Ground Rules

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FTSE Goldman Sachs ESG-Enhanced Global Investment-Grade Corporate Bond Index

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FTSE RUSSELL
An LSEG Business

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Contents

Section 1

Introduction

1. Introduction

1.1 FTSE Goldman Sachs ESG-Enhanced Global Investment-Grade Corporate Bond Index

1.2 The FTSE Goldman Sachs ESG-Enhanced Global Investment-Grade Corporate Bond Index (the index) is a global corporate, multi-currency benchmark, which provides a broad-based measure of the global corporate fixed income markets.

1.2.1 The index is created from the FTSE World Broad Investment-Grade Corporate Bond Index (WorldBIG Corporate) as the starting universe (the base index).

1.2.2 The index seeks to deliver stable performance for a given level of risk relative to the WorldBIG Corporate Index. This is achieved through a series of screens and weight allocation adjustments aimed at return optimisation and/or volatility minimisation. Securities are selected and the weights adjusted in accordance to liquidity, ESG and/or fundamental weighting adjustments and term structure optimisation. The corporate universe is then duration adjusted and reweighted to match the Base Index in the resulting index composition.

1.3 The FTSE Goldman Sachs ESG-Enhanced Global Investment-Grade Corporate Bond Index does take account of ESG factors in its design.

1.4 FTSE Russell

FTSE Russell is a trading name of FTSE International Limited, Frank Russell Company, FTSE Global Debt Capital Markets Limited (and its subsidiaries FTSE Global Debt Capital Markets Inc. and FTSE Fixed Income Europe Limited), FTSE Fixed Income LLC, FTSE (Beijing) Consulting Limited, Refinitiv Benchmark Services (UK) Limited, Refinitiv Limited and Beyond Ratings.

1.5 FTSE Russell hereby notifies users of the index that it is possible that factors, including external factors beyond the control of FTSE Russell, may necessitate changes to, or the cessation, of the index and therefore, any financial contracts or other financial instruments that reference the index or investment funds which use the index to measure their performance should be able to withstand, or otherwise address the possibility of changes to, or cessation of, the index.

1.5.1 Index users who choose to follow this index or to buy products that claim to follow this index should assess the merits of the index's rules-based methodology and take independent investment advice before investing their own or client funds. No liability whether as a result of negligence or otherwise is accepted by FTSE Russell or any members of the FTSE Russell Policy Advisory Board (or any person concerned with the preparation or publication of these Ground Rules) for any losses, damages, claims and expenses suffered by any person as a result of:

– any reliance on these Ground Rules;
– any inaccuracies in these Ground Rules;
– any non-application or misapplication of the policies or procedures described in these Ground Rules; and/or
– any inaccuracies in the compilation of the Index or any constituent data.

Section 2

Management responsibilities

2. Management responsibilities

2.1 FTSE International Limited (FTSE)

2.1.1 FTSE is the benchmark administrator of the index series[1].

2.1.2 FTSE is responsible for the daily calculation, production and operation of the index series, and will:

- maintain records of all the constituents;
- be responsible for the addition and deletion of bonds and changes of nominal amounts, in accordance with the Ground Rules; and
- disseminate the indices.

2.2 Amendments to these Ground Rules

2.2.1 These Ground Rules shall be subject to regular review (at least once a year) by FTSE Russell to ensure that they best reflect the aim of the index series. Any proposals for significant amendments to these Ground Rules will be subject to consultation with FTSE Russell advisory committees and other stakeholders if appropriate. The feedback from these consultations will be considered by the FTSE Russell Index Governance Board before approval is granted.

2.2.2 As provided for in the Statement of Principles for FTSE Russell Fixed Income Indices, where FTSE Russell determines that the Ground Rules are silent or do not specifically and unambiguously apply to the subject matter of any decision, any decision shall be based as far as practical on the Statement of Principles. After making any such determination, FTSE Russell shall advise the market of its decision at the earliest opportunity. Any such treatment will not be considered as an exception or change to the Ground Rules, or to set a precedent for future action, but FTSE Russell will consider whether the Ground Rules should subsequently be updated to provide greater clarity.

