR, the reference rate time series over the interest period is required to determine the average of the rate over the interest period.

4.3 At-the-Money Swaption Implied Volatility Surface

The At-the-Money (ATM) Swaption Implied Volatility Surface is used in the pricing of bonds with embedded optionality such as Puttable and Callable bonds. It is the volatility series used to calibrate the short rate volatility and the mean reversion speed parameters of the Hull-White One-Factor (HW1F) option pricing model.

When an ATM swaption surface is not available the zero-coupon swap curve time series is used to calibrate the short rate volatility and the mean reversion speed parameters of the option pricing model.

5 Single Security Analytics

The Single Security Analytics (SSAs) are computed by MSCI's RiskServer Calculation engine using best practice modeling defined by the MSCI Pricing and Model Validation Research team.

5.1 Price

5.1.1 Present Value

The Present Value is the present value (dirty price) of a bond on the analysis date. See Eq. (1) for the (dirty) model value of a bond.

5.1.2 Clean Present Value

The Clean Present Value is the present value (clean price) of a bond on the analysis date, equal to Present Value minus Accrued Interest. See Eq. (1) for the (dirty) model value of a bond and 5.6 Accrued Interest.

5.1.3 Settlement Price

The Settlement Price is the present value (dirty price) of a bond on the settlement date (analysis date plus settlement period). See Eq. (1) for the (dirty) model value of a bond.

5.2 Yield

The compounding frequency for all yield analytics is annual.

5.2.1 Yield-to-Maturity

Yield-to-maturity is obtained by calibrating y to the price of the bond P according to the formula below:

$$P = \sum_{i=1}^N D(y, t_i) c_i \quad (2)$$

Where:

c_i = cashflow at time t_i

D = discount factor for discount rate y at time t_i

P = clean price

t_i = time to coupon / principal payment

y = yield-to-maturity

Yield-to-maturity assumes that the bond is held to maturity and all coupon payments are reinvested at the interest rate equal to the yield-to-maturity.

5.2.2 Yield-to-Worst

The yield at which a callable or puttable bond is most likely to be redeemed. It is the lower of the yield-to-call/put (see below) and the yield-to-maturity (see 5.2.1 Yield-to-Maturity). An optionable bond can be redeemed on any redemption payment date established in the contract and will be redeemed when it is most advantageous to the holder of the option to do so. In other words, it is the minimum yield for callable bonds and the maximum yield for puttable bonds across all the possible redemption payment dates.

5.2.2.1 Yield-to-Call

Yield-to-call is defined as the internal rate of return on any callable investment that will make the present value of the cash flows equal to the price assuming the bond is called on the next call/put date.

To calculate yield-to-call the bond is assumed to be held until its first viable call date, T_c . The first viable call date is the first call date that is later than the settlement date d_s . The bond is redeemed at T_c for the corresponding strike price, K (Note that K is a

dirty price and includes accrued interest up to T_c). In this case the yield is calibrated using:

$$P = \sum_{i=1}^{n_c} D(y, t_i)c_i + D(y, T_c)K \tag{3}$$

where the sum covers the n_c cashflows before or on T_c , and we have explicitly separated the contribution from the bond redemption at T_c .

5.2.2.2 Yield-to-Put

To calculate yield-to-put the bond is assumed to be held until its first viable put date, T_p . The first viable put-date is the first put date that is later than the settlement date d_s . The bond is redeemed at T_p for the corresponding strike price, K (Note that K is a dirty price and includes accrued interest up to T_p). In this case the yield is calibrated using:

$$P = \sum_{i=1}^{n_p} D(y, t_i)c_i + D(y, T_p)K \tag{4}$$

where the sum covers the n_p cashflows before or on T_p , and we have explicitly separated the contribution from the bond redemption at T_p .

5.3 Duration

Duration is a linear approximation of the price sensitivity of a bond to changes in interest rates.

5.3.1 Macaulay Duration

Macaulay duration (MD_m) represents the time-weighted present value of cash flows of a bond divided by the bond's price. Macaulay duration implicitly assumes that a bond's cash flows do not change when interest rates change. Therefore, Macaulay duration is not a proper measure of duration for bonds with embedded options.

Macaulay Duration is defined as:

$$MD_m = \frac{1}{|P|} \sum_{i=1}^N t_i D(y, t_i) c_i \tag{5}$$

Where:

c_i = cashflow at time t_i

D = discount factor for discount rate y_k at time t_i

P = clean price

t_i = time to coupon / principal payment

y = yield-to-maturity

5.3.2 Modified Duration

Modified duration is a measure of price sensitivity of a bond with respect to the yield-to-maturity. It assumes that the expected cash flows for a bond remain constant for a given change in yield. This assumption holds for bonds without embedded options, however, given this assumption modified duration is not a proper measure of duration for bonds with embedded options.

Modified Duration is defined as:

$$MD = -\frac{1}{|P|} \frac{\partial P}{\partial y} = \frac{MD_m}{(1 + y/k)} \quad (6)$$

Where:

k = annual compounding frequency

MD_m = Macaulay Duration

MD = Modified Duration

P = clean price

y = yield-to-maturity

5.3.3 Effective Duration

Effective duration directly measures the price sensitivity of a bond with respect to changes in the par yield curve and is a proper measure of price sensitivity for bonds with embedded options.

Effective duration is defined as:

$$D_{effective} = -\frac{1}{|P|} \frac{P_{+\Delta x} - P_{-\Delta x}}{2\Delta x} * 10000 \quad (7)$$

Where:

Δx = parallel shift in basis points applied to the par yield curve (equal to 5 bps)

$D_{effective}$ = Effective Duration

P = clean price

5.3.4 Duration-to-Worst

Duration to worst is modified duration calculated with respect to yield-to-worst. See section 5.2.2 Yield-to-Worst.

5.3.5 Effective Spread Duration

Effective spread duration measures the price sensitivity of a bond with respect to changes in the credit spread. See 5.5.1 Option-Adjusted Spread.

Effective Spread Duration is defined as:

$$SD_{zc} = -\frac{1}{|P|} \frac{P_{+\Delta s} - P_{-\Delta s}}{2\Delta s} * 10000 \quad (8)$$

Where:

Δs = shift in basis points applied to the OAS (equal to 10 bps)

SD_{zc} = Effective Spread Duration

P = clean price

5.3.6 Key Rate Duration

Key rate duration (KRD) is a component of Effective duration, where the parallel shift in the par yield curve is replaced with a “tent-shaped” shift centered at a given key-rate node.

Key Rates are 1M, 6M, 1Y, 2Y, 5Y, 7Y, 10Y, 20Y, 30Y, 50Y.

5.3.7 Dollar Value of a Basis Point

The Dollar Value of a Basis Point (DV01) is the change in the price of a bond for a parallel, positive one basis point shift in the par-yield curve.

$$DV01 = -\frac{\Delta P}{\Delta y} \quad (9)$$

Where:

ΔP = change in price

Δy = +1 basis point shift in the par-yield curve

5.4 Convexity

Convexity is the second derivative of the price-yield function and measures the second-order sensitivity of the price of a bond with respect to yield changes.

5.4.1 Effective Convexity

Effective convexity is the second order sensitivity of the price of a bond with respect to changes in the par-yield curve.

Effective convexity is defined as:

$$Convexity_{py} = -\frac{1}{100|P|} \frac{P_{+\Delta x} + P_{-\Delta x} - 2P}{\Delta x^2} * 10000 \quad (10)$$

Where:

Δx = parallel shift in basis points applied to the par yield curve (equal to 10 bps)

$Convexity_{py}$ = Effective Convexity

P = clean price

5.4.2 Modified Convexity

Modified convexity is the second-order sensitivity of the price with respect to yield-to-worst. See 5.2.1 Yield-to-Maturity 5.2.2 Yield-to-Worst

$$MC = -\frac{1}{|P|} \frac{\partial^2 P}{\partial y^2} \quad (11)$$

Where:

MC = Modified Convexity

P = clean price

y = yield-to-worst

5.4.3 Spread Convexity

Spread convexity is the second order sensitivity of the price with respect to credit spread. See 5.5.1 Option-Adjusted Spread.

$$Convxy_{spread} = -\frac{1}{|P|} \frac{\partial^2 P}{\partial s^2} = -\frac{1}{P} \frac{P_{\Delta s} + P_{-\Delta s} - 2P}{\Delta s^2} \quad (12)$$

Where:

Δs = shift in basis points applied to the OAS (equal to 10 bps)

$Convxy_{py}$ = Effective Convexity

P = clean price

s = credit spread

5.5 Spread

5.5.1 Option-Adjusted Spread

Option Adjusted Spread (OAS) is a constant spread (s) above the zero-coupon risk-free (government) rate (r) that makes a bond's model price (P_{model}) equal to its market price (P_{market}):

$$P_{market} = P_{model}(r, s) \quad (13)$$

Where:

P_{market} = market price

P_{model} = model price

r = zero-coupon risk-free (government) rate

s = OAS

5.6 Accrued Interest

Accrued Interest is the calculated amount of interest on a fixed income security which has been earned but not yet paid between the last coupon date and the analysis date. Accrued interest is calculated as-of the pricing date and not the settlement date.

5.6.1 Coupon Payments

The generic form for calculation of a coupon payment is given by:

$$\sum_{k=1}^n \hat{P}_k * c_k * \tau_k \quad (14)$$

Where:

c_k = the coupon rate for period (t_k, t_{k+1})

\hat{P}_k = the modified outstanding principal at τ_k

τ_k = the time between t_k and t_{k+1} , computed according to the bond's day count convention

5.6.2 Fixed-Coupons

The method for calculating accrued interest for a fixed-rate bond with a single fixed-coupon rate and regular coupon periods is detailed below.

Coupon payments are computed using Eq. (14):

ACT_ACT, 30_ACT, and 30E_ACT define τ_k as the fraction of coupon periods between t_k and t_{k+1} divided by the coupon frequency in 1/years

$$t_k = \frac{\tau(t_k, t_{k+1})}{\tau(T^{start}, T^{end})} / couponFrequency \quad (15)$$

Where:

- ACT_ACT is the actual/actual ICMA day-count convention
- 30_ACT is the SIA 30/actual day-count convention
- 30E_ACT is the E 30 (ICMA)/actual ICMA day-count convention

5.6.3 Ex-Dividend Bonds

Bonds that trade ex-dividend do not include the interest or coupon payment when purchased or sold. The last date a bond trade settles on a cum-dividend basis is the ex-dividend date. Trades settling after the ex-dividend date and inclusive of the next coupon date trade on an ex-dividend basis. RiskServer defines the ex-dividend date as the date corresponding to the number of specified ex-dividend days before the next scheduled coupon date.

The impact of ex-dividend treatment on accrued interest is when a bond settles on an ex-dividend basis the accrued interest is negative. If $ACI_{cum}(t)$ is the accrued interest

at time t assuming the bond does not trade ex-dividend and instead settles cum-dividend accrued interest at time t can be expressed as:

$$ACI(t) = ACI_{cum}(t) \tag{16}$$

When a bond settles on an ex-dividend basis the discounted value of the next coupon is subtracted from the accrued interest cum-dividend and accrued interest is negative.

$$ACI(t) = ACI_{cum}(t) - C_n e^{-(r_n + s_d)t_n} \tag{17}$$

Regardless if a bond trades cum-dividend or ex-dividend, the clean and dirty price at time t are bound by Eq. (18).

$$P_{clean}(t) = P_{dirty}(t) - ACI(t) \tag{18}$$

Where:

$P_{clean}(t)$ = clean present value

$P_{dirty}(t)$ = present value

ACI = Accrued Interest

*Note that the PV statistics report the present value of a bond on analysis date, regardless of settlement period.

6 Corporate Events Handling

Corporate events consist of all events resulting in a change to the asset level outstanding amount or asset characteristics that can impact eligibility throughout the lifespan of a bond included in the Index Universe. The redemption price is attached to each event given the vendor’s best knowledge and availability of information from the market. The new effective bonds due to exchange or fudge events will be linked to the existing bonds, to better reflect the replacement relationship. Events that do not impact the asset level amount outstanding but impact the qualitative status of an asset like defaults or recovery from defaults will also be recorded as corporate events.

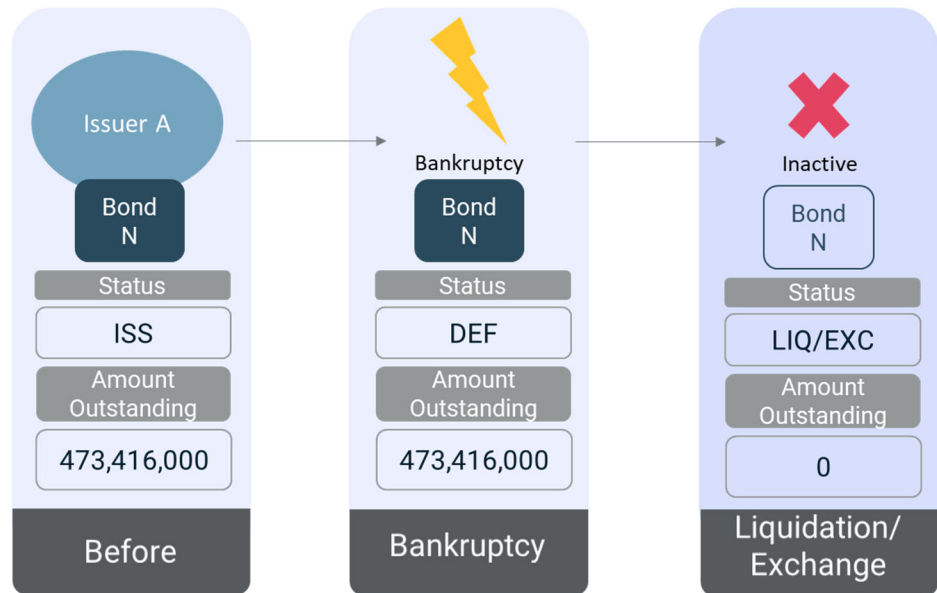
Corporate events data not only reflects changes in the historical asset level outstanding amount but can also have forward-looking functionality, foreshowing announced events in the future.

Assets that originally qualified to be added to the Index Universe will remain in the Index Universe after a corporate event even if the assets do not meet eligibility criteria post-event.

6.1 Issuers Corporate Event Handling

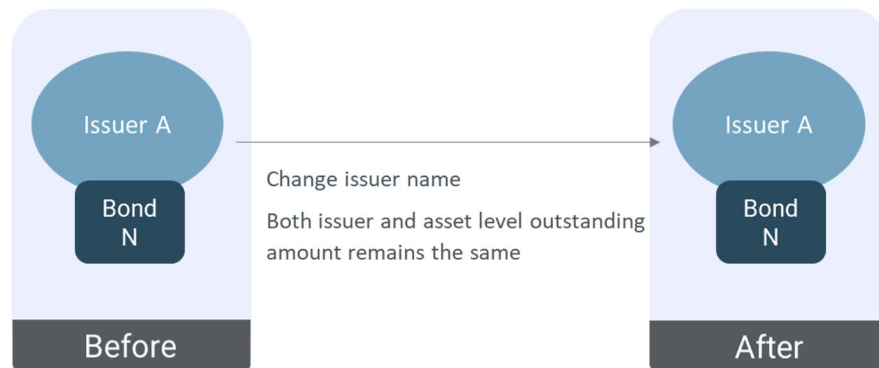
6.1.1 Issuer Bankruptcy

Once an issuer files for bankruptcy, and the event becomes effective, the assets attached to the issuer will be classified as “In default.” If the issuer emerges from bankruptcy and has a reorganization plan, the assets will be updated as “liquidated” or “exchanged” as applicable.



