

MSCI Fixed Income Data Methodology

June 2020

Contents		
1	MSCI Fixed Income Data Methodology Overview	4
2	Opportunity Set and Eligibility Criteria	5
2.1	Currency	5
2.2	Asset Classification	5
2.3	Credit Quality	5
2.4	Seniority	6
2.5	Bonds and Coupon Types	6
2.6	Amount Outstanding	7
3	Asset Pricing	9
3.1	Bond Pricing Model	9
3.2	Option Pricing Model	9
4	Reference Curves	10
4.1	Zero-Coupon Government Curve	10
4.2	Zero-Coupon Swap Curve	10
4.3	At-the-Money Swaption Implied Volatility Surface	10
5	Single Security Analytics	11
5.1	Price	11
5.2	Yield	11
5.3	Duration	12
5.4	Convexity	15
5.5	Spread	16
5.6	Accrued Interest	16
6	Corporate Events Handling	19
6.1	Issuers Corporate Event Handling	19
6.2	Issue Level Corporate Event Handling	22
7	Forward looking Information	27

8	Market Conventions	27
8.1	Market Calendars and Settlement Conventions	27
8.2	Timing of Prices and Reference Data	27
9	Data Sources and Quality Assurance	29
9.1	Reference Data and Terms and Conditions Quality Assurance	29
9.2	Pricing Data Quality Assurance	29
10	Data Governance	30
11	Appendices	31
11.1	MSCI Average Rating Methodology	31
11.2	Market Calendars and Settlement Conventions	32
11.3	Currency Specific Model Definitions & Reference Curves	36
11.4	Data for Back-Calculated History	38
11.5	Corporate Event Terminology	40
11.6	Glossary	52
12	References	56

1 MSCI Fixed Income Data Methodology Overview

This document provides information regarding 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 regarding 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.

Market Conventions: information regarding 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 5 broadly accepted asset categories. They reflect the different characteristics of the assets as well as the investment processes, allocation decisions and specialization of investors within the respective categories.

- Sovereign bonds
- Supranational bonds
- Municipal bonds
- Corporate bonds
- Securitized Products

MSCI currently considers Sovereign, Supranational and Corporate bonds as eligible assets for the Index Universe.

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 thru 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 9.2 Pricing Data Quality Assurance.

MSCI currently uses Standard and Poor’s Rating Services (S&P) and Moody’s Investor Service (Moody’s) as the two credit ratings agencies to determine the MSCI Average Rating which is a key criterion in defining the eligibility of an asset in the Index Universe.

MSCI uses the lower of the two credit ratings between the two agencies to determine the eligibility of an asset in the Index Universe. If the bond is rated by only one agency, that rating is used as the minimum rating available.

Companies are required to be rated. Non-rated companies from one or the other rating agencies, S&P or Moody's, are excluded from the Index Universe.

See 11.1 MSCI Average Rating Methodology for more details on composite rating.

2.4 Seniority

Seniority types cover 2 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.

All issues 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 and excluded one year prior to the conversion date
- Step-up/Step-down coupons
- Puttable and callable bonds
- Bullet bonds
- Regulation S securities (RegS) *
- Private placements
- Equity Clawbacks

* Note that RegS issuances are treated as totally independent from their corresponding 144A issuances as their terms, corporate events and pricing might differ.

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
- Perpetual Bonds *
- Payment-in-Kinds (PIKs) and sinking funds
- Strippable (Interest Only/Principal Only)
- Hybrids including bonds with equity features (convertible, warrants, preferred) *
- Exchange-traded notes
- Dual currency

* Note that CAD denominated perpetual Non-viability Contingent Convertibles (NVCCs) are eligible.

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 takes into account 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 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) issues are excluded to avoid double counting, whereas private placements are included. 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 in order 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

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 Emerging Markets are considered eligible for Index Universe.

3 Asset Pricing

A pricing model is required 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:

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

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 a given 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

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 11.3 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 a given 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, specified by currency, 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.

4.3 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-to-worst is the lower of the yield-to-call/put (see below) and the yield-to-maturity (see 5.2.1 Yield-to-Maturity).

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.

In order 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:

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

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

In order 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:

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

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 an appropriate measure of duration for bonds with embedded options.

Macaulay Duration is defined as:

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

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 an appropriate 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 an appropriate 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 defined as 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 1 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-maturity. See 5.2.1 Yield-to-Maturity.

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

Where:

MC = Modified Convexity

P = clean price

y = yield-to-maturity

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 $ACI_{cum}(t)$ represents 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:

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

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.

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

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

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

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 fungible 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.

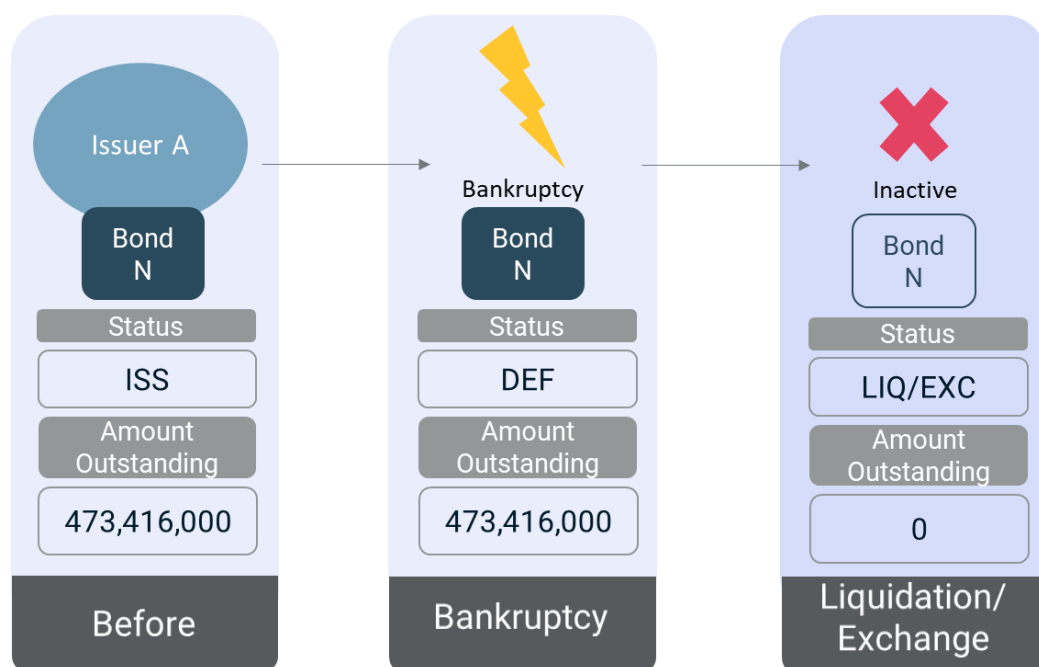
Corporate events data not only reflects changes in the historical asset level outstanding amount but can also have forward-looking functionality, foreshadowing announced events in the future.