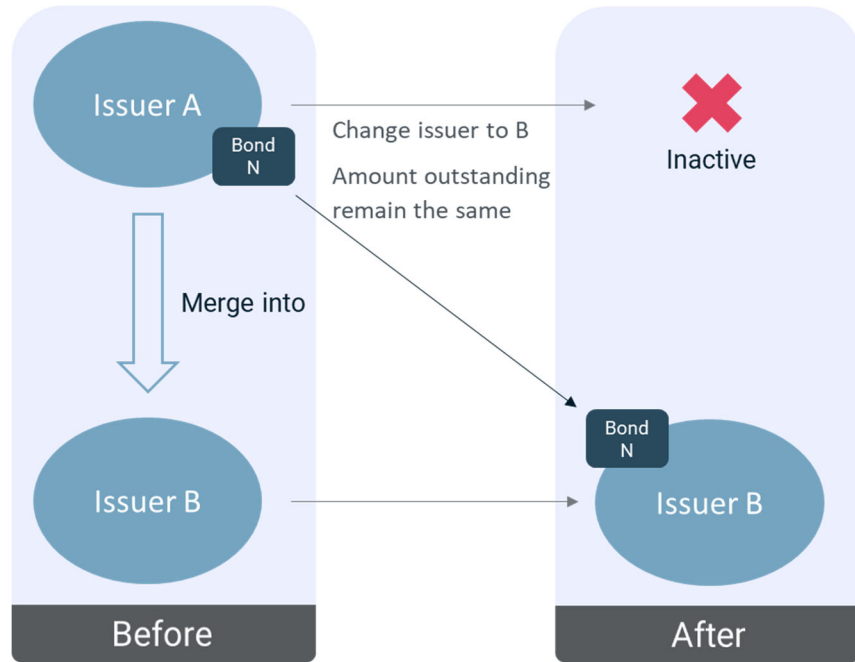
6.1.2 Issuer Name Change

Issuer’s name changes are reflected at the time they occur. Such events do not impact the attributes of the issuer/bond in the universe.



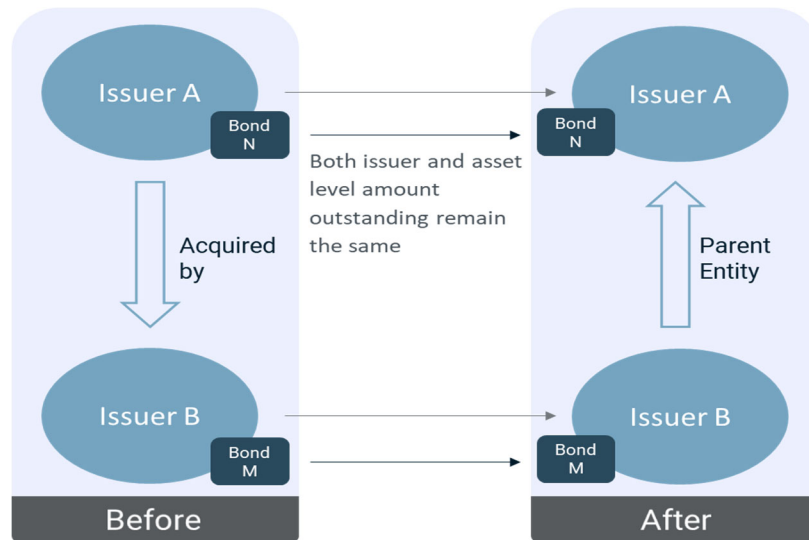
6.1.3 Issuer Merger

In the event Issuer A merges with, and into, Issuer B, all of instruments associated with Issuer A will be moved to Issuer B. The issuer amount outstanding of Issuer B will increase by an amount equivalent to the issuer amount outstanding of Issuer A after the completion of the merger. There is no impact to the asset level outstanding amount due to such events.



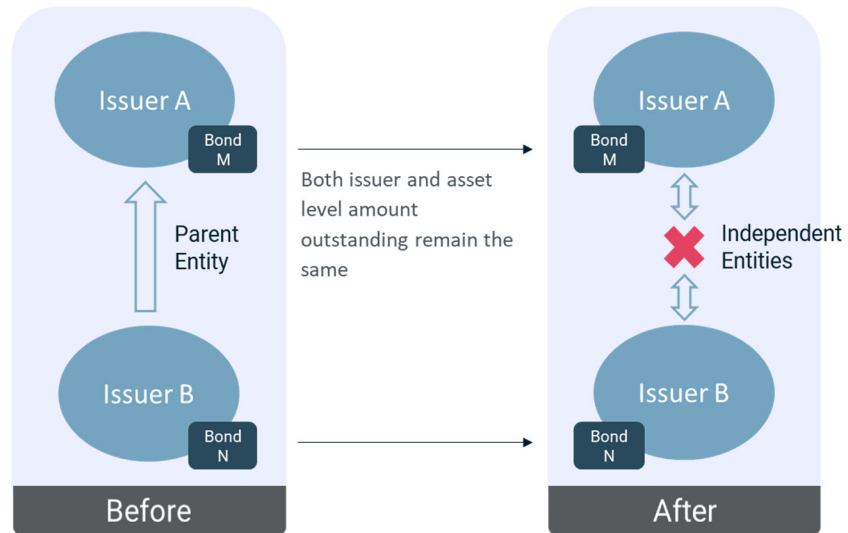
6.1.4 Issuer Acquisition

In the event Issuer A is acquired by Issuer B, both issuers are still treated as active and there is no impact to the issuer to issue mapping. Issuer B will be marked as new parent entity of Issuer A. There is no impact to the asset level outstanding amount due to such events.



6.1.5 Issuer Spin-off

A spun-off entity will remain as “active” as it is either a creation of an independent company or distribution of new shares of an existing business or division of a parent company. There is no impact to the asset level outstanding amount due to such events.

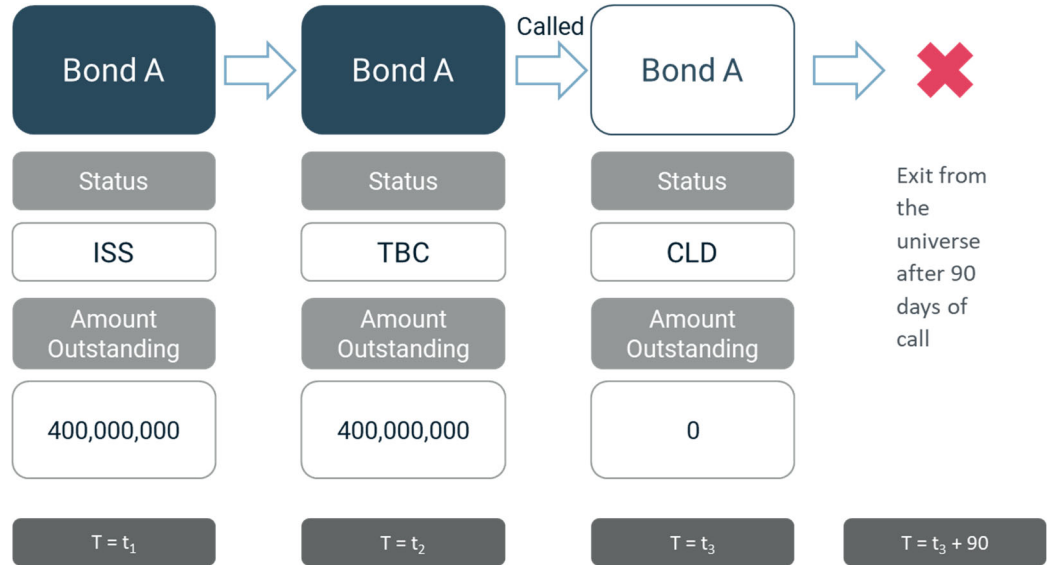


6.2 Issue Level Corporate Event Handling

The following charts represent the logic of some common corporate events on an issue level. Please refer to 12.5 Corporate Event Terminology for the exhaustive list of issue level corporate events.

6.2.1 Asset Called

An asset is called when there is a cancellation of debt issued by the issuer. There is no change in the asset identifier nor a transfer of amount to any existing or new security. The debt will be terminated and its amount outstanding decreased to zero. 90 days after the call date, the asset will exit from the universe.

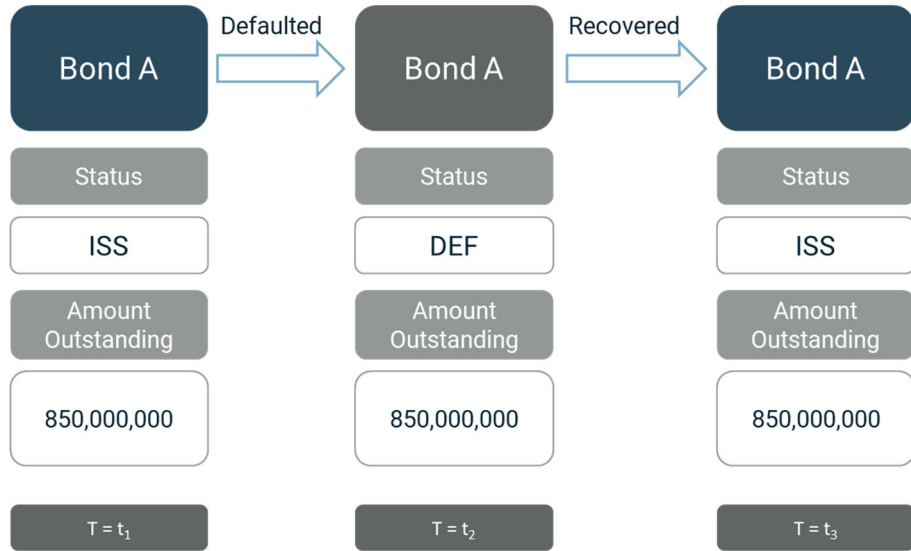


6.2.2 Asset-in-Default

When the reference data vendor confirms a bond issuer is under financial difficulty and fails to make an interest or principal payment within the specified period for payment, the bond will be classified as “in default.” There is no change in asset identifier nor a transfer of amount to any existing or new security.

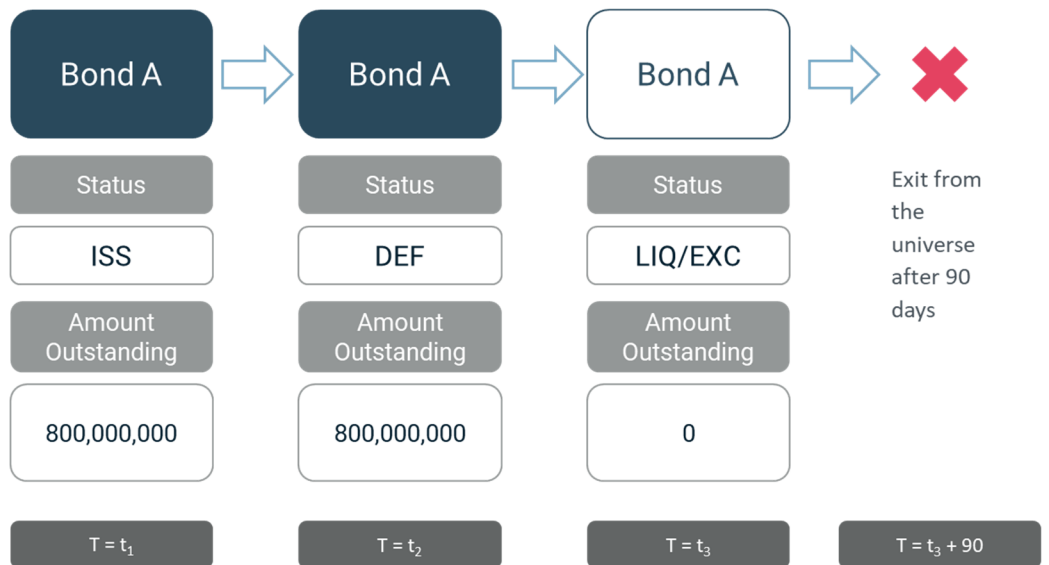
6.2.2.1 Asset Recovered from Default

If the liquidity of the issuer of a defaulted bond improves and the issuer can repay the missing interest or principal payments, the bond will recover from default and change back to “Issuance” status.



6.2.2.2 Asset Liquidated/Exchanged after Default

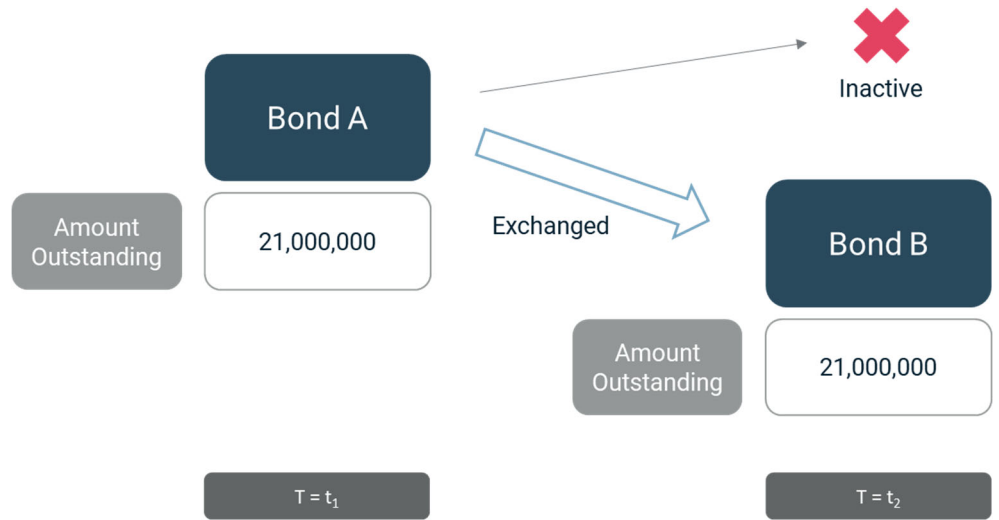
If the financial difficulty of the issuer persists and leads to bankruptcy of the issuer, the bond will be liquidated or exchanged into other instruments as part of the reorganization plan. In either case, the bond will become inactive after the liquidation/exchange.



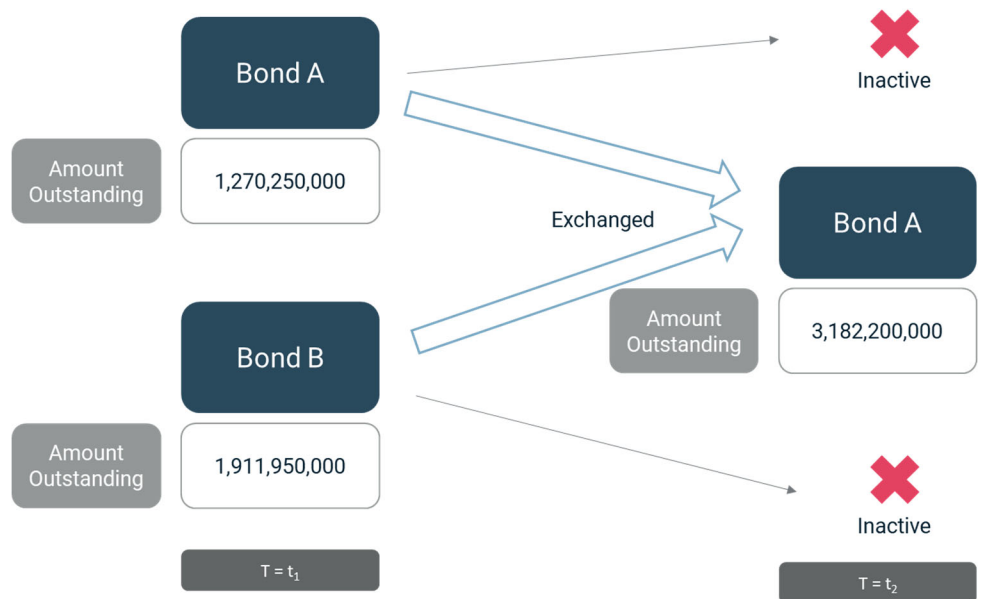
6.2.3 Asset Exchanged

When an existing security is fully exchanged to a new security the asset status is updated to “Exchanged/Converted.” A new asset identifier will be generated, and the exchanged amount of the old security will be transferred to the new security.

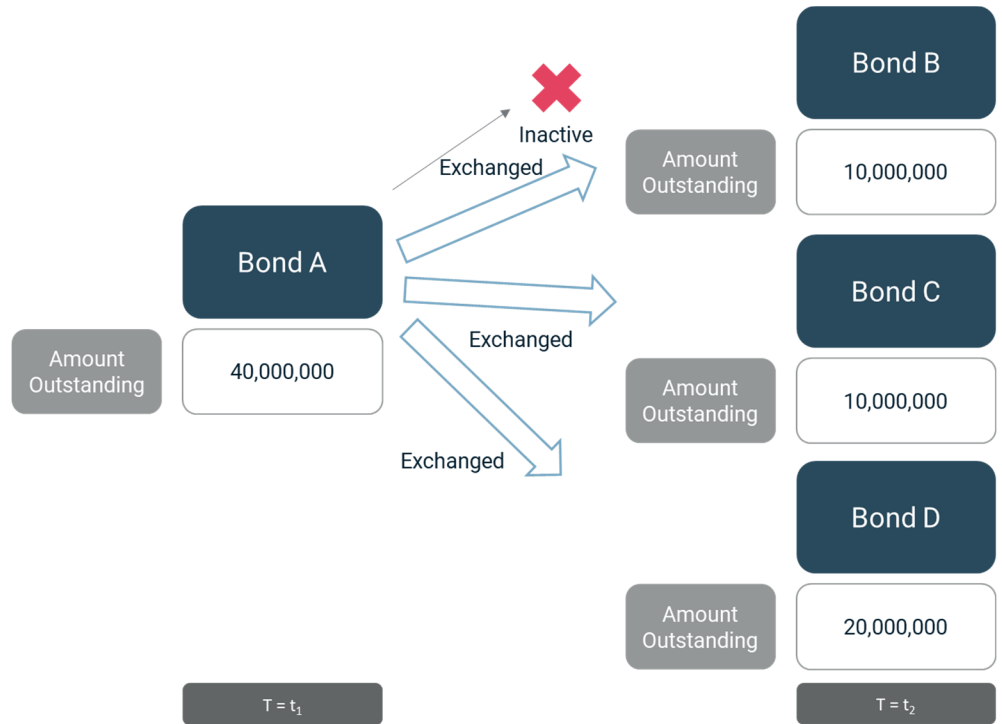
6.2.3.1 One-to-One Exchange



6.2.3.2 Multiple-to-One Exchange

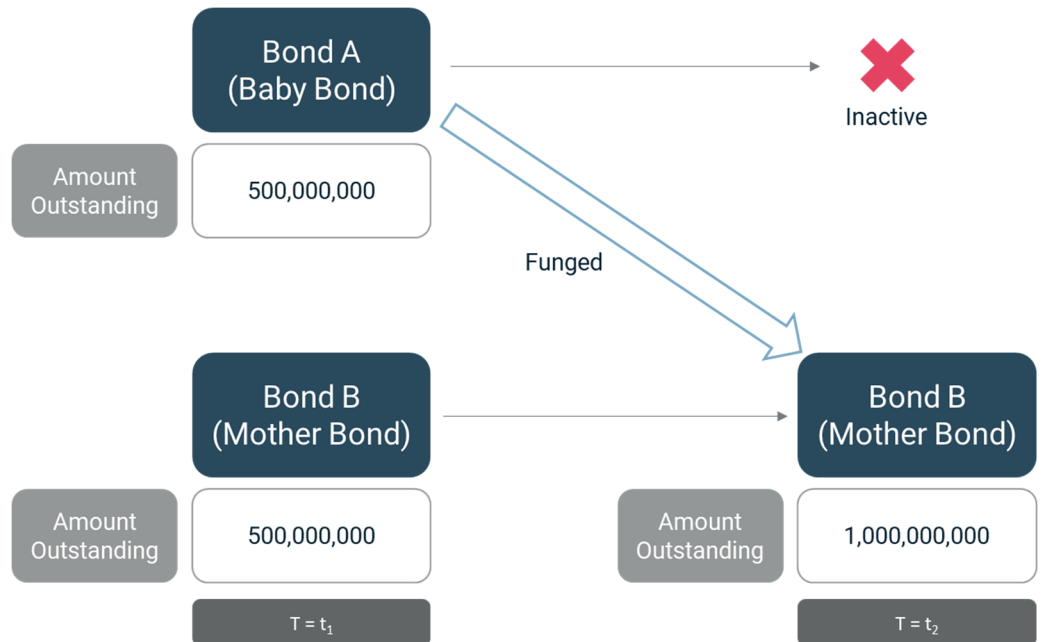


6.2.3.3 One-to-Multiple Exchange



6.2.4 Asset Funged

Funging is the process of retiring the temporary identifiers for a temporary security (baby bond) and merging the temporary security with the permanent security (mother bond). There will be a temporary security with a unique identifier which trades separately for a certain number of days (generally 40 days) and is then funged. The asset status of the temporary security is updated to “FNG” (inactive), and the amount outstanding will be added to the current amount outstanding of the mother bond. Consequently, the amount outstanding for the temporary security/identifier becomes zero.



7 Forward Looking Information

Forward looking information covers prospective corporate events for all active issues received from vendor in the Index Universe.⁵ Such information is used to calculate forward looking issuer amount outstanding covering T+1 to T+10 as well as issue amount outstanding using the same methodology as described in section 2.6.

8 Additional Published Reference Data

8.1 Government Amount Outstanding Allocation

Government amount outstanding allocation or government holdings refers to the amount held by the issuing government as a percentage of the current amount outstanding. Please note that this data point does not apply to each government entity. MSCI reserves the right not to disclose government amount outstanding allocation for specific government entities due to insufficient amount of data collected.

Central banks conduct open market operations as part of their monetary measures by holding government bonds issued. Therefore, there is usually a difference between total amount outstanding of sovereign bonds and the actual amount available in the marketplace, the difference being the amount held by the government.

The percentage of government holding is calculated by the sum of the amount outstanding held by the government and the amount outstanding held by central banks divided by the total amount outstanding. The amount held by central banks is only applicable to GB gilts, representing the portion of the current amount outstanding held by Debt Management Office.

The below is an example of the percentage of government holding for a sample U.S. Treasury bond.

Effective date	End Date	Amount held by government	Amount held by others	Total amount outstanding	Amount held by government%
1/1/2020	3/19/2020	303,031,700	0	35,127,64,6800	0.86
3/20/2020	3/22/2020	403,031,700	0	35,127,646,800	1.15
3/23/2020	4/29/2020	523,031,700	0	35,127,646,800	1.49
4/30/2020	12/31/3999	0	0	0	0

⁵ The information, while prospective, is based on announced publicly available information.

8.2 HasEquity Flag

HasEquity is a binary tag that details whether the issuer has any active equity listings according to the methodology outlined. There are seventy-two equity subcategories⁶ covered by MSCI’s analytics. Kindly note that MSCI does not support equity positions from thirty-one exchanges or sources⁷ due to restrictions on data usage rights. Consequently, listings that do not fall within the seventy-two supported asset subcategories or are from exchanges with data rights restrictions will not be considered when computing the hasEquity flag.

Below is an example of hasEquity flag representation.

Effective Date	End Date	ISSUER	HAS_EQUITY
11/14/2022	11/15/2022	FORTRESS TRANSPORTATION AND INFRASTRUCTURE INVESTORS LLC	1
11/16/2022	12/31/3999	FORTRESS TRANSPORTATION AND INFRASTRUCTURE INVESTORS LLC	0

Has equity flag value change due to ordinary share of FORTRESS TRANSP AND INFRA INV listed at Nasdaq was delisted.

8.3 Actual Payment

MSCI calculates scheduled payment as the sum of all cash flows from either coupon payment or principal redemption to be received on a future date. Cash flow refers to the periodic coupon payments and principal repayment received by investors from a fixed-income instrument. These cash flows are integral to the valuation of securities as they represent the projected financial income that are discounted to determine present value. Maintaining the accuracy and integrity of cash flow data is vital at both the individual security level and the index level.

This method, which distinguishes cash flows between coupon and principal, provides transparency as-to the source of income as well as the specific date. It offers a more accurate representation of these securities’ true cash flows. In particular, it prevents the

⁶ Seventy-two supported asset subcategories can be found in Section 12.8.3

⁷ Thirty-one exchanges or sources can be found in Section 12.8.4

misattribution of a full coupon payment when only partially accrued payment should be recognized on the first interest payment date.

The below is an example of scheduled payments for sample bond.

SOURCE	EFF_DATE	END_DATE	SCHEDULED_DATE	ACTUAL_DATE	SCHD_PYMT
coupon	10/25/2022	1/24/2023	1/25/2023	1/25/2023	1.298
coupon	1/25/2023	1/24/2024	1/25/2024	1/25/2024	5.148
coupon	1/25/2024	12/31/3999	1/25/2025	1/27/2025	5.148
principal	10/25/2022	12/31/3999	1/25/2034	1/25/2034	100

9 Market Conventions

9.1 Market Calendars and Index Settlement Conventions

Calendar conventions vary across markets and currencies. The calendar convention for a given currency/market determines the holiday schedule for that market and if pricing and SSAs data will be published on designated holidays.

Please refer to 12.2 Market Calendars and Settlement Conventions for market calendars detailed by market.

Standard index settlement convention will be same day (e.g., T+0) unless otherwise specified. The market settlement convention varies across markets and currencies.

9.2 Timing of Prices and Reference Data

9.2.1 Bond Pricing

The timing of the bond pricing data collection used for the instruments included in the Index Universe is presented in the table below.

Cycle	Source	Bond Pricing Timing
AMER ⁸	Primary Source	4:00pm EST (16.00 local New York)
	Ancillary Source	4:00pm EST (16.00 local New York)

⁸ Refers to the currencies and bond markets of the following: CAD, MXN & USD.

EMEA ⁹	Primary Source	4:15pm GMT/BST (16.15 local London)
	Ancillary Source	4:00pm GMT/BST (16.00 local London)
APAC ¹⁰	Primary Source	3:00pm JST (15.00 local Tokyo)
	Ancillary Source	4:00pm JST (16.00 local Tokyo)

Prior to November 11th, 2024, securities in USD, CAD, and MXN were priced at 15:00 local New York time. Starting said date, the securities are priced at 16:00 local New York time. This change applies to price times from the Implementation Date forward; historical values remain unchanged.

9.2.2 Bond Terms and Conditions

Sovereign, supranational, and corporate bond reference data with terms and conditions for bonds included in the Index Universe, including rating, is collected throughout the day to ensure timely maintenance as well as appropriate quality assurance.

The final timing of terms of reference data is synchronized with the bond pricing data collection used for any currency covered in the Index Universe.

9.2.3 Swap Data Timing

The timing of the swap pricing data collection is coordinated with the respective bond pricing data collection specified for that currency.

Currency / Market	Par Swap Pricing Timing	Reference Rates
USD	3PM ET (15.00 local New York)	ICE Libor Rates 11:55GMT (11:55 local London)
USD Secured Overnight Financing Rate	4PM ET (16.00 local New York)	SOFR 08:00 ET (08:00 local New York)

⁹ Refers to the currencies and bond markets of the following: CHF, DKK, EUR, GBP, ILS, NOK, SEK & ZAR. Please note that during summer, the local London time changes from GMT (Greenwich Mean Time) to BST (British Summer Time).

¹⁰ Refers to the currencies and bond markets of the following: AUD, CNY, JPY, MYR, & SGD.

CAD	3PM ET (15.00 local New York)	CDOR 10:15ET (10.15 local Toronto)
CAD Canadian Overnight Repo Rate Average	4PM ET (16.00 local New York)	CORRA 09:00 ET (09:00 local New York)
EUR	4.15PM GMT (16.15 local London)	EURIBOR® 11.00CET (11.00 local Brussels)
EUR Euro short-term rate	4.30PM GMT (16.30 local London)	€STR 09.00CET (09:00 local Brussels)
GBP	4.15PM GMT (16.15 local London)	ICE Libor Rates 11.55 GMT (11:55 local London)
GBP Sterling Overnight Interbank Average rate	4.30PM GMT (16.30 local London)	SONIA 09.00GMT (09:00 local London)
CHF	4.15PM GMT (16.15 local London)	ICE Libor Rates 11.55 GMT (11:55 local London)
CHF Swiss Average Rate Overnight	4.15PM GMT (16.15 local London)	SIX SARON 08.30CET (08:30 local Zurich)
AUD	3.00PM JST (15:00 local Tokyo)	ASX Bank Bill Swap Rate 10.30 AEST (10:30 local Sydney)
AUD AONIA	3.00PM JST (15:00 local Tokyo)	RBA AONIA Overnight Rate 09.20 AEST (09:20 local Sydney)
JPY	3.00PM JST (15:00 local Tokyo)	ICE Libor Rates 11.55 GMT (11:55 local London)
JPY TONA	3.00PM JST (15:00 local Tokyo)	BoJ TONA 10.00 JST (10:00 local Tokyo)

9.2.4 Swaption Data Timing

The timing of the ATM Swaption volatilities data collection is coordinated with the respective bond pricing data collection specified for that currency.

Currency / Market	ATM Swaption Timing
USD	4PM ET pricing (16.00 local New York)
CAD	4PM ET pricing (16.00 local New York)
EUR	4.15PM GMT pricing (16.15 local London)
GBP	4.15PM GMT pricing (16.15 local London)
CHF	4.15PM GMT pricing (16.15 local London)
AUD	3:00pm JST (15.00 local Tokyo)
JPY	3:00pm JST (15.00 local Tokyo)

10 Data Sources and Quality Assurance

MSCI uses a well-established global provider of reference and terms & conditions (T&C) data as a consistent source across all markets and segments as well as multiple sources for bonds pricing from readily available data providers whenever relevant and or available.

10.1 Reference Data and Terms and Conditions Quality Assurance

Throughout the day, MSCI applies stringent QA processes to the T&C data to ensure data integrity and the timeliness of changes provided by our vendor. MSCI escalates to the T&C data provider for scenarios such as:

- Daily changes in any critical data fields including maturity date, coupon, call schedule entries, etc.
- Nullified T&C data
- Logical inconsistencies or mismatches between related T&C data fields.

10.2 Pricing Data Quality Assurance

The instruments included in the Index Universe use pricing data from readily available asset pricing products from multiple global price vendors, when available and relevant.

MSCI performs stringent pricing QA to ensure adequate coverage and validity of the pricing data through:

- Asset universe pricing coverage by market

- Static asset price review and vendor confirmation
- Multiple pricing source comparison (when available and relevant)
- Extreme or suspicious price and return review and vendor confirmation

10.2.1 Handling of Missing Prices

In the case of a missing price from vendors, MSCI systematically escalates to vendors to challenge missing prices. In the absence of vendor's response or until vendor responds, for any instrument already eligible for inclusion in the Index Universe with a price missing from vendors, MSCI applies a price filling rule for up to ten consecutive business days after which the asset is dropped from the Index Universe.

MSCI's price filling rules are defined based on the instrument level rating. However, for government bonds issued by sovereign entities in local currency, issuer level ratings are considered in-lieu if instrument level ratings are not available:

- For Investment Grade bonds, MSCI applies a flat-spread price filling method. This method assumes that Investment Grade bond prices are predominantly driven by changes in the interest rate term structure. In this case, a new price is derived daily by applying the spread as of the date of last available vendor price on top of the relevant daily risk-free curve.
- For High-Yield bonds, MSCI applies a flat price filling method. This method assumes that High-Yield bond prices are predominantly driven by credit specific characteristics and are not overly sensitive to the interest rate term structure. In this case, the latest available vendor price is carried forward.

10.2.2 Handling of Outlier Prices

In the case of severe outlying prices MSCI rejects the received price, generates an escalation to the vendor, and applies price filling as described in section 10.2.1. Severe outlying prices are defined as any price received which is negative (<0) or greater than a specified threshold that is determined on a market-by-market basis.

10.2.3 Handling of Abnormal Returns

In the case of receipt of a price which implies a severe outlying return, MSCI rejects the received price, generates an escalation to the vendor and applies price filling as described in section 10.2.1. for up to two consecutive business days. If the vendor does not confirm that the price implying an abnormal return is incorrect within two consecutive business days, the price is deemed valid and no longer rejected.

Severe outlying returns are dynamically defined relative to returns for similar bonds as well as across pricing sources (when available and relevant).

Comparative analysis across multiple pricing sources is leveraged (when available and relevant) to inform severe outlying price and return validation.

11 Data Governance

The Fixed Income Data Committee (FIDC) presides over the development, review and calibration of the fixed income data methodology and provides its recommendations to other product or research level bodies, such as the FIIC (Fixed Income Index Committee).

12 Appendices

12.1 MSCI Rating Methodology

To be included in the Index Universe, an instrument must have a rating from at least one nationally recognized statistical rating organization (NRSRO). MSCI obtains ratings from Standard and Poor's Rating Services (S&P), Moody's Investor Service (Moody's), or Fitch Ratings (Fitch). Government bonds in local currency are eligible if issuer ratings are available, even without bond ratings.

12.1.1 MSCI Aggregate Credit Rating Methodology

MSCI publishes an aggregate credit rating that is derived from the MSCI bond, sovereign issuer and quasi-sovereign issuer credit rating. It uses the MSCI bond credit rating if available; otherwise, if the bond is a local currency government bond issued by a sovereign issuer, it maps to the sovereign or quasi-sovereign issuer rating based on the issuer's characteristics.