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

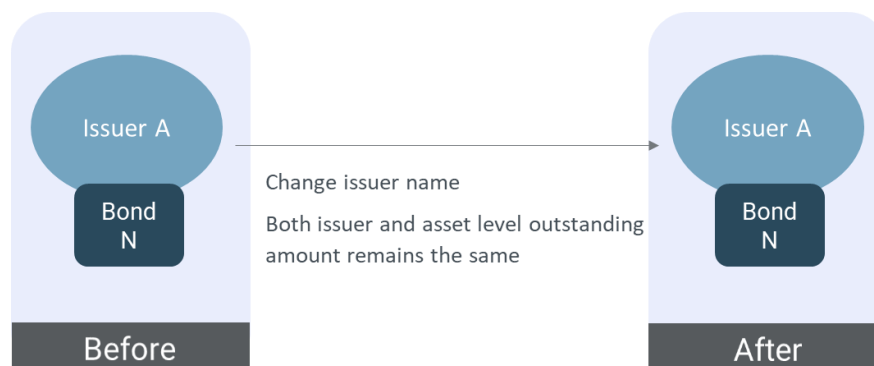
6.1.1 Issuer Bankruptcy

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.



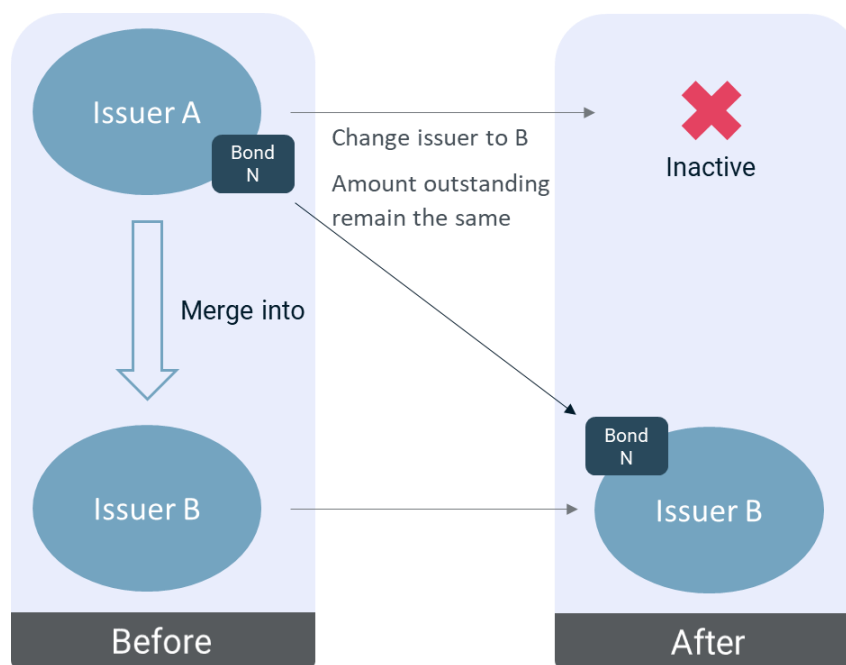
6.1.2 Issuer Name Change

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.



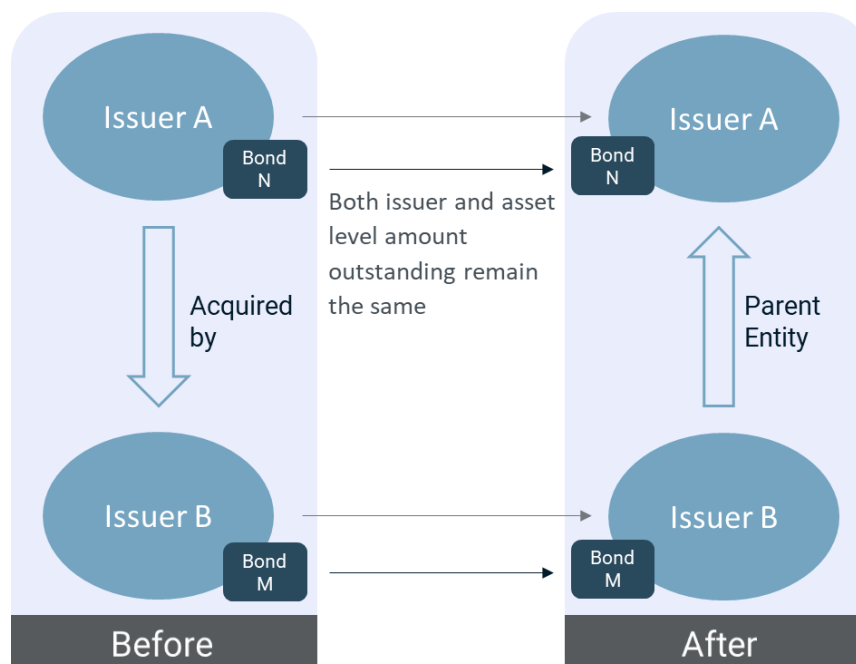
6.1.3 Issuer Merger

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.



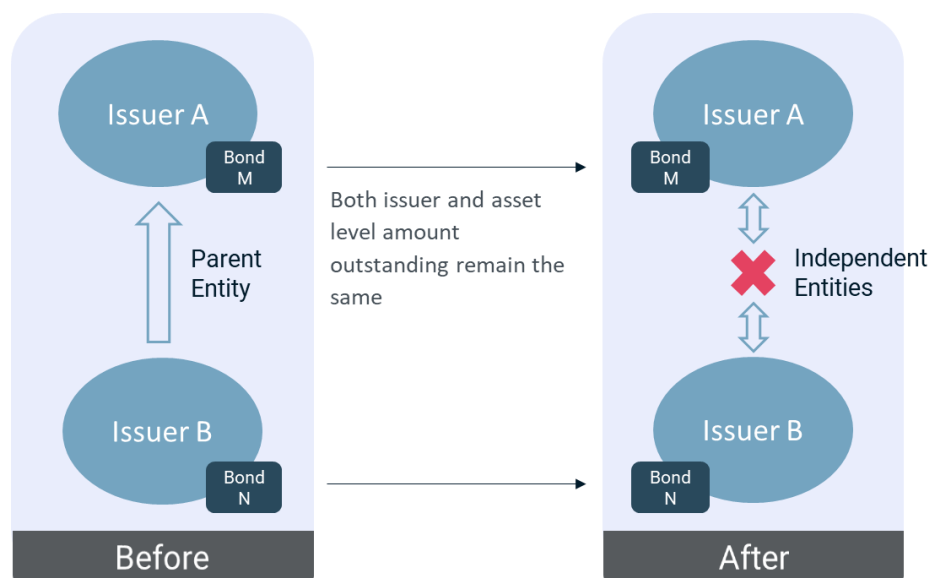
6.1.4 Issuer Acquisition

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.