12.1.2 MSCI Bond Credit Rating Methodology¹¹

The MSCI bond credit rating follows these rules:

- Rated by all three providers: uses the median rating
- Rates by two providers: uses the lower rating
- Rated by one provider: uses that rating

The MSCI bond credit rating is based on the mappings and scores below:

Moody's	S&P	Fitch	Score	MSCI
Aaa	AAA	AAA	0	AAA
Aa1	AA+	AA+	1	AA+
Aa2	AA	AA	2	AA
Aa3	AA-	AA-	3	AA-
A1	A+	A+	4	A+
A2	A	A	5	A

¹¹ The bond credit rating methodology applies to defaulted assets too, and default events are reported individually in corporate action.

A3	A-	A-	6	A-
Baa1	BBB+	BBB+	7	BBB+
Baa2	BBB	BBB	8	BBB
Baa3	BBB-	BBB-	9	BBB-
Ba1	BB+	BB+	10	BB+
Ba2	BB	BB	11	BB
Ba3	BB-	BB-	12	BB-
B1	B+	B+	13	B+
B2	B	B	14	B
B3	B-	B-	15	B-
Caa1	CCC+	CCC+	16	CCC+
Caa2	CCC	CCC	17	CCC
Caa3	CCC-	CCC-	18	CCC-
Ca1	CC+	CC+	19	CC+
Ca2	CC	CC	20	CC
Ca3	CC-	CC-	21	CC-
C1	C+	C+	22	C+
C2	C	C	23	C
C3	C-	C-	24	C-
D ¹²	D	D	25	D

A datapoint titled MSCI Average Rating Methodology is also supported and published. It is the numerical average of S&P and Moody's ratings, rounded up if needed.

¹² Credit ratings methodology also applies to defaulted assets, with default events reported individually via a corporate action.

12.1.3 MSCI Issuer Rating Methodology

MSCI currently provides issuer level ratings for government bonds issued by sovereign entities in local currency only. Currently, MSCI supports the below sovereign government issuers and corresponding local currencies:

Sovereign Government	Local Currency
United States	USD
Canada	CAD
Austria	EUR
Belgium	EUR
Cyprus	EUR
Estonia	EUR
Finland	EUR
France	EUR
Germany	EUR
Greece	EUR
Ireland	EUR
Italy	EUR
Latvia	EUR
Lithuania	EUR
Luxembourg	EUR
Malta	EUR
Netherlands	EUR
Portugal	EUR
Slovakia	EUR
Slovenia	EUR
Spain	EUR
United Kingdom	GBP

12.1.3.1 MSCI Sovereign Issuer Credit Rating Methodology

This rating is determined using long-term issuer ratings, following the same rules as the bond credit rating methodology, for both local and foreign currencies.

12.1.3.2 MSCI Quasi-Sovereign Issuer Credit Rating Methodology

It includes official, municipal, agency issuers, or corporate issuers with a sovereign parent. The rating is based on senior unsecured issuer ratings, following the bond credit rating methodology, for both local and foreign currencies.

12.2 Market Calendars and Settlement Conventions

12.2.1 Settlement Conventions

As of May 28th, 2024, the settlement convention for USD-denominated bonds has transitioned to T+1, with CAD bonds adopting this change one day earlier. From September 2nd, 2017, to May 27th, 2024, both USD and CAD bond settlements followed a T+2 convention. Prior to this period, USD and CAD bond settlements adhered to a T+3 business day convention.

For EURO and GBP, the specific settlement conventions are determined by various clearing systems and are a function of, instrument type, issuer country of domicile, and type of issuer. With settlement days ranging from T+1 to T+3, 90% of bonds in the Index Universe have a settlement between T+2 and T+3 business days based on our analysis¹³.

For all other currencies, the T+2 settlement convention generally remains in effect.

12.2.2 USD Market Calendar

The US holiday calendar is derived from the SIFMA US holiday guidelines and populated from year 1996 up to 2099. The assumptions of each holiday and its observed rule are outlined below.

Holiday Name	Rule	Observed Rule (If applicable)
New Year's Day	First day of each year	Take the next day as observed holiday if holiday falls on Sunday, no observed holiday if falls on Saturday.

¹³ Analysis conducted as of April 12th, 2021.

Holiday Name	Rule	Observed Rule (If applicable)
Martin Luther King Day	3 rd Monday of January	N/A
Presidents' Day	3 rd Monday of February	N/A
Good Friday	The Friday before the first Sunday after the first ecclesiastical full moon that occurs on or after March 21 st	N/A
Memorial Day	Last Monday of May	N/A
Independence Day	4 th of July	Take the next day as observed holiday if falls on Sunday. Take the preceding day if falls on Saturday.
Labor Day	First Monday of September	N/A
Columbus Day	Second Monday of October	N/A
Veterans Day	11 th of November	Take the next day as observed holiday if holiday falls on Sunday, no observed holiday if falls on Saturday.
Thanksgiving Day	4 th Thursday of November	N/A
Christmas Day	25 th of December	Take the next day as observed holiday if falls on Sunday. Take the preceding day if falls on Saturday.

In addition, the market will close early on 2PM Eastern Time (14.00 local New York) on the weekday preceding or succeeding the following six holidays:

Early Close Date	Observed Rule (if applicable)
Day before New Year's Day	Take the previous Friday if the observed holiday falls on Monday.
Thursday before Good Friday	N/A

Early Close Date	Observed Rule (if applicable)
Friday before Memorial Day	Take the previous Friday.
Day before Independence Day	Take the previous Friday if the observed holiday falls on Monday.
Friday after Thanksgiving Day	N/A
Day before Christmas Day	Take the previous Friday if the observed holiday falls on Monday.

12.2.3 CAD Market Calendar

The CAD holiday calendar is derived from the Toronto Stock Exchange's published settlement holidays and populated from year 1974 up to 2068. The assumptions of each holiday and its observed rule are outlined below.

Holiday Name	Rule	Observed Rule (If applicable)
New Year's Day	First day of each year	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
Family day	3 rd Monday of February	N/A
Good Friday	The Friday before the first Sunday after the first ecclesiastical full moon that occurs on or after March 21 st	N/A
Victoria Day	Penultimate Monday of May	N/A
Canada Day	1 st of July	Take the next day as observed holiday if falls on Sunday, no observed holiday if falls on Saturday.
Civic Holiday	First Monday of August	N/A
Labour Day	First Monday of September	N/A

Holiday Name	Rule	Observed Rule (If applicable)
National Day for Truth and Reconciliation	30 th of September	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
Thanksgiving Day	4 th Thursday of November	N/A
Remembrance Day	11 th of November	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
Christmas Day	25 th of December	Take the next Monday as observed holiday if falls on Sunday or Saturday.
Boxing Day	26 th of December	Take the next Tuesday as observed holiday if falls on Sunday or Monday. Take the next Monday as observed holiday if falls on Saturday.

12.2.4 EURO Market Calendar

The EURO holiday calendar is derived from Trans-European Automated Real-time Gross Settlement Express Transfer (TARGET) settlement holidays and is populated from year 1950 up to 2100. The assumptions of each holiday and its observed rule are outlined below.

Holiday Name	Rule	Observed Rule (If applicable)
New Year's Day	First day of each year	No observed holiday if falls on Saturday or Sunday.
Good Friday	The Friday before the first Sunday after the first ecclesiastical full moon that occurs on or after March 21 st	N/A
Easter Monday	First Monday after Good Friday	N/A

Labour Day	1 st of May	No observed holiday if falls on Saturday or Sunday.
Christmas Day	25 th of December	No observed holiday if falls on Saturday or Sunday.
Christmas Holiday	26 th of December	No observed holiday if falls on Saturday or Sunday.

12.2.5 GBP Market Calendar

The GBP holiday calendar is derived from London Stock Exchange's settlement holidays and is populated from year 1960 up to 2069. The assumptions of each holiday and its observed rule are outlined below.

Holiday Name	Rule	Observed Rule (If applicable)
New Year's Day	First day of each year	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
Good Friday	The Friday before the first Sunday after the first ecclesiastical full moon that occurs on or after March 21 st	N/A
Easter Monday	First Monday after Good Friday	N/A
Early May Bank Holiday ¹⁴	First Monday in May	N/A
Late May Bank Holiday	Last Monday in May	N/A
Summer Bank Holiday	First Monday in August	N/A
Christmas Day	25 th of December	Take the next Monday as observed holiday if falls on Sunday or Saturday.
Boxing Day	26 th of December	Take the next Tuesday as observed holiday if falls on

¹⁴ In 2020, this holiday was moved to May 8 (Friday) to coincide with Victory in Europe Day.

		Sunday or Monday. Take the next Monday as observed holiday if falls on Saturday.
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12.2.6 AUD Market Calendar

The AUD holiday calendar is derived from Australian Stock Exchange Settlement Holidays and is populated from year 1988 up to 2073. The assumptions of each holiday and its observed rule are outlined below.

Holiday Name	Rule	Observed Rule (If applicable)
New Year's Day	First day of each year	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
Australia Day	16 th of January	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
Good Friday	The Friday before the first Sunday after the first ecclesiastical full moon that occurs on or after March 21	N/A
Easter Monday	First Monday after Good Friday	N/A
ANZAC Day	25 th of April	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
King's Birthday	2 nd Monday in June	N/A
Christmas Day	25 th of December	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
Boxing Day	26 th of December	Take the next Tuesday as observed holiday if falls

		on Sunday or Monday. Take the next Monday as observed holiday if falls on Saturday.
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12.2.7 DKK Market Calendar

The DKK holiday calendar is derived from OMX Nordic Exchange Copenhagen Settlement Holidays and is populated from year 1996 up to 2073. The assumptions of each holiday and its observed rule are outlined below.

Holiday Name	Rule	Observed Rule (If applicable)
New Year's Day	First day of each year	N/A
Holy Thursday	Last Thursday before Good Friday	N/A
Good Friday	The Friday before the first Sunday after the first ecclesiastical full moon that occurs on or after March 21	N/A
Easter Monday	First Monday after Good Friday	N/Athre
General Prayer Day	4 th Friday after Easter Sunday	N/A
Ascension Day	6 th Thursday after Easter Sunday	N/A
Day After Ascension	The next day after Ascension Day	N/A
Whitmonday	51 st day after Easter	N/A
Constitution Day	5 th of June	N/A
Christmas Eve	24 th of December	N/A
Christmas Day	25 th of December	N/A
Christmas Holiday	26 th of December	N/A

New Year's Eve	31 st of December	N/A
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12.2.8 NOK Market Calendar

The NOK holiday calendar is derived from Oslo Bors Settlement Holidays and is populated from year 1988 up to 2073. The assumptions of each holiday and its observed rule are outlined below.

Holiday Name	Rule	Observed Rule (If applicable)
New Year's Day	First day of each year	N/A
Holy Thursday	Last Thursday before Good Friday	N/A
Good Friday	The Friday before the first Sunday after the first ecclesiastical full moon that occurs on or after March 21	N/A
Easter Monday	First Monday after Good Friday	N/A
Labour Day	1 st of May	N/A
Constitution Day	17 th of May	N/A
Ascension Day	6 th Thursday after Easter Sunday	N/A
Whitmonday	51 st day after Easter	N/A
Christmas Eve	24 th of December	N/A
Christmas Day	25 th of December	N/A
Boxing day	26 th of December	N/A
New Year's Eve	31 st of December	N/A

12.2.9 SEK Market Calendar

The SEK holiday calendar is derived from OMX Nordic Exchange Stockholm Settlement Holidays and is populated from year 1988 up to 2073. The assumptions of each holiday and its observed rule are outlined below.

Holiday Name	Rule	Observed Rule (If applicable)
New Year's Day	First day of each year	N/A
Epiphany	6 th of January	N/A
Good Friday	The Friday before the first Sunday after the first ecclesiastical full moon that occurs on or after March 21	N/A
Easter Monday	First Monday after Good Friday	N/A
Labour Day	1 st of May	N/A
Ascension Day	6 th Thursday after Easter Sunday	N/A
National Day	6 th of June	N/A
Midsummer Eve OBS	The Friday between 19 th of June and 25 th of June	N/A
Christmas Eve	24 th of December	N/A
Christmas Day	25 th of December	N/A
Boxing day	26 th of December	N/A
New Year's Eve	31 st of December	N/A

12.2.10 ZAR Market Calendar

The ZAR holiday calendar is derived from Johannesburg Stock Exchange Settlement Holidays and is populated from year 1988 up to 2073. The assumptions of each holiday and its observed rule are outlined below.

Holiday Name	Rule	Observed Rule (If applicable)
New Year's Day	First day of each year	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
Human Rights Day	21 st of March	N/A
Good Friday	The Friday before the first Sunday after the first ecclesiastical full moon that occurs on or after March 21	N/A
Family Day (Easter Monday)	First Monday after Good Friday	N/A
Freedom Day	27 th of April	N/A
Workers' Day	1 st of May	N/A
Youth Day	16 th of June	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
National Women's Day	9 th of August	N/A
Heritage Day	24 th of September	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
Day of Goodwill	16 th of December	N/A
Christmas Day	25 th of December	N/A
Day of Goodwill	26 th of December	N/A

12.2.11 MXN Market Calendar

The MXN holiday calendar is derived from Mexico Stock Exchange Settlement Holidays and is populated from year 1988 up to 2073. The assumptions of each holiday and its observed rule are outlined below.

Holiday Name	Rule	Observed Rule (If applicable)
New Year's Day	First day of each year	N/A
Constitution Day	1 st Monday in February	N/A
Juarez's Birthday	3 rd Monday in March	N/A
Holy Thursday	Last Thursday before Good Friday	N/A
Good Friday	The Friday before the first Sunday after the first ecclesiastical full moon that occurs on or after March 21	N/A
Labour Day	1 st of May	N/A
Independence Day	16 th of September	N/A
All Souls' Day	2 nd of November	N/A
Mexican Revolution	3 rd Monday in November	N/A
Our Lady of Guadalupe	12 th of December	N/A
Christmas Day	25 th of December	N/A

12.2.12 JPY Market Calendar

The JPY holiday calendar is derived from Tokyo Stock Exchange Settlement Holidays and is populated from year 1988 up to 2073. The assumptions of each holiday and its observed rule are outlined below.

Holiday Name	Rule	Observed Rule (If applicable)
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New Year's Day	First day of each year	N/A
Bank Holiday 2	2 nd of January	N/A
Bank Holiday 3	3 rd of January	N/A
Coming of Age (Adults') Day	2 nd Monday in January	N/A
National Founding Day	11 th of February	Take the next Monday day as observed holiday if holiday falls on Sunday.
Emperor's Birthday	23 rd of February	Take the next Monday day as observed holiday if holiday falls on Sunday.
Vernal Equinox	Usually on 20 th or 21 st of March. The date of the holiday is not officially declared until February of the previous year, due to the need for recent astronomical measurements.	Take the next Monday day as observed holiday if holiday falls on Sunday.
Showa Day (formerly Greenery Day)	29 th of April	Take the next Monday day as observed holiday if holiday falls on Sunday.
Constitution Day	3 rd of May	N/A
Greenery Day (formerly National Holiday)	4 th of May	N/A
Children's Day	5 th of May	Take the next Monday day as observed holiday if holiday falls on Sunday.
Marine Day	3 rd Monday in July	N/A
Mountain Day	11 th of August	Take the next Monday day as observed holiday if holiday falls on Sunday.
Respect for the Aged Day	3 rd Monday in September	N/A

Autumn Equinox	Usually on 22 nd or 23 rd of March. The date of the holiday is not officially declared until February of the previous year, due to the need for recent astronomical measurements.	Take the next Monday day as observed holiday if holiday falls on Sunday.
Health-Sports Day	2 nd Monday in October	N/A
Culture Day	3 rd of November	Take the next Monday day as observed holiday if holiday falls on Sunday.
Labour Thanksgiving Day	23 rd of November	Take the next Monday day as observed holiday if holiday falls on Sunday.
New Year's Eve	31 st of December	N/A

12.2.13 MYR Market Calendar

The MYR holiday calendar is derived from Bursa Malaysia Settlement Holidays and is populated from year 1995 up to 2073. The assumptions of each holiday and its observed rule are outlined below.

Holiday Name	Rule	Observed Rule (If applicable)
New Year's Day	First day of each year	Take the next Monday day as observed holiday if holiday falls on Sunday.
Lunar New Year 1*	1 st day of 1 st lunar month	N/A
Lunar New Year 2*	2 nd day of 1 st lunar month	N/A
Federal Territory Day	1 st of February	Take the next Monday day as observed holiday if holiday falls on Sunday.
Thaipusam*	The day of 1 st full moon during the Tamil month of Thai	N/A

Nuzul Al Quran*	17 th of 9 th month in Islamic calendar	N/A
Hari Raya Puasa 1*	Last day of 9 th month in Islamic calendar	N/A
Hari Raya Puasa 2*	First day of 10 th month in Islamic calendar	N/A
Labour Day	1 st of May	Take the next Monday day as observed holiday if holiday falls on Sunday.
Wesak Day*	1 st full moon day of May	N/A
Birthday of Yang DiPertuan Agong	1 st Monday in June	N/A
Hari Raya Haji*	10 th of the last month in Muslim calendar	N/A
First Day of Muharram*	First day of Islamic calendar	N/A
National Day	31 st of August	Take the next Monday day as observed holiday if holiday falls on Sunday.
Malaysia Day	16 th of September	Take the next Monday day as observed holiday if holiday falls on Sunday.
Prophet's Birthday*	12 th of 3 rd month in Islamic calendar	N/A
Deepavali*	15 th of 8 th month of India calendar	Take the next Monday day as observed holiday if holiday falls on Sunday.
Christmas Day	25 th of December	Take the next Monday day as observed holiday if holiday falls on Sunday.

* Holiday varies every year based on the calendar rules it follows

12.2.14 CHF Market Calendar

The CHF holiday calendar is derived from SIX Swiss Exchange Settlement Holidays and is populated from year 1988 up to 2073. The assumptions of each holiday and its observed rule are outlined below.

Holiday Name	Rule	Observed Rule (If applicable)
New Year's Day	First day of each year	N/A
Berchtoldstag	2 nd of January	N/A
Good Friday	The Friday before the first Sunday after the first ecclesiastical full moon that occurs on or after March 21	N/A
Easter Monday	First Monday after Good Friday	N/A
Labour Day	1 st of May	N/A
Ascension Day	6 th Thursday after Easter Sunday	N/A
Whit Monday	51 st day after Easter	N/A
National Day	1 st of August	N/A
Christmas	25 th of December	N/A
St. Stephen's Day	26 th of December	N/A

12.2.15 SGD Market Calendar

The SGD holiday calendar is derived from Singapore Exchange Settlement Holidays and is populated from year 1988 up to 2073. The assumptions of each holiday and its observed rule are outlined below.

Holiday Name	Rule	Observed Rule (If applicable)
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New Year's Day	First day of each year	Take the next Monday day as observed holiday if holiday falls on Sunday.
Lunar New Year 1*	1 st day of 1 st new moon of lunar calendar	N/A
Lunar New Year 2*	2 nd day of 1 st new moon of lunar calendar	N/A
Good Friday	The Friday before the first Sunday after the first ecclesiastical full moon that occurs on or after March 21 st	N/A
Hari Raya Puasa*	Last day of the 9 th month of the Islamic calendar	N/A
Labour Day	1 st of May	Take the next Monday day as observed holiday if holiday falls on Sunday.
Vesak Day*	1 st full moon day of May	N/A
Hari Raya Haji*	9 th of the final month of the Islamic calendar	N/A
National Day	9 th of August	Take the next Monday day as observed holiday if holiday falls on Sunday.
Deepavali*	15 th of 8 th month of India calendar	Take the next Monday day as observed holiday if holiday falls on Sunday.
Christmas Day	25 th of December	Take the next Monday day as observed holiday if holiday falls on Sunday.

Holiday with * varies every year based on the specific calendars they refer

12.2.16 CNY Market Calendar

The CNY holiday calendar is derived from Shanghai Stock Exchange A-shares Settlement Holidays and is populated from year 1988 up to 2073. The assumptions of each holiday and its observed rule are outlined below.

Holiday Name	Rule	Observed Rule (If applicable)
New Year's Day	First day of each year	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
Lunar NY Eve*	Last day of lunar calendar	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
Lunar New Year*	6 days starting from 1 st day of 1 st new moon of lunar calendar	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
Qingming Festival*	15 th day after Spring Equinox - either the 4 th , 5 th , or 6 th of April	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
Labour Day	3 days starting from the 1 st of May	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
Dragon Boat Festival*	5 th day of the 5 th month in the lunar calendar	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
Mid-Autumn Festival*	15 th day of the 8 th month in lunar calendar	Take the next Monday day as observed holiday if holiday falls on Sunday.
National Day	7 days starting from 1 st of October	Take the next Monday day as observed holiday if holiday falls on Sunday.

* Holiday varies every year based on the calendar rules it follows

12.2.17 ILS Market Calendar

The ILS holiday calendar is derived from Tel Aviv Stock Exchange Settlement Holidays and is populated from year 1988 up to 2073. The assumptions of each holiday and its observed rule are outlined below. According to Israel exchange

market conventions, trading days start from Sunday to Thursday and weekends include Friday and Saturday.

Holiday Name	Rule	Observed Rule (If applicable)
Feast of Purim (Tel Aviv) *	14 th of the month Adar in Jewish calendar	N/A
Pesach Day 1*	15 th of the moth Nissan in Jewish calendar	N/A
Pesach Day 7*	6 days after Pesach Day 1	N/A
National Independence Day*	5 th day of Iyar in the Hebrew calendar	N/A
Shavuot*	6 th of the month Sivan in Jewish calendar	N/A
Fast of Ninth of Ab*	9 th of the month Av in Jewish calendar	N/A
Rosh Hashana*	First day in Jewish calendar	N/A
Rosh Hashana 2nd day*	Second day in Jewish calendar	N/A
Yom Kippur Eve*	9 th of the month Tishri in Jewish calendar	N/A
Yom Kippur*	10 th of the month Tishri in Jewish calendar	N/A
Sucot Day 1*	15 th of the month Tishri in Jewish calendar	N/A
Sucot Day 8*	7 days after Sucot Day 1	N/A

* Holiday varies every year based on the calendar rules it follows

12.3 Currency Specific Model Definitions & Reference Curves

12.3.1 Zero-Coupon Government Curves

Zero-coupon government curves are derived using the most relevant methodology for each currency / market. The constituent basket used in estimation is defined as any Government issued fixed coupon bond with the following properties:

- Not inflation linked
- Not callable
- Not the on-the-run bond for its associated benchmark tenor

The table below provides more details about the curve methodology and the constituent basket by currency / market.

Currency / Market	Constituent Baskets
USD	1M, 3M, 6M, 1Y Benchmark T-Bills, and off-the-run T-notes and T-bonds >1Y to Maturity
CAD	T-Bills between 1M and 6M and off-the-run T-bonds >1Y to Maturity
EURO	Bubills between 3M and 6M and off-the-run Schaetze, Bobls, and Bunds >1Y to Maturity
GBP	T-Bills between 1M and 6M and off-the-run Gilts >1Y to Maturity
MXN	Govt Bonds > 6M to Maturity
CHF	Govt Bonds > 9M to Maturity
DKK	Bills between 1M and 6M and Govt Bonds >1Y to Maturity
SEK	Bills between 1M and 6M and Govt Bonds >1Y to Maturity
NOK	Govt Bonds > 9M to Maturity
ILS	Govt Bonds > 6M to Maturity
ZAR	Govt Bonds > 1Y to Maturity
AUD	Govt Bonds > 3M to Maturity
JPY	Bills between 1M and 6M and Govt Bonds >1Y to Maturity
MYR	Govt Bonds > 6M to Maturity
CNY	Govt Bonds > 6M to Maturity

SGD	Govt Bonds > 6M to Maturity
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12.3.2 Zero-Coupon Swap Curve

Zero-coupon swap curves are used to create a forward-looking expectation for the reference rates which are used in the pricing of fixed-to-float bonds. Additionally, swap curves are used to calibrate the short-rate volatility and the mean reversion speed parameters of the option pricing model for optionable bonds when at-the-money swaption surface is not available.

12.3.2.1 Zero-Coupon Swap Curve

Currency / Market	Constituent Baskets
USD	ICE Libor: Overnight, 1-Week, 2-Week, 1-Month, 2-Month, 3-Month Par-Swap: USD Semi-Annual Par Swap Rates on 3-Month ICE Libor, snap at 15:00 local New York from 1 to 10Y, plus 12Y, 15Y, 20Y and 30Y.
CAD	CDOR: 3-Month Par-Swap: CAD Semi-Annual Par Swap Rates on 3-Month CDOR, snap at 15:00 local New York from 2Y to 10Y, plus 12Y, 15Y, 20Y, 25Y, and 30Y.
EURO	EURIBOR®: 6-Month, published at 11.00 Brussels Par-Swap: EUR Annual Par Swap Rates on 6-Month EURIBOR®, snap at 16.15 local London from 1Y to 15Y, plus 20Y, 25Y, 30Y, 40Y, and 50Y.
GBP	ICE Libor: 6-Month Par-Swap: GBP Semi-Annual Par-Swap Rates on 6-Month Libor, snap 16:15 local London from 1Y to 10Y, plus 12Y, 15Y, 20Y, 25Y, 30Y, 40Y, and 50Y.
CHF	ICE Libor: 6-Month Par-Swap: CHF Semi-Annual Par-Swap Rates on 6-Month Libor, snap 16:15 local London from 1Y to 11Y, plus 12Y, 15Y, 20Y, 25Y, and 30Y.
JPY	ICE Libor: 6-Month

	Par-Swap: JPY Semi-Annual Par-Swap Rates on 6-Month Libor, snap 16:15 local London from 1Y to 15Y, plus 20Y, 25Y, 30Y, 35Y, and 40Y.
AUD	ASX Bank Bill Swap Rate: 6-Month Par-Swap: AUD Semi-Annual Par-Swap Rates on 6-Month BBSW, snap 16:00 local Tokyo from 1Y to 10Y, plus 12Y, 15Y, 20Y, 25Y, and 30Y.

12.3.2.2 Zero-Coupon Overnight Indexed Swap Curve

Currency / Market	Constituent Baskets
USD	SOFR: Overnight Par-Swap: USD SOFR At-maturity and Annual Par Swap Rates on Overnight SOFR, snap at 16:00 local New York from 1 to 3W, monthly from 1M to 12M; 15M, 18M, 21M; yearly from 2Y to 15Y; each 5 years from 20Y to 35Y.
CAD	CORRA: Overnight Par-Swap: CAD CORRA At-maturity and Annual Par Swap Rates on Overnight CORRA, snap at 16:00 local New York from 1 to 3W, monthly from 1M to 12M; 15M, 18M; yearly from 2Y to 10Y; 12Y, 15Y; each 5 years from 20Y to 30Y.
EURO	€STR: Overnight Par-Swap: EUR €STR At-maturity and Annual Par Swap Rates on Overnight €STR, snap at 16:30 local London from 1 to 6W, monthly from 1M to 12M; quarterly from 15M to 33M; yearly from 3Y to 30Y; each 10 years from 40Y to 60Y.
GBP	SONIA: Overnight Par-Swap: GBP SONIA At-maturity and Annual Par Swap Rates on Overnight SONIA, snap at 16:30 local London from 1 to 3W, monthly from 1M to 12M; quarterly from 15M to 21M; yearly from 2Y to 15Y; each 10 years from 30Y to 70Y.
CHF	SARON: Overnight Par-Swap: CHF SARON At-maturity and Annual Par Swap Rates on Overnight SARON, snap at 16:30 local London from 1 to 3W, monthly from 1M to 12M; 15M, 18M; yearly from 2Y to 10Y; 12Y, 15Y; each 5 years from 20Y to 30Y.

JPY	<p style="text-align: center;">TONA: Overnight</p> <p>Par-Swap: JPY TONA At-maturity and Annual Par Swap Rates on Overnight TONA, snap at 15:00 local Tokyo from 1 to 3W, monthly from 1M to 12M; 18M; yearly from 2Y to 10Y; 12Y, 15Y; each 5 years from 20Y to 40Y.</p>
AUD	<p style="text-align: center;">AONIA: Overnight</p> <p>Par-Swap: AUD AONIA At-maturity and Annual Par Swap Rates on Overnight AONIA, snap at 15:00 local Tokyo from monthly 1M to 12M; yearly from 2Y to 10Y; 12Y; each 5 years from 15Y to 30Y.</p>

On December 13th, 2021, the swap curves for USD, EURO and GBP transitioned to Overnight Index Swaps used in the pricing of fixed-to-float bonds which are indexed to their corresponding alternative reference rate. This is to address the continuity of Swap curves after LIBOR Cessation. In the case of EURO, a multi-rate approach is taken with both EURIBOR® and €STR swap curves to co-exist.

12.3.3 ATM Swaption Implied Volatility Surface

The ATM swaption volatilities are used to calibrate the short rate volatility and the mean reversion speed parameters of the option pricing model. They are passed to the option pricing model as-is, no transformation of the swaption surface is applied.

The table below provides more details about the instruments used in the construction of the At-the-Money Swaption Surface by currency / market.

Currency / Market	Swap Terms	Option Terms	Reference Rates
USD	2-Year Swap, 10-Year Swap	1M, 3M, 6M, 1Y, 2Y, 3Y, 4Y, 5Y, 7Y, 10Y, 15Y, 20Y, 25Y, and 30Y.	ICE Libor

USD	2-Year Swap, 10-Year Swap	1M, 3M, 6M, 1Y, 2Y, 3Y, 4Y, 5Y, 7Y, 10Y, 15Y, 20Y, 25Y, and 30Y.	SOFR
CAD	2-Year Swap, 10-Year Swap	1M, 3M, 6M, 1Y, 2Y, 3Y, 4Y, 5Y, 7Y, and 10Y.	CDOR
CAD	2-Year Swap, 10-Year Swap	1M, 3M, 6M, 1Y, 2Y, 3Y, 4Y, 5Y, 7Y, and 10Y.	CORRA
EURO	2-Year Swap, 10-Year Swap	1M, 3M, 6M, 1Y, 2Y, 3Y, 4Y, 5Y, 7Y, 10Y, 15Y, 20Y, 25Y, and 30Y.	ICE Libor
GBP	2-Year Swap, 10-Year Swap	1M, 3M, 6M, 1Y, 2Y, 3Y, 4Y, 5Y, 7Y, 10Y, 15Y, 20Y, 25Y, and 30Y.	ICE Libor
GBP	2-Year Swap, 10-Year Swap	1M, 3M, 6M, 9M, 1Y, 18M, 2Y, 3Y, 4Y, 5Y, 6Y, 7Y, 8Y, 9Y, 10Y, 12Y, 15Y, 20Y, 25Y, and 30Y.	SONIA
CHF	2-Year Swap, 10-Year Swap	1M, 3M, 6M, 1Y, 2Y, 3Y, 4Y, 5Y, 7Y, and 10Y	ICE LIBOR
CHF	2-Year Swap, 10-Year Swap	1M, 3M, 6M, 1Y, 2Y, 3Y, 4Y, 5Y, 7Y, and 10Y	SARON
AUD	2-Year Swap, 10-Year Swap	1M, 3M, 6M, 1Y, 2Y, 3Y, 4Y, 5Y, 7Y, 10Y, 15Y, and 20Y	Bank Bill Rate
JPY	2-Year Swap, 10-Year Swap	1M, 3M, 6M, 9M, 1Y, 2Y, 3Y, 4Y, 5Y, 7Y, 10Y, 15Y, and 20Y	ICE Libor

JPY	2-Year Swap, 10-Year Swap	1M, 3M, 6M, 9M, 1Y, 2Y, 3Y, 4Y, 5Y, 7Y, 10Y, 15Y, and 20Y	TONA
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On December 13th, 2021, the volatilities for GBP (Pound Sterling) ATM Swaption used in the option pricing model transitioned to volatilities which are indexed and discounted to Sterling Overnight Interbank Average rate (SONIA). This is to address the continuity of ATM Swaptions after LIBOR Cessation.

12.3.4 USD, CAD and MXN Reference Curves Snap Changes

Prior to November 11th, 2024, the Reference Curves in USD, CAD, and MXN were priced at 15:00 local New York time. Starting on said date, the Reference Curves are priced at 16:00 local New York time. This change applies to curves price times from the Implementation Date forward; historical values remain unchanged.

12.4 Data for Back-Calculated History

This section lists the variations / assumptions used for deriving the data supporting the back-calculated history of the Index Universe.