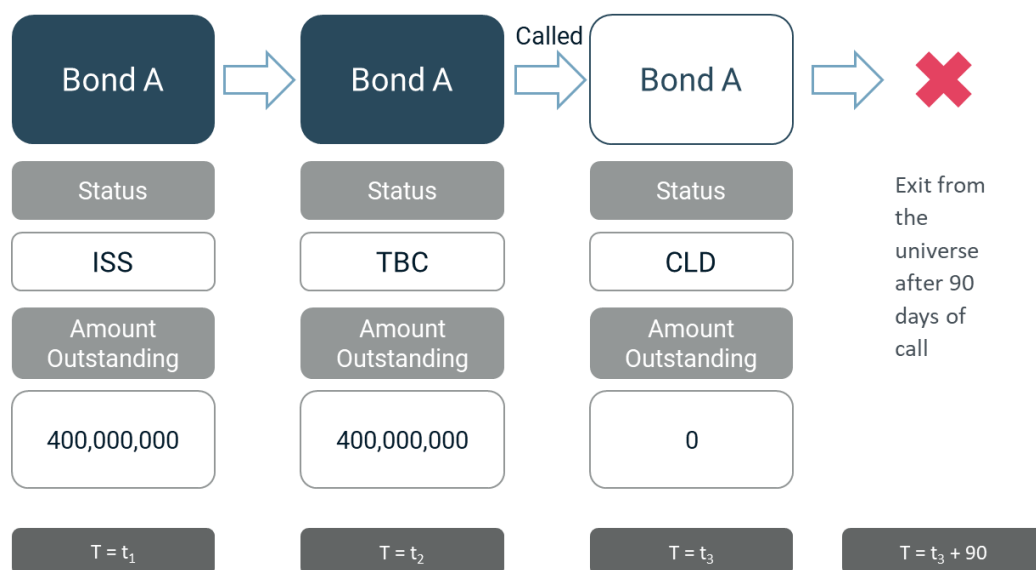


6.2 Issue Level Corporate Event Handling

The following charts represent the logic of some common corporate events on an issue level. Please refer to 11.5 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.

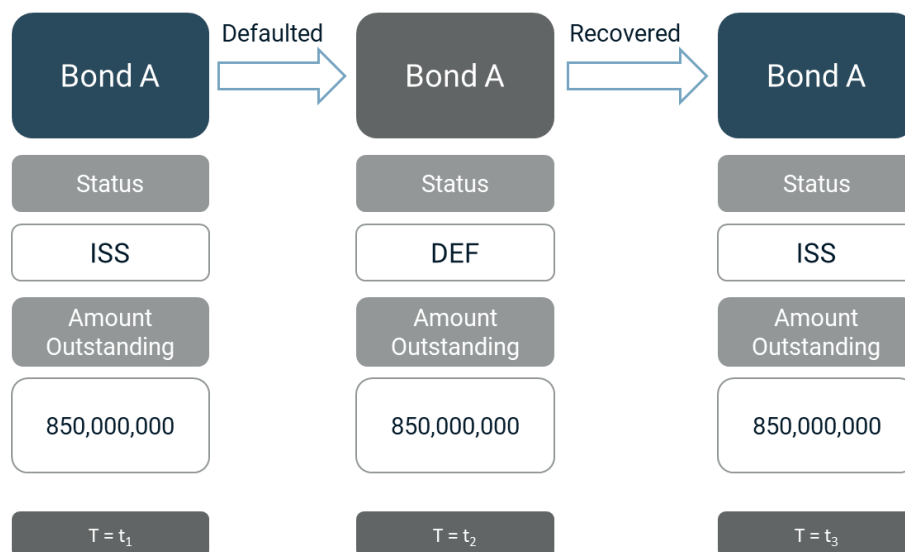


6.2.2 Asset-in-Default

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.

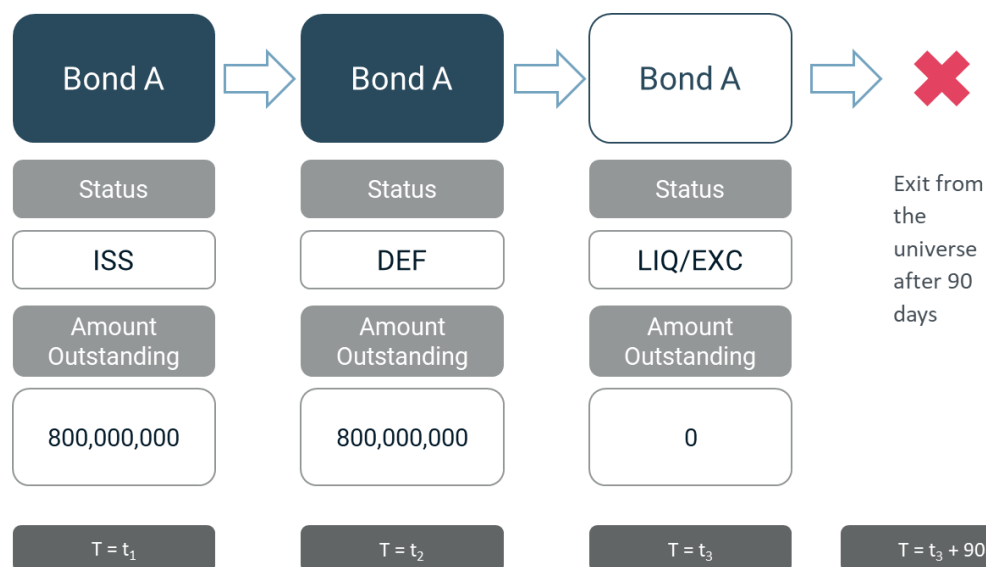
6.2.2.1 Asset Recovered from Default

If the liquidity of the issuer of a defaulted bond improves and the issuer is able to 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

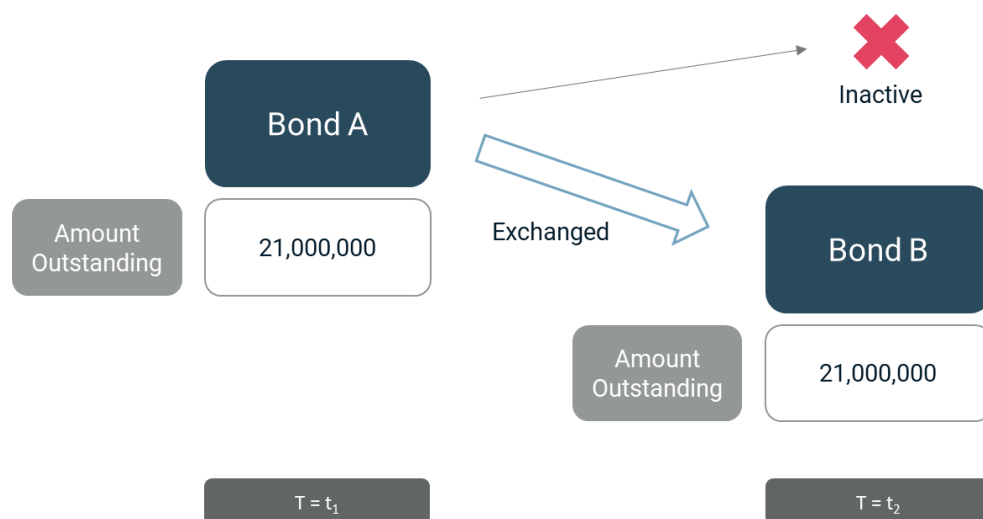
If the financial difficulty of the issuer persists and leads to bankruptcy of the issuer, the bond will be liquidated or exchanged into other instruments as part of the reorganization plan. In either case, the bond will become inactive after the liquidation/exchange.



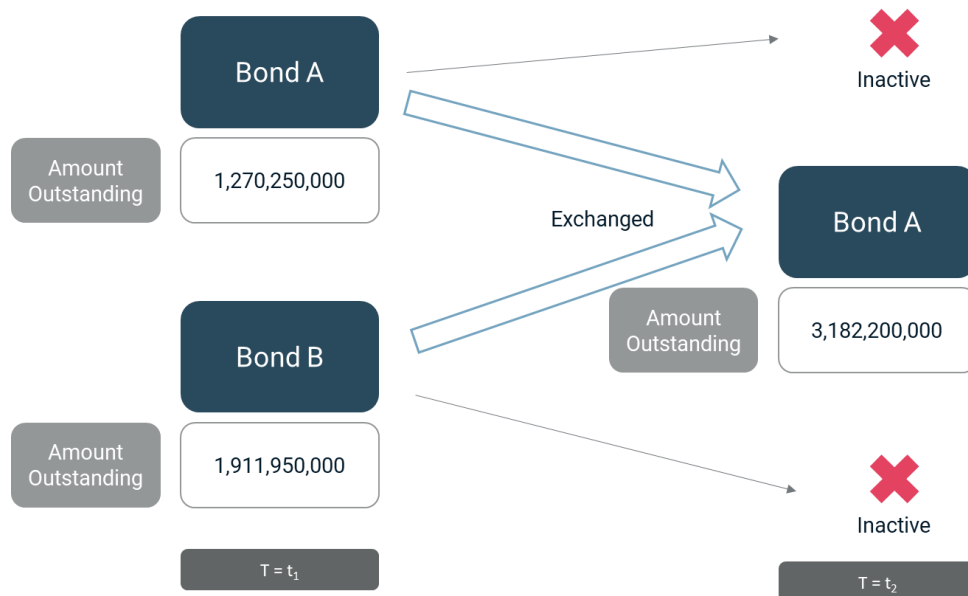
6.2.3 Asset Exchanged

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.