Unless it is stated otherwise, the data quality assurance for reference data and term and conditions as well as pricing detailed in section 10 Data Sources and Quality Assurance is also applied for history.

12.4.1 For USD Index Universe

12.4.1.1 Bond Pricing for Treasury and Corporate Bonds

Historical pricing information for the period from February 17th, 2005, to September 13th, 2018, has been obtained from end-of-day (EOD) sources reflecting fixed income asset prices at 8:00 PM Eastern Time (20:00 local New York).

12.4.1.2 Par-Swap Pricing

Historical swap pricing for the period ranging from January 1st, 2005, to June 27th, 2018, has been sourced from end-of-day (EOD) swap pricing sources reflecting prices as-of 5:00 PM Eastern Time (17:00 local New York).

12.4.1.3 ATM Swaption Implied Volatility

Swaption collection as of 3:00 PM Eastern Time (15:00 local New York) is only available beginning August 1st, 2018, all historical prices prior to this date represent “market close” values. Swaption market close timing varies by market, for the US

market, the effective close price represents data as-of 4:00 PM Eastern Time (16:00 local New York).

Prior to the beginning of the ATM swaption surface time series (August 22nd, 2012), the swap curve is used for pricing the call option associated with puttable and callable bonds.

12.4.2 For CAD Index Universe

12.4.2.1 Bond Pricing for Treasury and Corporate Bonds

Historical pricing information for the period from February 17th, 2005, to September 13th, 2018, has been obtained from end-of-day (EOD) sources reflecting fixed income asset prices at 8:00 PM Eastern Time (20:00 local New York).

12.4.2.2 Par-Swap Pricing

Historical swap pricing for the period ranging from January 1st, 2005, to September 10th, 2019, has been sourced from end-of-day (EOD) swap pricing sources reflecting prices as-of 5:00 PM Eastern Time (17:00 local New York).

12.4.2.3 ATM Swaption Implied Volatility

Swaption collection as of 3:00 PM Eastern Time (15:00 local New York) is only available beginning November 26th, 2019, all historical prices prior to this date represent “market close” values. Swaption market close timing varies by market, for the US market, the effective close price represents data as-of 4:00 PM Eastern Time (16:00 local New York).

12.4.3 For EURO Index Universe

12.4.3.1 Bond Pricing for Treasury and Corporate Bonds

Historical pricing information for the period ranging from April 8th, 2005, to October 8th, 2019, has been sourced from end-of-day (EOD) pricing sources reflecting 23:00 GMT fixed income asset prices.

12.4.3.2 Par-Swap Pricing

Historical swap pricing for the period ranging from January 1st, 2005, to December 13th, 2019, has been sourced from end-of-day (EOD) swap pricing sources reflecting prices as-of 21:15 GMT.

12.4.3.3 ATM Swaption Implied Volatility

Prior to the beginning of the ATM swaption surface time series (February 7th, 2013), the swap curve is used for pricing the call option associated with puttable and callable bonds.

12.4.4 For GBP Index Universe

12.4.4.1 Bond Pricing for Treasury and Corporate Bonds

Historical pricing information for the period ranging from April 8th, 2005, to October 8th, 2019, has been sourced from end-of-day (EOD) pricing sources reflecting 23:00 GMT fixed income asset prices.

12.4.4.2 Par-Swap Pricing

Historical swap pricing for the period ranging from January 1st, 2005, to December 3rd, 2019, has been sourced from end-of-day (EOD) swap pricing sources reflecting prices as-of 21:15 GMT.

12.4.4.3 ATM Swaption Implied Volatility

Prior to the beginning of the ATM swaption surface time series (February 7th, 2013), the swap curve is used for pricing the call option associated with puttable and callable bonds.

12.5 Corporate Event Terminology

Event Type - Represents the reason for a change in the value of the amount outstanding on the instrument level.

Event Effective Date - Represents a schedule of the history and proforma of all obtainable dates of changed amounts outstanding.

Redemption Price - In case of an issuance, this is the price at which the public may purchase the individual tranche of the offered security, from the underwriter(s). In case of a redemption event, it represents price at which the issuer redeemed the individual tranche of the security.

Effective Instrument ID - Represents the exchanged/funged instrument from the existing instrument.

The below is a summary of supported event types and their definitions.

Event	Description	Details
CAN	Cancelled	Cancellation of debt issued by the issuer due to any event or any other cause. No change in identifier or transfer of amount to any existing or new security. The debt is terminated.
CAP	Capitalization of Interest	Increase in the principal amount outstanding of a security if the issuer has an option to add unpaid interest to the amount outstanding

CLD	Called	Debt issued by the issuer is called. No change in identifier or transfer of amount to any existing or new security. The debt is terminated.
CPT	Call – Pro Rata	Debt issued by the issuer is partially called. No change in identifier or transfer of amount to any existing or new security. The debt is still alive.
CUR	Currency Redenomination	Used when a country has a currency redenomination.
DEF	In Default	When the bond issuer fails to make an interest or principal payment within the specific period. No change in identifier or transfer of amount to any existing or new security.
EXC	Exchange/Converted	Existing security is fully exchanged to new security then the asset status is updated to Exchanged/Converted. The new identifier will be generated, and the exchanged amount of the old security will be transferred to new security.
FDD	Repaid via Final Default Distribution	Generally, NOT CLEAR constitutes as a part of bankruptcy proceedings and creditors' claims are settled. No change in identifier or transfer of amount to any existing or new security.
FNG	Funged	Funging is a process of retiring the temporary identifiers and merging the temporary security (baby bond) with the permanent security (mother bond). There will be a temporary identifier/ identifier (Baby bond) which trades separately for certain days (generally 40 days) and then 'funged' with the original security post then the asset status for the baby bond is updated as FNG (inactive) and the amounts will be added to the current amount outstanding of mother bond thereby resulting amount outstanding as 0 for the temporary identifier (baby bond).
IEX	Issued in Exchange	Issuance of a new instrument due to conversion or exchange from an old instrument. The amount outstanding is transferred from the old instrument.
INF	Increase due to Funding	Increase in amount outstanding of a mother bond due to funging of a baby bond.

ISA	Issuance due to a Switch Auction	Increase in amount outstanding due to switch auction.
ISS	Issued	When an instrument past its first settlement date and is available in the market. External identifiers will be made available. Amount outstanding may change if "ISS" status in use.
LIQ	Liquidated	Generally, the debt is liquidated as part of bankruptcy proceeding and creditors' claims are settled. No change in identifier or transfer of amount to any existing or new security
MAT	Expired/Matured	When the debt is fully repaid by issuer on the scheduled maturity date and no other action occurred that resulted in a full repayment before the maturity date.
MLT	Multiple Actions	When the reduction in the amount outstanding of the debt is due to multiple corporate action events.
NAC	Not Active	When vendor has confirmed information that the asset is inactive, but the reason is unknown. For example, if we receive a Null/Void or worthless status from clearing house, the issuer was in default for many years and no bankruptcy proceedings is ongoing in any court of law then we will update the asset as NAC.
OVA	Overallotment	Increase in outstanding amount due to overallotment from the issuer.
PPT	Prepayment	Decrease in outstanding amount due to Prepayment made by the issuer.
PRE	Preliminary	Instruments that are added based on initial data for Norwegian bonds, without Final Terms and Conditions.
PRT	Prepayment – Pro Rata	When each bondholder is paid out as part of repurchase.
PUT	Put	When a security is fully repaid via the exercise of a put option then we update asset status as 'Put.'
RBM	Repaid before Maturity	When the debt is fully repaid by the issuer before maturity and the repayment was not a result of a call or a put.

RDM	Euro Redenominated	Security redenominated in EUR when the country responsible for the currency of denomination joins the European Monetary Union.
REF	Refinancing Transaction	When the issuer redeems a portion of the debt by replacing it with a new debt obligation.
REM	Remarketing	When the security is remarketed by the remarketing agent with few changes in terms and conditions.
REO	Reorganization	Represents the principal reduction in a security due to restructuring of the security to equity/other issuances.
REP	Repurchased/Bought back	The outstanding debt is fully bought back by repurchase option by the issuer and not the call option. The amount of the security repurchased is not transfer to any existing or new security. The security is turned to inactive.
RES	Restructured	The existing debt of the issuing entity is restructured into new debt, equity, preferred stock, etc. as part of bankruptcy proceedings. The restructured debt may convert into new securities (debt, equity, preferred stock, etc.) as per the plan of reorganization approved by the bankruptcy court or via voluntary restructuring.
REV	Reverse Auction	When there is a decrease in amount when the seller of the security (the holder) places bids to retire the debt.
RMK	Remarketed	When the security is remarketed by the remarketing agent with few changes in terms and conditions then we update the status of bond to remarketed (active status). Remarketed means investor will have the option to sell their bonds to the market. The re-marketing agent will manage the resale process. The remarketing agent receives notices from investors who want to sell their bonds. The remarketing agent then surveys the market to determine a rate at which all the bonds being put up for sale can be sold to other investors. Sometimes new identifier is generated.
RPN	Reopened	Re-opening is an option of the issuer to issue additional Notes under the original indenture

		without any new identifiers. The 'Reopened' securities will have identical terms and conditions same as the notes originally issued save for the amount, issue price and settlement date. These reopening securities will be immediately consolidated and form a single series with the already issued and outstanding securities. There will be an increase in amount outstanding. There will not be a new identifier issued/assigned.
RTA	Retained Amount	When issuers market their bonds and retain a small portion of the issue amount and sell it later when they need funds, which are represented as retained amount.
RTP	Reinstatement – Pro Rata	Issuers can reinstate the amount written down. This event is related to Contingent Convertible bonds only.
TEN	Tendered	The security is fully bought back as part of a tender offer by the issuer. No change in identifier or transfer of amount to any existing or new security. The security is either fully or partially repaid by the issuer which leads to a reduction in amount outstanding. (In case of a partial tender we will not update the asset status).
UNK	Unknown	Represents all remaining uncategorized events not listed herein due to no details received from vendor, in terms of the event nature. The outstanding amount change is published, without further specifying the details.
WDP	Write Down – Pro Rata	Issuers can write down their Contingent Convertible bonds on a pro rata basis.
WRT	Write Down	Contingent Convertible bonds that absorb losses when the capital of the issuing bank falls below a certain level.
CAN	Cancelled	Cancellation of debt issued by the issuer due to any event or any other cause. No change in identifier or transfer of amount to any existing or new security. The debt is terminated.

12.5.1 Issuer Corporate Actions Examples

12.5.1.1 Issuer Bankruptcy

In May 2012, issuer RESIDENTIAL CAPITAL LLC filed for chapter 11 bankruptcy protection and bond US76113BAR06 under this issuer changed status to “DEF” (in default). The issuer was liquidated in December 2013 and the asset status was changed to “LIQ” (liquidation).

T&C Received from Vendor					
ISIN	EFF_DATE	END_DATE	ASSET_STATUS_CD	ISSUER_LONG_NAME	AMT_OUTSD
US76113BAR06	4/17/2012	5/13/2012	ISS	RESIDENTIAL CAPITAL LLC	473416000
US76113BAR06	5/14/2012	12/16/2013	DEF	RESIDENTIAL CAPITAL LLC	473416000
US76113BAR06	12/17/2013	12/31/3999	LIQ	RESIDENTIAL CAPITAL LLC	0
Index Universe					
ISIN	EFF_DATE	END_DATE	MARKET_STATUS	ISSUER_NAME	OUTSTD
US76113BAR06	4/18/2012	5/13/2012	ISS	RESIDENTIAL CAPITAL LLC	473416000
US76113BAR06	5/14/2012	12/16/2013	DEF	RESIDENTIAL CAPITAL LLC	473416000
US76113BAR06	12/17/2013	12/31/3999	LIQ	RESIDENTIAL CAPITAL LLC	0
Issuer Amount Outstanding					
DATE	ISSUER			AMT_OUTSTD	

7/30/2013	RESIDENTIAL CAPITAL LLC	1770388641
12/17/2013	RESIDENTIAL CAPITAL LLC	0

12.5.1.2 Issuer Name Change

In December 2018, issuer WESTROCK RKT CO changed its name to WESTROCK RKT LLC. This event does not affect its outstanding amount nor the relationship between the parent and child entity. It is treated in the following manner:

T&C Received from Vendor					
ISIN	EFF_DATE	END_DATE	ASSET_STATUS_CD	ISSUER_LONG_NAME	AMT_OUTSD
US772739AL23	11/2/2018	12/27/2018	ISS	WESTROCK RKT CO	399000000
US772739AL23	12/28/2018	5/8/2019	ISS	WESTROCK RKT LLC	399000000
Index Universe					
ISIN	EFF_DATE	END_DATE	MARKET_STATUS	ISSUER_NAME	OUTSTD
US772739AL23	11/2/2018	12/27/2018	ISS	WESTROCK RKT CO	399000000
US772739AL23	12/28/2018	5/8/2019	ISS	WESTROCK RKT LLC	399000000
Issuer Amount Outstanding					
DATE	ISSUER		AMT_OUTSTD		
12/27/2018	WESTROCK RKT CO		1450000000		
12/28/2018	WESTROCK RKT LLC		1450000000		

12.5.1.3 Issuer Merger

In May 2019, COOPER INDUSTRIES merged into EATON CORPORATION, and the assets under issuer COOPER US INC (subsidiary of Cooper Industries) changed

issuer to EATON ELECTRIC HOLDINGS LLC with outstanding amount transferred to EATON ELECTRIC HOLDINGS LLC. This event is treated as follows:

T&C Received from Vendor					
ISIN	EFF_DATE	END_DATE	ISSUER_LONG_NAME	PARENT_ISSUER_LONG_NAME	AMT_OUTSTD
US216871AE36	5/28/2019	5/28/2019	COOPER US INC	COOPER INDUSTRIES	238967000
US216871AE36	5/29/2019	12/31/39	EATON ELECTRIC HOLDINGS LLC	EATON CORPORATION PLC	238967000
Index Universe					
ISIN	EFF_DATE	END_DATE	ISSUER_NAME	P_ISSUER_NAME	OUTSTD
US216871AE36	5/28/2019	5/28/2019	COOPER US INC	COOPER INDUSTRIES	238967000
US216871AE36	5/29/2019	12/31/39	EATON ELECTRIC HOLDINGS LLC	EATON CORPORATION PLC	238967000
Issuer Amount Outstanding					
DATE	ISSUER			AMT_OUTSTD	
5/28/2019	COOPER US INC			238967000	
5/28/2019	EATON ELECTRIC HOLDINGS LLC			N/A	
5/29/2019	COOPER US INC			0	
5/29/2019	EATON ELECTRIC HOLDINGS LLC			238967000	

12.5.1.4 Issuer Acquisition

BECTON DICKINSON acquired BARD (C.R.) by the end of 2017, and the assets under issuer C R BARD INC did not change issuer but added BECTON DICKINSON AND CO as its parent entity. The outstanding amount of the asset remained the same. This event is treated as following:

T&C Received from Vendor					
ISIN	EFF_DATE	END_DATE	ISSUER_LO NG_NAME	PARENT_ISSUER_LONG_NAME	AMT_OUTS D
US067383AC36	12/29/2017	12/31/2017	C R BARD INC		67782000
US067383AC36	1/1/2018	1/2/2018	C R BARD INC	BECTON DICKINSON AND CO	67782000
Index Universe					
ISIN	EFF_DATE	END_DATE	ISSUER_NAME	P_ISSUER_NAME	OUTS TD
US067383AC36	12/29/2017	1/1/2018	C R BARD INC		67782000
US067383AC36	1/2/2018	1/10/2018	C R BARD INC	BECTON DICKINSON AND CO	67782000
Issuer Amount Outstanding					
DATE	ISSUER		AMT_OUTSTD		
12/29/2017	C R BARD INC		610658000		
1/1/2018	C R BARD INC		610658000		

12.5.1.5 Issuer Spin-Off

In June 2018, WYNDHAM HOTELS & RESORTS INC was spun-off from its parent entity WYNDHAM DESTINATIONS INC. Post the event, WYNDHAM HOTELS & RESORTS INC is a standalone entity and the bonds under this issuer remained under

the same entity except that the new independent entity does not have a parent issuer anymore. Assets under the original parent entity remained the same.