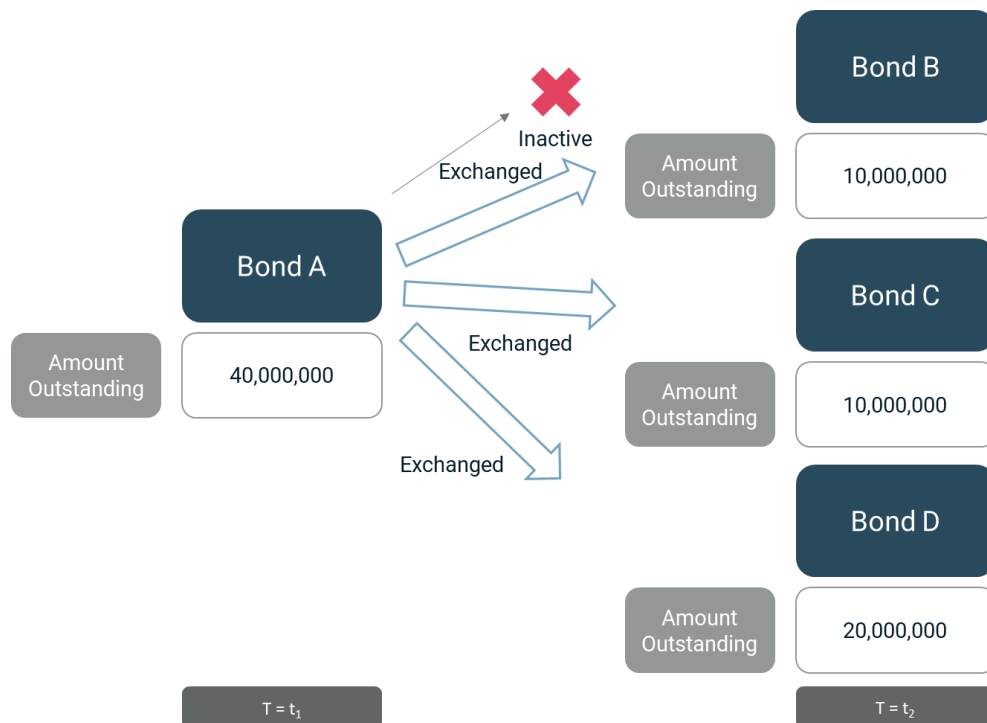
6.2.3.1 One-to-One Exchange



6.2.3.2 Multiple-to-One Exchange

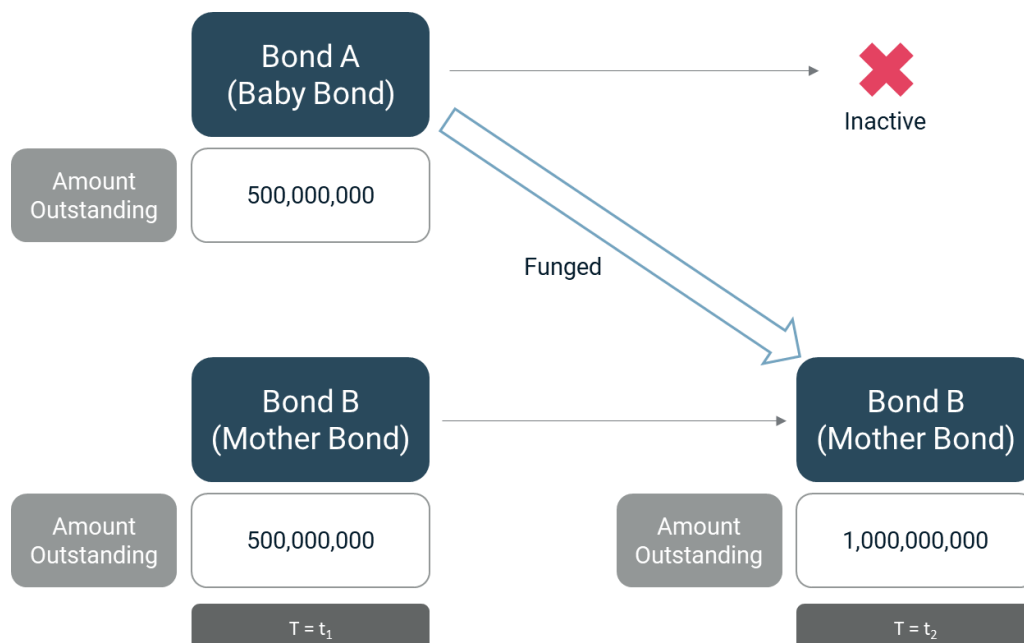


6.2.3.3 One-to-Multiple Exchange



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.¹ 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 Market Conventions

8.1 Market Calendars and 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 11.2 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.

For a month-end that occurs on a weekend or a holiday ('non-business day'), the interest accrued during the month will be reflected within the calendar month, regardless of settlement convention. For rates that are not available at month-end (e.g. a rate with an unknown reset), the accrual will be based on the current-rate and adjusted the first business day of the next month.

8.2 Timing of Prices and Reference Data

8.2.1 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.

Currency / Market	Bond Pricing Timing
USD	3pm EST (15.00 local New York)
CAD	3pm EST (15.00 local New York)
EUR	4pm GMT (16.00 local London)
GBP	4pm GMT (16.00 local London)

¹ The information, while prospective, is based on announced publicly available information.

8.2.2 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.

8.2.3 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	Overnight Rates
USD	3PM ET (15.00 local New York)	ICE Libor Rates 11.55GMT (11:55: local London)
CAD	3PM ET (15.00 local New York)	CDOR 10.15 ET (10.15 local Toronto)
EUR	4.15PM GMT (16.15 local London)	EURIBOR® 11.00CET (11.00 local Brussels)
GBP	4.15PM GMT (16.15 local London)	ICE Libor Rates 11.55 GMT (11:55: local London)

8.2.4 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	3PM ET pricing (15.00 local New York)
CAD	3PM ET pricing (15.00 local New York)
EUR	4.15PM GMT pricing (16.15 local London)
GBP	4.15PM GMT pricing (16.15 local London)

9 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.

9.1 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.

9.2 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

9.2.1 Handling of Missing Prices

In the case of a missing price from vendors, MSCI systematically escalates to vendors to challenges 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 10 consecutive business days after which the asset is dropped from the Index Universe.

MSCI's price filling rules are the following:

- 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 very sensitive to the interest rate term structure. In this case, the latest available vendor price is carried forward.

9.2.2 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 9.2.1. 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.

9.2.3 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 9.2.1. for up to 2 consecutive business days. If the vendor does not confirm that the price implying an abnormal return is incorrect within 2 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.

10 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).

11 Appendices

11.1 MSCI Average Rating Methodology

To be eligible in the Index Universe, each instrument must be rated by at least one nationally recognized statistical rating organization (NRSRO). MSCI sources rating from Standard and Poor's Rating Services (S&P) or Moody's Investor Service (Moody's). The MSCI Average Rating is the average rating of S&P and Moody's, rounded up to the nearest integer, if a half value occurs.

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

Moody's	S&P	Score	MSCI
Aaa	AAA	0	AAA
Aa1	AA+	1	AA+
Aa2	AA	2	AA
Aa3	AA-	3	AA-
A1	A+	4	A+
A2	A	5	A
A3	A-	6	A-
Baa1	BBB+	7	BBB+
Baa2	BBB	8	BBB
Baa3	BBB-	9	BBB-
Ba1	BB+	10	BB+
Ba2	BB	11	BB
Ba3	BB-	12	BB-
B1	B+	13	B+
B2	B	14	B
B3	B-	15	B-
Caa1	CCC+	16	CCC+
Caa2	CCC	17	CCC
Caa3	CCC-	18	CCC-
Ca1	CC+	19	CC+

Ca2	CC	20	CC
Ca3	CC-	21	CC-
C1	C+	22	C+
C2	C	23	C
C3	C-	24	C-
D*	D	25	D

* Average ratings methodology applies to defaulted assets too, and default events are reported individually in corporate action.

11.2 Market Calendars and Settlement Conventions

11.2.1 USD Settlement Conventions

For the US and Canada, as of Sept 2, 2017, bond settlement shifted to T+2 business days. For all days prior to this date, corporate settlement conventions are denoted as T+3 business days to settle.

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, overall 90% of bonds in the Index Universe have a settlement between T+2 and T+3 business days based on our analysis. *

* Analysis conducted as of June 5, 2020.

11.2.2 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.
Martin Luther King Day	3rd Monday of January	N/A
Presidents day	3rd 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	N/A
Memorial Day	Last Monday of May	N/A
Independence Day	4th 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	11th of November	Take the next day as observed holiday if holiday falls on Sunday, no observed holiday if falls on Saturday.
Thanksgiving Day	4th Thursday of November	N/A
Christmas Day	25th 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
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.

11.2.3 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	3rd 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	N/A
Victoria Day	Penultimate Monday of May	N/A
Canada Day	1st 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
Thanksgiving Day	4th Thursday of November	N/A
Remembrance Day	11th of November	Take the next Monday day as observed holiday if holiday falls on Saturday or Sunday.
Christmas Day	25th of December	Take the next Monday as observed holiday if falls on Sunday or Saturday.
Boxing Day	26th 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.

11.2.4 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	N/A
Easter Monday	First Monday after Good Friday	N/A
Labour Day	1st of May	No observed holiday if falls on Saturday or Sunday.
Christmas Day	25th of December	No observed holiday if falls on Saturday or Sunday.
Christmas Holiday	26th of December	No observed holiday if falls on Saturday or Sunday.

11.2.5 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	N/A
Easter Monday	First Monday after Good Friday	N/A

Early May Bank Holiday*	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	25th of December	Take the next Monday as observed holiday if falls on Sunday or Saturday.
Boxing Day	26th 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.

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

11.3 Currency Specific Model Definitions & Reference Curves

11.3.1 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
GPB	T-Bills between 1M and 6M and off-the-run Gilts >1Y to Maturity

11.3.2 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.

Currency / Market	Constituent Baskets
USD	<p>Libor: Overnight, 1-Week, 2-Week, 1-Month, 2-Month, 3-Month</p> <p>Par-Swap: USD Semi-Annual Par Swap Rates on 3-Month Libor, snap at 15:00 local New York from 1 to 10Y, plus 12Y, 15Y, 20Y and 30Y.</p>
CAD	<p>CDOR: 3-Month</p> <p>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.</p>
EURO	<p>EURIBOR®: 6-Month, published at 11.00 Brussels;</p> <p>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.</p>
GPB	<p>Libor: 6-Month</p> <p>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.</p>

11.3.3 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
USD	2-Year Swap, 10-Year Swap	1M, 3M, 6M, 1Y, 2Y, 3Y, 4Y, 5Y, 7Y, 10Y, 15Y, 20Y, 25Y, and 30Y.

CAD	2-Year Swap, 10-Year Swap	1M, 3M, 6M, 1Y, 2Y, 3Y, 4Y, 5Y, 7Y, and 10Y.
EURO	2-Year Swap, 10-Year Swap	1M, 3M, 6M, 1Y, 2Y, 3Y, 4Y, 5Y, 7Y, 10Y, 15Y, 20Y, 25Y, and 30Y.
GPB	2-Year Swap, 10-Year Swap	1M, 3M, 6M, 1Y, 2Y, 3Y, 4Y, 5Y, 7Y, 10Y, 15Y, 20Y, 25Y, and 30Y.

11.4 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 9 Data Sources and Quality Assurance is also applied for history.

11.4.1 For USD Index Universe

11.4.1.1 Bond Pricing for Treasury and Corporate Bonds

Historical pricing information for the period ranging from Feb 17, 2005 to Sep 13, 2018 has been sourced from end-of-day (EOD) pricing sources reflecting 8PM Eastern Time (20.00 local New York) fixed income asset prices.

11.4.1.2 Par-Swap Pricing

Historical swap pricing for the period ranging from Jan 1, 2005 to Jun 27, 2018 has been sourced from end-of-day (EOD) swap pricing sources reflecting prices as-of 5PM Eastern Time (17.00 local New York).

11.4.1.3 ATM Swaption Implied Volatility

Swaption collection as of 3PM Eastern Time (15.00 local New York) is only available beginning Aug 1, 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 4PM Eastern Time (16.00 local New York).

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

11.4.2 For CAD Index Universe

11.4.2.1 Bond Pricing for Treasury and Corporate Bonds

Historical pricing information for the period ranging from Feb 17, 2005 to Sep 13, 2018 has been sourced from end-of-day (EOD) pricing sources reflecting 8PM Eastern Time (20.00 local New York) fixed income asset prices.

11.4.2.2 Par-Swap Pricing

Historical swap pricing for the period ranging from Jan 1, 2005 to Sep 10, 2019 has been sourced from end-of-day (EOD) swap pricing sources reflecting prices as-of 5PM Eastern Time (17.00 local New York).

11.4.2.3 ATM Swaption Implied Volatility

Swaption collection as of 3PM Eastern Time (15.00 local New York) is only available beginning Nov 26, 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 4PM Eastern Time (16.00 local New York).

11.4.3 For EURO Index Universe

11.4.3.1 Bond Pricing for Treasury and Corporate Bonds

Historical pricing information for the period ranging from Apr 8, 2005 to Oct 8, 2019 has been sourced from end-of-day (EOD) pricing sources reflecting 23.00 GMT fixed income asset prices.

11.4.3.2 Par-Swap Pricing

Historical swap pricing for the period ranging from Jan 1, 2005 to Dec 13, 2019 has been sourced from end-of-day (EOD) swap pricing sources reflecting prices as-of 21.15 GMT.

11.4.3.3 ATM Swaption Implied Volatility

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

11.4.4 For GBP Index Universe

11.4.4.1 Bond Pricing for Treasury and Corporate Bonds

Historical pricing information for the period ranging from Apr 8, 2005 to Oct 8, 2019 has been sourced from end-of-day (EOD) pricing sources reflecting 23.00 GMT fixed income asset prices.

11.4.4.2 Par-Swap Pricing

Historical swap pricing for the period ranging from Jan 1, 2005 to Dec 3, 2019 has been sourced from end-of-day (EOD) swap pricing sources reflecting prices as-of 21.15 GMT.

11.4.4.3 ATM Swaption Implied Volatility

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

11.5 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 principle 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 remarketing agent will handle 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.

11.5.1 Issuer Corporate Actions Examples

11.5.1.1 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_STAT US_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	

11.5.1.2 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_STAT US_CD	ISSUER_LONG_ NAME	AMT_OUTSD
US772739 AL23	11/2/2018	12/27/2018	ISS	WESTROCK RKT CO	399000000
US772739 AL23	12/28/2018	5/8/2019	ISS	WESTROCK RKT LLC	399000000
Index Universe					
ISIN	EFF_DATE	END_DATE	MARKET_STA TUS	ISSUER_NAME	OUTSTD
US772739 AL23	11/2/2018	12/27/2018	ISS	WESTROCK RKT CO	399000000
US772739 AL23	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	

11.5.1.3 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_OUTSD
US2168 71AE36	5/28/2019	5/28/2019	COOPER US INC	COOPER INDUSTRIES	238967000
US2168 71AE36	5/29/2019	12/31/3999	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	12/31/3999	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	

11.5.1.4 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_LONG_NAME	PARENT_ISSUER_LONG_NAME	AMT_OUTSD
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	OUTSTD
US067383AC36	12/29/2017	1/1/2018	C R BARD INC		67782000