T&C Received from Vendor (parent entity)					
ISIN	EFF _DA TE	EN D_D ATE	ISSUER_LONG_NA ME	PARENT_ISSUE R_LONG_NAME	AMT _OU TSD
US067 383AC 36	6/1 /20 18	6/3 /20 18	WYNDHAM DESTINATIONS INC		4000 0000 0
US067 383AC 36	6/4 /20 18	9/2 7/2 018	WYNDHAM DESTINATIONS INC		4000 0000 0
Index Universe (parent entity)					
ISIN	EFF _DA TE	EN D_D ATE	ISSUER_NAME	P_ISSUER_NAM E	OUT STD
USU98 323AA 39	6/1 /20 18	6/3 /20 18	WYNDHAM DESTINATIONS INC		4000 0000 0
USU98 323AA 39	6/4 /20 18	9/2 7/2 018	WYNDHAM DESTINATIONS INC		4000 0000 0
T&C Received from Vendor (subsidiary)					
ISIN	EFF _DA TE	EN D_D ATE	ISSUER_NAME	P_ISSUER_NAM E	OUT STD
USU98 323AA 39	6/1 /20 18	6/1 8/2 018	WYNDHAM HOTELS & RESORTS INC	WYNDHAM DESTINATIONS INC	5000 0000 0
USU98 323AA 39	6/1 9/2 018	8/7 /20 18	WYNDHAM HOTELS & RESORTS INC		5000 0000 0
Index Universe (subsidiary)					

ISIN	EFF_DATE	ENDDATE	ISSUER_NAME	P_ISSUER_NAME	OUTSTD
USU98323AA39	6/1/2018	6/18/2018	WYNDHAM HOTELS & RESORTS INC	WYNDHAM DESTINATIONS INC	50000000
USU98323AA39	6/19/2018	8/7/2018	WYNDHAM HOTELS & RESORTS INC		50000000
Issuer Amount Outstanding					
DATE	ISSUER		AMT_OUTSTD		
6/18/2018	WYNDHAM DESTINATIONS INC		2390067000		
6/19/2018	WYNDHAM DESTINATIONS INC		2390067000		

12.5.2 Asset Level Corporate Event Examples

12.5.2.1 Asset Called

For instance, Bond US854502AF89 changed status from “ISS” (issuance) to “TBC” (to-be-called) on Jan 25, 2019, and were called on Feb 25, 2019. Its outstanding amount changed to zero when its status changed to “CLD.”

T&C Received from Vendor			
ISIN	ASSET_STATUS_CD	STATUS_EFF_DT	AMT_OUTSD
US854502AF89	ISS	12/3/2013	400000000
US854502AF89	TBC	1/25/2019	400000000
US854502AF89	CLD	2/25/2019	0
Index Universe			
ISIN	EVENT_TYPE	EVENT_EFF_DATE	OUTSTANDING_AMT

US854502AF89	ISS	12/3/2013	400000000
US854502AF89	CLD	2/25/2019	0

12.5.2.2 Asset Recovered from Default

In July 2003, MIRANT AMERICAS GENERATION LLC, issuer of bond US60467PAH73, filed for bankruptcy. In January 2006, the issuer fully recovered from bankruptcy and made all missing interest payments. Outstanding amount of 850,000,000 remained unchanged.

T&C Received from Vendor			
ISIN	ASSET_STATUS_CD	STATUS_EFF_DT	AMT_OUTSD
US60467PAH73	ISS	9/19/2001	850000000
US60467PAH73	DEF	7/14/2003	850000000
US60467PAH73	ISS	1/3/2006	850000000
Index Universe			
ISIN	EVENT_TYPE	EVENT_EFF_DATE	OUTSTANDING_A MT
US60467PAH73	ISS	9/19/2001	850000000
US60467PAH73	DEF	7/14/2003	850000000
US60467PAH73	ISS	1/3/2006	850000000

12.5.2.3 Asset Liquidated after Default

Bond US281023AX91 defaulted in December 2012 when its issuer EDISON MISSION ENERGY filed for bankruptcy. The bond was further liquidated as part of the issuer's plan of reorganization in March 2014.

T&C Received from Vendor			
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ISIN	ASSET_STATUS_CD	STATUS_EFF_DT	AMT_OUTSD
US281023AX91	ISS	11/20/2007	800000000
US281023AX91	DEF	12/17/2012	800000000
US281023AX91	LIQ	3/11/2014	0
Index Universe			
ISIN	EVENT_TYPE	EVENT_EFF_DATE	OUTSTANDING_A MT
US281023AX91	ISS	11/20/2007	800000000
US281023AX91	DEF	12/17/2012	800000000
US281023AX91	LIQ	3/11/2014	0

12.5.2.4 Asset Exchanged (One-to-One)

Bond US96647KAF93 was exchanged into a new bond US713448EA28 on Nov 9, 2018. Outstanding amount of 88,230,000 was transferred to the new bond.

T&C Received from Vendor			
ISIN	ASSET_STATUS_CD	STATUS_EFF_DT	AMT_OUTSD
US96647KAG76	ISS	9/23/1996	21000000
US96647KAG76	EXC	11/9/2018	0
US713448EB01	IEX	11/9/2018	21000000
Index Universe			
ISIN	EVENT_TYPE	EVENT_EFF_DATE	OUTSTANDING_A MT

US96647KAG 76	ISS	9/23/1996	21000000
US96647KAG 76	EXC	11/9/2018	21000000

12.5.2.5 Asset Exchanged (Multiple-to-One)

Bonds US611688AA01 and US61166WAC55 were exchanged into a new bond US07274NBA00 on Jul 12, 2018. Total outstanding amount of 318,220,000 was transferred to the new bond.

T&C Received from Vendor				
ISIN	AMT_OUTSD _CHG_CD	AMT_OUT_D T	AMT_OUTSD	
US611688AA01	ISS	7/15/2005	150000000	
US611688AA01	EXC	7/12/2018	22975000	
US61166WAC55	ISS	7/15/2005	250000000	
US61166WAC55	EXC	7/12/2018	58805000	
US07274NBA00	IEX	7/12/2018	3182200000	
Index Universe				
ISIN	EVENT _TYPE	EVENT_EFF_ DATE	OUTSTANDI NG_AMT	EFFECTIVE_INST RUMENT_ID
US61168 8AA01	ISS	7/15/2005	150000000	
US61168 8AA01	EXC	7/12/2018	22975000	US07274NBA00
US61166 WAC55	ISS	7/15/2005	250000000	
US61166 WAC55	EXC	7/12/2018	58805000	US07274NBA00

12.5.2.6 Asset Funged

Baby bond USA8372TAH17 was funged on Dec 19, 2018. The bond issue amount outstanding was decreased to zero and was added to the issue amount outstanding of the mother bond USA8372TAC20:

T&C Received from Vendor				
ISIN	AMT_OUTSD_CHG_CD	STATUS_EFF_DT	AMT_OUTSD	
USA8372TAH17	ISS	11/6/2018	500000000	
USA8372TAH17	FNG	12/19/2018	0	
USA8372TAC20	RPN	10/22/2017	500000000	
USA8372TAC20	RPN	12/19/2018	1000000000	
Index Universe				
ISIN	EVEN_T_TYPE	EVENT_EFF_DATE	OUTSTANDING_AMT	EFFECTIVE_INSTRUMENT_ID
USA8372TAH17	ISS	11/6/2018	500000000	
USA8372TAH17	FNG	12/19/2018	0	USA8372TAC20

12.6 Glossary

12.6.1 Bond Terminology

- Accrued Interest** - The amount of interest as a percentage of par that accrues between the last coupon date and the bond settlement date owed to a buyer of the bond.
- Amount outstanding** – The amount outstanding or par value of a bond determines not only the notional balance on which an issuer pays interest, but the amount of principal to be repaid by an issuer at the end of a bond’s term. Par amount outstanding is seen as a measure of relative liquidity and as a proxy of the float available for investors to purchase, with larger bonds viewed as more accessible than smaller ones.
- Bullet Bond** – A bond whose entire principal value is paid all at once on the maturity date, as opposed to amortizing the bond over its lifetime. Bullet bonds cannot be redeemed early by an issuer, which means they are non-callable.
- Callable Bond** – A bond that can be redeemed or “called” by the issuer on or after a specific date. Interest payments on these bonds are typically higher to

compensate buyers for reinvestment risk as issuers will tend to redeem them when prevailing interest rates fall as they can reissue/refinance at a lower rate.

- **Convertible Bond** – is a fixed-income debt security that provides interest payments and can be converted into a specified number of common stock or equity shares. The conversion from the bond to stock can occur at certain times during the bond's duration, typically at the discretion of the bondholder. Contingent Convertible (CoCo) bonds fall within this category for instruments that comply with BASEL III Additional Tier 1 or Solvency II Restricted Tier 1 securities with mechanical loss absorption.
- **Coupon** – The effective interest rate for the instrument.
- **Coupon Payment Frequency** – Represents the frequency of scheduled accrued interest payments per year.
- **Country of Exposure** – a country to which a security has significant economic, legal or political risk exposure.
- **Credit** – Quality of a bond as measured by the ratings agencies, Moody's, Standard and Poor's, and Fitch. This is important for index users with investment guidelines that make a clear distinction between investment grade (rated BBB-/Baa3 and above) and high yield (rated BB+/Ba1 thru C-/C3) securities.
- **Currency** – Denomination of a bond's principal and interest payments
- **Day Count Convention** – Represents the number of days in a month and the number of days assumed in a year. The day count convention is used to calculate the accrued interest on the offered instrument.
- **Defaulted Bond** – A bond is defaulted when it fails to repay its interest or principal. A default can occur when a borrower is unable to make timely payments, misses payments, or avoids or stops making payments.
- **Dual Currency Bond** – A debt instrument in which the coupon and principal payments are made in two different currencies. The currency in which the bond is issued, which is called the base currency, will be the currency in which interest payments are made.
- **Equity Clawbacks** – Equity Clawbacks allow the issuer to refinance a certain amount of the outstanding bonds with proceeds from an equity offering.
- **Exchange-Traded Notes** – A type of bond that does not pay interests and pays the return of the index it tracks at maturity. Prices of exchange-traded notes fluctuate like stocks.
- **Fixed-Rate Coupon** – Coupon or interest payment on a bond that remains fixed at a given rate throughout the term of the bond.

- **Floating-Rate Coupon** – Coupon or interest payment on a bond is tied to a benchmark rate such as a U.S. Treasury note rate, the Federal Reserve funds rate, the London Inter-bank Offered Rate (LIBOR), or the prime rate throughout the term of the bond. The coupon rate is calculated based on the aggregation of underlying index level and a predetermined margin spread.
- **Hybrid securities** – Bonds that have the qualities of both an interest-bearing debt and equity. These allow borrowers to defer interest payments without defaulting. Deferred interest can be cumulative or non-cumulative. Interest payments are made from pre-taxed income.
- **Inflation linked bonds** – Bonds where the principal to be repaid at maturity is indexed to inflation or deflation daily over the life of the bond.
- **Issue Amount** – Represents the amount issued at initial issuance.
- **Issue Date** – The settlement date for the first placement that resulted in an issuance of securities.
- **Issuer** – Company, government, government-sponsored entity, or any other entity accessing capital markets and that sells newly created bonds to raise money for funding operations.
- **Make Whole Call** – A type of call provision on a bond allowing the issuer to pay off remaining debt early. The issuer typically must make a lump sum payment to the investor derived from a formula based on the net present value (NPV) of future coupon payments that will not be paid incrementally because of the call combined with the principal payment the investor would have received at maturity.
- **Maturity** – Redemption date of the security from the auction.
- **NVCC** - Non-viability Contingent Convertibles are subordinated debt or preferred shares that are issued by banks in Canada and can be converted into common stocks if a trigger event occurs. This conversion has two potential trigger events: 1) when a bank is facing financial difficulties so severe that it is deemed “non-viable” by the Office of the Superintendent of Financial Institutions (OSFI); or 2) if a government injection of capital or similar support has been provided or agreed to, without which the bank would be non-viable.
- **Par Value** – The face value of a security, typically in \$100 or \$1000.
- **Parent issuer** – A parent issuer is a company that owns or controls the issuer through the ownership of greater than 50% of the voting stock.

- **Payment-in-Kind Bond** – A bond that pays interest in additional bonds rather than cash. These are considered a type of deferred coupon bond and usually issued by firms in financial distress. Sometimes referred to as PIK bonds.
- **Perpetual** – Perpetual bond is a type of bond with no maturity date assigned. Issuers will make nonstop periodic coupon payments on perpetual bonds, and the issuer does not have the obligation to redeem the principal as no maturity is defined.
- **Preferred Security** – A preferred security is a form of instrument with properties of both equity and a debt instrument and is typically considered a hybrid instrument. Preferred shareholders have priority over common stockholders when it comes to dividends, which generally yield more than common stock and can be paid monthly or quarterly.
- **Private Placement** – A bond or other security that is sold to a small number of large, qualified investors (Qualified Institutional Buyers (“QIBs”) for example) without being registered with the SEC.
- **Puttable Bond** – A bond where the holder can demand the issuer redeem on or after specific dates before maturity. The interest payments will be lower than prevailing interest rates as the option to force redemption has value to the holder.
- **Reg-S Bonds** – Bonds offered and sold outside the U.S. and thus not subject to SEC registration requirements. As such, offering participants (the issuer, banks involved in offer or their affiliates) cannot engage in direct selling efforts nor can offers and sales be made to U.S. persons, including U.S. persons physically located outside the U.S.
- **Sector** – Classification of the bond issuer, recognizing the wide range of issuer types in the fixed income market including corporate, government and securitized borrowers.
- **Secured Debt** - Any type of debt or general obligation that is protected by a guarantor or collateralized by a lien on specific assets of the borrower in the case of a bankruptcy or liquidation or failure to meet the terms for repayment.
- **Senior Debt** – Senior unsecured debt of an issuer’s outstanding bonds, is considered lower risk than subordinated debt. Although senior debt holders must be repaid before other unsecured creditors in a bankruptcy event, the securities are backed only by the credit of the issuer and its ability to service the debt.
- **Sinking Bonds** – These are bonds backed by funds set aside to ensure principal and interest payments are made as promised and often accompanied by call

schedules covering the life of the bond. They are often referred to as Sinkable Bonds or Sinking Fund Bonds.

- **Step-down Coupon** – Coupon or interest payment on a bond that can decrease by a given increment at some point or points over the life of the bond.
- **Step-up Coupon** – Coupon or interest payment on a bond that can increase by a given increment at some point or points over the life of the bond.
- **Strippable** – It is the process of separating a bond into its principal component and interest components. These components are then sold separately into interest only and principal only bonds.
- **Strips** – STRIPS (Separate Trading of Registered Interest and Principal of Securities) are debt securities that are created through the process of coupon stripping. The bond's principal and interest have been separated as two separate instruments.
- **Subordinated Issues** – Bonds or notes that rank below other debt in terms of claims on the issuer assets in the event of a bankruptcy or liquidation.
- **Sukuk Instruments** – Islamic financial tools often called Shariah-compliant bonds. They represent ownership of tangible assets, services, or investments in projects or activities that follow Shariah principles.
- **Ultimate Parent Issuer** – An ultimate parent issuer is a company that owns or controls the parent issuer through the ownership of greater than 50% of the voting stock.
- **Unsecured Debt** – Any type of debt or general obligation that is not protected by a guarantor or collateralized by a lien on specific assets of the borrower in the case of a bankruptcy or liquidation or failure to meet the terms for repayment.
- **Warrant-linked bond** – Bonds issued with warrants that entitle the bearer to buy shares in the issuing company at a predetermined price, usually following a given period.
- **X/N Notes & Receipts** – a type of 144a fixed income instruments issued by Italian issuers. Italy imposes a specific 'Italian Substitute Tax' on interest and related income from these Notes & Receipts, regardless of whether they are issued within or outside Italy. These instruments are structured to take advantage of tax relief provisions. The "N" designation refers to taxable assets, while the "X" designation refers to the tax-exempt version.
- **Zero-Coupon** – Bonds that do not have a coupon or make periodic interest payments. They sell at a discount to par value and pay out par value at maturity.

The discount equates to interest paid by the issuer and is amortized over the holding period of the bond.

- **144(a) Bonds** – Privately placed bonds that can trade under SEC rule 144(a). This rule allows privately placed bonds to trade among QIBs without the minimum two-year holding period assuming other provisions are met.