US06738 3AC36	1/2/20 18	1/10/2 018	C R BARD INC	BECTON DICKINSON AND CO	677820 00
Issuer Amount Outstanding					
DATE	ISSUER			AMT_OUTSTD	
12/29/20 17	C R BARD INC			610658000	
1/1/2018	C R BARD INC			610658000	

11.5.1.5 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_ DATE	END_ DATE	ISSUER_LONG_NAME	PARENT_ISSUER_ LONG_NAME	AMT_ OUTS D
US0673 83AC36	6/1/2 018	6/3/2 018	WYNDHAM DESTINATIONS INC		40000 0000
US0673 83AC36	6/4/2 018	9/27/ 2018	WYNDHAM DESTINATIONS INC		40000 0000
Index Universe (parent entity)					
ISIN	EFF_ DATE	END_ DATE	ISSUER_NAME	P_ISSUER_NAME	OUTST D
USU983 23AA39	6/1/2 018	6/3/2 018	WYNDHAM DESTINATIONS INC		40000 0000
USU983 23AA39	6/4/2 018	9/27/ 2018	WYNDHAM DESTINATIONS INC		40000 0000
T&C Received from Vendor (subsidiary)					
ISIN	EFF_ DATE	END_ DATE	ISSUER_NAME	P_ISSUER_NAME	OUTST D
USU983 23AA39	6/1/2 018	6/18/ 2018	WYNDHAM HOTELS & RESORTS INC	WYNDHAM DESTINATIONS INC	50000 0000

USU983 23AA39	6/19/ 2018	8/7/2 018	WYNDHAM HOTELS & RESORTS INC		50000 0000
Index Universe (subsidiary)					
ISIN	EFF_ DATE	END_ DATE	ISSUER_NAME	P_ISSUER_NAME	OUTST D
USU983 23AA39	6/1/2 018	6/18/ 2018	WYNDHAM HOTELS & RESORTS INC	WYNDHAM DESTINATIONS INC	50000 0000
USU983 23AA39	6/19/ 2018	8/7/2 018	WYNDHAM HOTELS & RESORTS INC		50000 0000
Issuer Amount Outstanding					
DATE	ISSUER			AMT_OUTSTD	
6/18/20 18	WYNDHAM DESTINATIONS INC			2390067000	
6/19/20 18	WYNDHAM DESTINATIONS INC			2390067000	

11.5.2 Asset Level Corporate Event Examples

11.5.2.1 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 0 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

11.5.2.2 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_AMT
US60467PAH73	ISS	9/19/2001	850000000
US60467PAH73	DEF	7/14/2003	850000000
US60467PAH73	ISS	1/3/2006	850000000

11.5.2.3 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			
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_AMT
US281023AX91	ISS	11/20/2007	800000000

US281023AX91	DEF	12/17/2012	800000000
US281023AX91	LIQ	3/11/2014	0

11.5.2.4 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_AMT
US96647KAG76	ISS	9/23/1996	21000000
US96647KAG76	EXC	11/9/2018	21000000

11.5.2.5 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_C HG_CD	AMT_OUT_DT	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	OUTSTANDING_ AMT	EFFECTIVE_INSTRUMENT_ID
US611688AA01	ISS	7/15/2005	150000000	
US611688AA01	EXC	7/12/2018	22975000	US07274NBA00
US61166WAC55	ISS	7/15/2005	250000000	
US61166WAC55	EXC	7/12/2018	58805000	US07274NBA00

11.5.2.6 Asset Funged

Baby bond USA8372TAH17 was funged on Dec 19, 2018. The outstanding amount of 500,000,000 of the bond decreased to 0 was added to the outstanding amount of the mother bond USA8372TAC20:

T&C Received from Vendor				
ISIN	AMT_OUTSD_C HG_CD	STATUS_EFF_ DATE	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	EVENT_ TYPE	EVENT_EFF_ DATE	OUTSTANDING_ AMT	EFFECTIVE_INSTRUMENT_ID
USA8372TAH17	ISS	11/6/2018	500000000	
USA8372TAH17	FNG	12/19/2018	0	USA8372TAC20

11.6 Glossary

11.6.1 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 generally 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** – A convertible bond is a fixed-income debt security that pays interest payments but can be converted into a predetermined number of common stock or equity shares. The conversion from the bond to stock can be done at certain times during the bond’s life and is usually at the discretion of the bondholder.
- **Coupon** – The effective interest rate for the instrument.
- **Coupon Payment Frequency** – Represents the frequency of scheduled accrued interest payments per year.
- **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.
- **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 has to 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 doesn't 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 generally 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 usually 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.
- **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.
- **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.
- **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

11.6.2 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 with
- **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 takes into account 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 References

1. ICE Benchmark Administration ICE LIBOR Methodology *Methodology*
https://www.theice.com/publicdocs/ICE_LIBOR_Methodology.pdf
2. European Money Markets Institute EURIBOR Benchmark Statement *Benchmark Governance*
<https://www.emmi-benchmarks.eu/euribor-org/about-euribor.html>

3. Refinitiv Benchmark Services (UK) Limited Canadian Dollar Offered Rate (CDOR)
Methodology
https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/cdor-methodology.pdf

Contact us

clientservice@msci.com

AMERICAS

Americas	1 888 588 4567 *
Atlanta	+ 1 404 551 3212
Boston	+ 1 617 532 0920
Chicago	+ 1 312 675 0545
Monterrey	+ 52 81 1253 4020
New York	+ 1 212 804 3901
San Francisco	+ 1 415 836 8800
São Paulo	+ 55 11 3706 1360
Toronto	+ 1 416 628 1007

EUROPE, MIDDLE EAST & AFRICA

Cape Town	+ 27 21 673 0100
Frankfurt	+ 49 69 133 859 00
Geneva	+ 41 22 817 9777
London	+ 44 20 7618 2222
Milan	+ 39 02 5849 0415
Paris	0800 91 59 17 *

ASIA PACIFIC

China North	10800 852 1032 *
China South	10800 152 1032 *
Hong Kong	+ 852 2844 9333
Mumbai	+ 91 22 6784 9160
Seoul	00798 8521 3392 *
Singapore	800 852 3749 *
Sydney	+ 61 2 9033 9333
Taipei	008 0112 7513 *
Thailand	0018 0015 6207 7181 *
Tokyo	+ 81 3 5290 1555

* = toll free

ABOUT MSCI

MSCI is a leading provider of critical decision support tools and services for the global investment community. With over 45 years of expertise in research, data and technology, we power better investment decisions by enabling clients to understand and analyze key drivers of risk and return and confidently build more effective portfolios. We create industry-leading research-enhanced solutions that clients use to gain insight into and improve transparency across the investment process.

To learn more, please visit
www.msci.com.

Notice and disclaimer

This document and all of the information contained in it, including without limitation all text, data, graphs, charts (collectively, the "Information") is the property of MSCI Inc. or its subsidiaries (collectively, "MSCI"), or MSCI's licensors, direct or indirect suppliers or any third party involved in making or compiling any Information (collectively, with MSCI, the "Information Providers") and is provided for informational purposes only. The Information may not be modified, reverse-engineered, reproduced or disseminated in whole or in part without prior written permission from MSCI.

The Information may not be used to create derivative works or to verify or correct other data or information. For example (but without limitation), the Information may not be used to create indexes, databases, risk models, analytics, software, or in connection with the issuing, offering, sponsoring, managing or marketing of any securities, portfolios, financial products or other investment vehicles utilizing or based on, linked to, tracking or otherwise derived from the Information or any other MSCI data, information, products or services.

The user of the Information assumes the entire risk of any use it may make or permit to be made of the Information. NONE OF THE INFORMATION PROVIDERS MAKES ANY EXPRESS OR IMPLIED WARRANTIES OR REPRESENTATIONS WITH RESPECT TO THE INFORMATION (OR THE RESULTS TO BE OBTAINED BY THE USE THEREOF), AND TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, EACH INFORMATION PROVIDER EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES (INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF ORIGINALITY, ACCURACY, TIMELINESS, NON-INFRINGEMENT, COMPLETENESS, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE) WITH RESPECT TO ANY OF THE INFORMATION.

Without limiting any of the foregoing and to the maximum extent permitted by applicable law, in no event shall any Information Provider have any liability regarding any of the Information for any direct, indirect, special, punitive, consequential (including lost profits) or any other damages even if notified of the possibility of such damages. The foregoing shall not exclude or limit any liability that may not by applicable law be excluded or limited, including without limitation (as applicable), any liability for death or personal injury to the extent that such injury results from the negligence or willful default of itself, its servants, agents or sub-contractors.

Information containing any historical information, data or analysis should not be taken as an indication or guarantee of any future performance, analysis, forecast or prediction. Past performance does not guarantee future results.

The Information should not be relied on and is not a substitute for the skill, judgment and experience of the user, its management, employees, advisors and/or clients when making investment and other business decisions. All Information is impersonal and not tailored to the needs of any person, entity or group of persons.

None of the Information constitutes an offer to sell (or a solicitation of an offer to buy), any security, financial product or other investment vehicle or any trading strategy.

It is not possible to invest directly in an index. Exposure to an asset class or trading strategy or other category represented by an index is only available through third party investable instruments (if any) based on that index. MSCI does not issue, sponsor, endorse, market, offer, review or otherwise express any opinion regarding any fund, ETF, derivative or other security, investment, financial product or trading strategy that is based on, linked to or seeks to provide an investment return related to the performance of any MSCI index (collectively, "Index Linked Investments"). MSCI makes no assurance that any Index Linked Investments will accurately track index performance or provide positive investment returns. MSCI Inc. is not an investment adviser or fiduciary and MSCI makes no representation regarding the advisability of investing in any Index Linked Investments.

Index returns do not represent the results of actual trading of investable assets/securities. MSCI maintains and calculates indexes, but does not manage actual assets. Index returns do not reflect payment of any sales charges or fees an investor may pay to purchase the securities underlying the index or Index Linked Investments. The imposition of these fees and charges would cause the performance of an Index Linked Investment to be different than the MSCI index performance.

The Information may contain back tested data. Back-tested performance is not actual performance, but is hypothetical. There are frequently material differences between back tested performance results and actual results subsequently achieved by any investment strategy.

Constituents of MSCI equity indexes are listed companies, which are included in or excluded from the indexes according to the application of the relevant index methodologies. Accordingly, constituents in MSCI equity indexes may include MSCI Inc., clients of MSCI or suppliers to MSCI. Inclusion of a security within an MSCI index is not a recommendation by MSCI to buy, sell, or hold such security, nor is it considered to be investment advice.

Data and information produced by various affiliates of MSCI Inc., including MSCI ESG Research LLC and Barra LLC, may be used in calculating certain MSCI indexes. More information can be found in the relevant index methodologies on www.msci.com.

MSCI receives compensation in connection with licensing its indexes to third parties. MSCI Inc.'s revenue includes fees based on assets in Index Linked Investments. Information can be found in MSCI Inc.'s company filings on the Investor Relations section of www.msci.com.

MSCI ESG Research LLC is a Registered Investment Adviser under the Investment Advisers Act of 1940 and a subsidiary of MSCI Inc. Except with respect to any applicable products or services from MSCI ESG Research, neither MSCI nor any of its products or services recommends, endorses, approves or otherwise expresses any opinion regarding any issuer, securities, financial products or instruments or trading strategies and MSCI's products or services are not intended to constitute investment advice or a recommendation to make (or refrain from making) any kind of investment decision and may not be relied on as such. Issuers mentioned or included in any MSCI ESG Research materials may include MSCI Inc., clients of MSCI or suppliers to MSCI, and may also purchase research or other products or services from MSCI ESG Research. MSCI ESG Research materials, including materials utilized in any MSCI ESG Indexes or other products, have not been submitted to, nor received approval from, the United States Securities and Exchange Commission or any other regulatory body.

Any use of or access to products, services or information of MSCI requires a license from MSCI. MSCI, Barra, RiskMetrics, IPD and other MSCI brands and product names are the trademarks, service marks, or registered trademarks of MSCI or its subsidiaries in the United States and other jurisdictions. The Global Industry Classification Standard (GICS) was developed by and is the exclusive property of MSCI and Standard & Poor's. "Global Industry Classification Standard (GICS)" is a service mark of MSCI and Standard & Poor's.

MIFID2/MIFIR notice: MSCI ESG Research LLC does not distribute or act as an intermediary for financial instruments or structured deposits, nor does it deal on its own account, provide execution services for others or manage client accounts. No MSCI ESG Research product or service supports, promotes or is intended to support or promote any such activity. MSCI ESG Research is an independent provider of ESG data, reports and ratings based on published methodologies and available to clients on a subscription basis. We do not provide custom or one-off ratings or recommendations of securities or other financial instruments upon request.

Privacy notice: For information about how MSCI LLC collects and uses personal data concerning officers and directors, please refer to our Privacy Notice at <https://www.msci.com/privacy-pledge>.