12.6.2 Single Security Analytics Terminology

- **Convexity** – This is the second derivative of the price-yield function and measures the second-order change in the price of a bond with respect to yield changes. Convexity is positive for conventional bonds. Negative convexity dampens the price appreciation if interest rates fall and aggravates the price decline if interest rates rise.
- **Current Yield** – This is the ratio of the annual income (interest) received by the bond divided by the current price of the security.
- **Duration Times Spread (DTS)** - Duration Times Spread is usually calculated as L-OAS * OASD. This measure is popular for spread/credit risk analysis, as the volatility of the spread return of a security is typically proportional to its DTS. DTS is one input of our Volatility & our Value FI Factor index.
- **Key Rate Duration** - a component of Effective Duration, where the parallel shift in the par yield curve is replaced with a “tent-shaped” shift centered at a given key-rate node.
- **Macaulay Duration** – This is a measure of the weighted average time to maturity (in years) for an investor to receive the present value cash flows from a bond.
- **Maturity** - The time (in years) for which an instrument remains outstanding. The term refers to a finite period at the end of which the instrument will no longer exist and the principal is repaid
- **Modified Duration** – This is a measure of the effect that a 100bp change in interest rates will have on the price of a bond.
- **Nominal Yield** – This represents the coupon rate on a bond. The nominal yield is the interest rate (to par value) that the bond issuer promises to pay the bond holders.
- **Option-Adjusted Spread (OAS)** – This is the constant spread that when added to all discount rates from the government curve on the binomial interest rate tree model (used by the indices) will make the theoretical value of the future cash flows equal to the market price of the instrument.

- Yield-to-Maturity** - it represents the rate of return anticipated on a bond if held until its maturity. The YTM calculation accounts for the bond's current market price, par value, coupon interest rate and time to maturity under the assumptions that all cash flows received are reinvested at the same rate as the bond's current yield.
- Yield-to-Worst**- Represents the lowest potential yield that an investor would receive on a bond if the issuer does not default. The yield to worst is calculated by making worst-case scenario assumptions on the issue by calculating the returns that would be received if provisions, including prepayment, call or sinking fund, are used by the issuer. The YTW is used to evaluate the worst-case scenario for yield to help investors manage their risk and exposures.

12.7 Excluded Security Types

12.7.1 Excluded Instrument Types

Instrument Type Code	Description
ABS	Asset Backed Security
ACS	Asset Covered Security (Covered Bond)
C2	Certificate of Participation
C3	Certificate of Obligation
CAPSEC	Capital Security
CAT	Insurance Linked Security
CDBCRP	Certificate of Deposit
CDINST	Certificate of Deposit - Institutional
CDO	Collateralized Debt Obligation
CDOSYN	Synthetic Collateralized Debt Obligation
CLN	Credit Linked Note
COLLTR	Collateral Trust

Instrument Type Code	Description
LOB	Lease Obligation Bond
LPN	Loan Participation Note
LTRGAGE	Lettre de Gages (Covered Bond)
MBS	Mortgage-Backed Security
PASSTHRU	Pass Through Certificate
PFDSTK	Preferred Stock
PFOFFEN	Oeffentlicher Pfandbrief (Covered Bond)
PNOTE	Equity Participation Note
SAKOBL	Sakerstallda Obligation (Covered Bond)
STPROD	Structured Product
TR	Trust
TRCTF	Trust Certificate

CTF	Certificate	TRPFDSEC	Preferred Security (Trust, SPV)
CVDBND	Covered Bond (Other)	UNIT	Unit
DEPSH	Depository Share of Preferred Stock		
EETC	Enhanced Equipment Trust Certificate		
EQUIPTR	Equipment Trust		
EQUUNIT	Equity Unit		
FAC	Facility Bond		
INCBND	Income Bond		
INCNT	Income Note		
INT	Strip - Interest only		

12.7.2 Excluded Seniority Types

Seniority Type Code	Description
2NDLIEN	Senior Secured - Second Lien
2NDMTG	Senior Secured - Second Mortgage
3RDMTG	Senior Secured - Third Mortgage
MTG	Senior Secured - Mortgage
REFMTG	Senior Secured - General & Refunding Mortgage

12.7.3 Supported Equity Subcategories

Supported Classes	DESCRIPTION
ADR	American Depository Receipts
BDR	Brazilian Depository Receipts
BRAZILUNT	Brazilian Units
CAPSEC	Capital Securities (NYSE)
CEDEAR	Argentinian Depository Receipts
CEF	Closed-Ended Fund
CFD	Contract for Difference
CHESS	CHESS Depository Interests
CHINDR	Chinese Depository Receipts

CPO	Mexican Ordinary Participation Certificates
CPR	Convertible Preference Shares
CRTRACK	Tracker Certificates
CUM	Cumulative Preference Shares
DEFER	Deferred Shares
DEPOSITSHS	Depository Shares
DRC	Depository Receipt
DUTCHCERT	Dutch Certificates
DVR	Differential Voting Rights Shares
EDR	European Depository Receipts
ELN	Equity-linked Note
ETC	Exchange-Traded Commodity
ETF	Exchange-Traded Fund
ETFA	Alternative ETFs
ETFB	Fixed Income ETFs
ETFC	Commodity ETFs
ETFE	Equity ETFs
ETFM	Money Market ETFs
ETFO	Other ETFs
ETFR	Real Estate ETFs
ETFX	Mixed Asset ETFs
ETMF	Exchange-Traded Managed Fund
ETN	Exchange Traded Note
ETV	Exchange-Traded Products
FULLPAID	Fully Paid Ordinary Shares
GDR	Global Depository Receipts
GEAREDUNT	Geared Ordinary Units
GENUS	Genussscheine
GROWUNT	Growth Units
INDIDR	Indian Depository Receipts
INS	Insurance Fund
INVCERT	Investment Certificates

INVESTSHAR	Peruvian Investment Shares
IRREDEEM	Irredeemable Preference Shares
NONCPR	Non-Convertible Preference Shares
NONCUM	Non-Cumulative Preference Shares
NONPARTPRF	Non-Participating Preference Shares
NVDR	Thai Non-Voting Depository Receipts
OPAL	OPALS (Optimised Portfolio as Listed Securities)
OPF	Open-Ended Fund
ORD	Ordinary Shares
ORDSUBR	Ordinary Subscription Receipts
PAIDSUBRTS	Paid Subscription Rights
PAIDSUBSHS	Paid Subscription Shares
PART	Participation
PARTPAID	Partly Paid Ordinary Shares
PARTPRF	Participating Preference Shares
PDR	Philippine Depository Receipts
PERPCAP	Perpetual Capital Securities
PREFERRED	Preferred Shares
PRF	Preference Shares
PRFSUBR	Preference Subscription Receipts
REDEEM	Redeemable Preference Shares
REDEM	Redemption Shares
RTS	Rights
SAVE	Savings Shares
STAPLED	Spread
STKDIV	Stock Dividend
SUBOPT	Subscription Option
SUBSRTS	Subscription Rights
SWEDDR	Swedish Depository Receipts
TCR	Transferable Custody Receipt
UNT	Unit

12.7.4 Excluded Exchange or Source

EXCHANGE_CODE	DESCRIPTION
ADC	NASD Alternative Display Facility for NYSE/AMEX Issues
ADF	NASD ADF when trading NASDAQ Global Market
ADS	NASD ADF when trading NASDAQ Capital Market
BDS	BOAT - MIFID Aggregator Feed
BQT	BeQuoted.com
BT1	Cboe BATS One
BZX	Cboe BZX PITCH
CT1	CeTO-Regulated Market
DBA	Deutsche Boerse AG MiFID II APA Service
FDI	Spanish Investment Funds
FEP	Financial Express
GSD	NASD ADF when trading NASDAQ Global Select Market
JSF	JAPAN SECURITIES FINANCE
LCC	NYSE National Exchange for Nasdaq Large Cap
LIP	Lipper
LPC	Lipper Canadian Mutual Funds
NBA	NASDAQ OMX NASDAQ Basic Amex
NBN	NASDAQ OMX NASDAQ Basic NYSE
NEO	Aequitas NEO-N
NGA	Nigerian Stock Exchange
NLB	Aequitas NEO-L
NXB	NASDAQ OMX - NASDAQ BASIC
OAP	Oslo Stock Exchange APA
OKB	Oesterreichische Kontrollbank AG (OeKB)
PPB	Provedor Integral De Precios SA de CV
RCT	Source is a Refinitiv Contributor
REU	Refinitiv
SCC	NYSE National Exchange for Nasdaq Capital Market
THM	NASDAQ INTERMARKET
UNL	Unlisted Public Company Market (UPCOM)

XDS	Cross-market Data Service
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12.8 MSCI Fixed Income Data Methodology Book Tracked Changes

First version reviewed and published in December 2019.

The following modifications are effective from June 2020.

- General coverage of additional currencies released to Fixed Income Asset Platform: CAD, GBP, EUR throughout the document
- Section 2 - Opportunity Set and Eligibility Criteria
 - Section 2.5.1 – Eligible Bond Types – addition of asset coverage approved by the Fixed Income Data Committee
 - Section 2.6.3 – Country of Domicile – added detail on the eligibility of emerging markets
- Section 7 – Forward Looking Information
 - Addition of Section 7
- Section 8 – Market Conventions
 - Added currency specific timing
- Section 11 – Appendix
 - Addition of currency specific definitions for market calendars, timing of prices and reference data, reference curves, back-calculated history

The following modifications are effective from August 2021.

- Section 2– Opportunity Set and Eligibility Criteria
 - Section 2.2 – Asset Classification – addition of Sub-sovereign bonds and removal of municipal bonds in effort to create alignment with MSCI Entity Classification and Relationship Methodology
 - Section 2.3 – Credit Quality – added detail on exceptions for rating requirements for government issued bonds if the issuer is rated.
 - Section 2.5.2 – Non-Eligible Bond Types – Clarification denoting that only STRIPS bonds are ineligible.
 - Section 2.6.1 – Issuer Amount Outstanding – Clarification that STRIPS are excluded in calculation of issuer amount outstanding
- Section 5 – Single Security Analytics
 - Section 5.2.2 – Yield-to-Worst – Improvement to statistic definition
 - Section 5.4.2 – Modified Convexity – Correction to statistic definition b/c it is in relation to YTW as opposed to YTM
- Section 8 – Market Conventions

- Section 8.1 – Market Calendars and Settlement Conventions – removal of language stating “interest accrued during the month will be reflected within the calendar month” because RiskServer is not currently able to accommodate this desired interest accrual.
- Section 9 – Data Sources and Quality Assurance
 - Section 9.2.1 – Handling of Missing Prices – clarifying language as to how handle missing prices for unrated issuances given that price filling is based on rating.
- Section 11 – Appendix
 - Section 11.1.1 – MSCI Average Rating Methodology – clarifying language detailing that for unrated government bonds issuer level ratings are provided in-lieu
 - Section 11.1.2 – MSCI Issuer Rating Methodology – addition of this section
 - Added Section 11.7 – MSCI Fixed Income Data Methodology Book Tracked Changes

The following modifications are effective from December 2021.

- Section 1– Opportunity Set and Eligibility Criteria
 - Added pf Additional Published Reference Data: covers additional reference data points including derived methodology supporting index calculations.
- Section 2– Opportunity Set and Eligibility Criteria
 - Section 2.4 – Seniority – Added exception of seniority types eligible to the Index Universe.
 - Section 2.5.1 – Eligible Bond Types – Introducing hybrid securities with deferrable interest payments that have not been deferred.
 - Section 2.5.2 – Non-Eligible Bond Types – Clarification denoting that hybrid securities whose interest payments have been deferred by the issuer, addition of excluded instrument types and seniority types.
 - Section 2.6.3 – Country of Domicile – Correction to eligible issuer country of domicile from Emerging Markets to Non-developed markets.
- Section 4 – Reference Curves and Reference Rates
 - Section 4.2.1 – Reference Rates – Added usage of reference rates and applicable scope.

- Section 8 – Additional Published Reference Data
 - Section 8.1 – Government Amount Outstanding Allocation – Addition of the section, announcing the support of additional data attributes, including data definition, representation, calculation methodology.
- Section 9 – Market Conventions
 - Section 9.2.3 – Swap Data Timing – Added timing of the swap pricing data for USD Secured Overnight Financing Rate, EUR Euro short-term rate, GBP Sterling Overnight Interbank Average rate
- Section 12 – Appendices
 - Section 12.2.3. – CAD Market Calendar – Inclusion of newly announced federal statutory holiday, National Day for Truth and Reconciliation
 - Section 12.3.2.1. – Zero-Coupon Swap Curve – Clarification denoting ICE as provider under GBP and USD LIBOR®.
 - Section 12.3.2.2. – Zero-Coupon Overnight Indexed Swap Curve – Addition of this section
 - Section 12.3.3. – ATM Swaption Implied Volatility Surface – Addition of GBP SONIA to construct ATM swaption surface. Clarification of reference rates used in the market.
 - Section 12.6.1. – Bond Terminology – Added definition of Hybrid Securities.
 - Section 12.7. – Excluded Security Types – Addition of this section.

The following modifications are effective from April 2023.

- Section 2 – Opportunity Set and Eligibility Criteria
 - Section 2.6.2 – Minimum Issue Outstanding – Add coverage for twelve newly onboard currencies
- Section 8 – Additional Published Reference Data
 - Section 8.2 – Has Equity Flag – Addition of the section, announcing the support of additional data attributes, including data definition, representation, methodology.
- Section 9 – Market Conventions
 - Section 9.2 – Timing of Prices and Reference Data – The table specifying the timing of the bond pricing data collection has been adjusted to reflect the addition of the APAC region, as well as granularity for primary and ancillary pricing sources.

- Section 12 – Market Calendars and Settlement Conventions
 - Section 12.2.6 – Section 12.2.17 – Addition of the sections for market calendar of twelve newly onboard currencies
 - Section 12.3.1 – Zero-Coupon Government Curves – The table specifying the details about the curves constituent basket by currency / market has been adjusted to reflect the addition of twelve newly onboard currencies.

The following modifications are effective from November 2024.

- Section 2 – Opportunity Set and Eligibility Criteria
 - Section 2.3 Credit Quality – Revised based on Fitch rating, MSCI bond credit rating, MSCI issuer credit rating and MSCI Aggregate Credit rating onboard
 - Section 2.5.1 Eligible Bond Types – Introducing Corporate Sukuk instruments
 - Section 2.5.2 Non-Eligible Bond Types – Specify Sovereign Sukuk instruments
 - Section 2.6.1 Issuer Amount Outstanding Calculation – Exclude N-Receipts issues
- Section 8 Additional Published Reference Data
 - Section 8.3 – Cash flow – Addition of the section, announcing the support of additional data attributes, including data definition, representation, methodology.
- Section 9 Market Conventions
 - Section 9.2.1 - Bond Pricing – Update of Primary and Ancillary Bond Pricing Timing and AMER 1600 NY Migration
 - Section 9.2.3 - Swap Data Timing – Addition of AUD, CHF and JPY ATM Swap Timing and AMER 1600 NY Migration
 - Section 9.2.4 - Swaption Data Timing – Update of the USD and CAD Timing and Addition of AUD, CHF and JPY ATM Swaption Timing and AMER 1600 NY Migration
- Section 12 – Appendices
 - Section 12.1.2 MSCI Bond Credit Rating Methodology – Addition of the section, announcing the support of additional data attributes, including data definition, representation, methodology.

- Section 12.1.4 MSCI Issuer Credit Rating Methodology – Addition of the section, announcing the support of additional data attributes, including data definition, representation, methodology.
- Section 12.1.5 MSCI Aggregate Credit Rating Methodology – Addition of the section, announcing the support of additional data attributes, including data definition, representation, methodology.
- Section 12.2.1 Settlement Conventions – Introducing special treatment for currency CAD and USD
- Section 12.3.2.1 Zero-Coupon Swap Curve – Addition of AUD, CHF and JPY currencies
- Section 12.3.2.2 Zero-Overnight Indexed Swap Curve – Addition of AUD, CAD (CORRA), CHF and JPY currencies
- Section 12.3.3 ATM Swaption Implied Volatility Surfaces – Addition of AUD, CAD (CORRA), CHF, JPY, and USD (SOFR) currencies
- Section 12.3.4 USD, CAD and MXN Reference Curves Snap Changes – Addition of the section
- Section 12.6.1 Bond Terminology – Reclassify Convertible Bond, introducing Country of Exposure, Sukuk Instruments and X/N Notes & Receipts
- Section 12.7.1 Excluded Instrument Types – Remove all the Sukuk Instruments related instrument types

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