[1] The term administrator is used in this document in the same sense as it is defined in Regulation (EU) 2016/1011 of the European Parliament and of the Council of 8 June 2016 on indices used as benchmarks in financial instruments and financial contracts or to measure the performance of investment funds (the European Benchmark Regulation) and The Benchmarks (Amendment and Transitional Provision) (EU Exit) Regulations 2019 (the UK Benchmark Regulation).

Section 3

FTSE Russell index policies

3. FTSE Russell index policies

These Ground Rules should be read in conjunction with the following policy documents which can be accessed using the links below or by contacting fi.index@lseg.com. These policies are reviewed annually and any changes are approved by the FTSE Russell Index Governance Board.

3.1 Statement of Principles for FTSE Fixed Income Indices (the Statement of Principles)

Indices need to keep abreast of changing markets and the Ground Rules cannot anticipate every eventuality. Where the Ground Rules do not fully cover a specific event or development, FTSE Russell will determine the appropriate treatment by reference to the Statement of Principles for FTSE Fixed Income Indices which summarises the ethos underlying FTSE Russell's approach to index construction. The Statement of Principles is reviewed annually and any changes proposed by FTSE Russell are presented to the FTSE Russell Policy Advisory Board for discussion before approval by the FTSE Russell Index Governance Board.

The Statement of Principles for Fixed Income Indices can be accessed using the following link:

Statement_of_Principles_Fixed_Income_Indices.pdf

3.2 Queries and Complaints

FTSE Russell's complaints procedure can be accessed using the following link:

Benchmark_Determination_Complaints_Handling_Policy.pdf

3.3 Recalculation Policy and Guidelines

The Recalculation Policy and Guidelines for Fixed Income Indices document is available from the FTSE Russell website using the link below or by contacting fi.index@lseg.com.

Fixed_Income_Recalculation_Policy_and_Guidelines.pdf

3.4 Index Policy in the Event Clients are Unable to Trade a Market or a Security

3.4.1 Details of FTSE Russell's treatment can be accessed using the following link:

Index_Policy_in_the_Event_Clients_are_Unable_to_Trade_a_Market_or_a_Security.pdf

3.5 Policy for Benchmark Methodology Changes

Details of FTSE Russell's policy for making benchmark methodology changes can be accessed using the following link:

Policy_for_Benchmark_Methodology_Changes.pdf

3.6 FTSE Russell Governance Framework

To oversee its indices, FTSE Russell employs a governance framework that encompasses product, service and technology governance. The framework incorporates the London Stock Exchange Group's three lines of defence risk management framework and is designed to meet the requirements of the IOSCO Principles for Financial Benchmarks[2], the European benchmark regulation[3] and the UK benchmark regulation[4]. The FTSE Russell Governance Framework can be accessed using the following link:

FTSE_Russell_Governance_Framework.pdf

[2] IOSCO Principles for Financial Benchmarks Final Report, FR07/13 July 2013.

[3] Regulation (EU) 2016/1011 of the European Parliament and of the Council of 8 June 2016 on indices used as benchmarks in financial instruments and financial contracts or to measure the performance of investment funds.

[4] The Benchmarks (Amendment and Transitional Provision) (EU Exit) Regulations 2019.

Section 4

Composition and design criteria

4. Composition and design criteria

4.1 The Global Investment Grade Corporates sector selects securities from the starting universe of the WorldBIG Corporate Index (base index) to provide a broad representation of the global investment grade corporate bond market after applying ESG exclusions. This universe then applies a fundamental screening based on fundamental financial data and then utilising an optimisation process to select securities relative to the Base Corporates Index and to determine weights such that projected return is maximised across the term structure based on currency and country weighted average life sectors. The sector is comprised of four currencies (USD, EUR, GBP, JPY). Japanese Yen denominated bonds form a small segment of the corporate universe and are omitted from the ESG screening, fundamental screening and optimisation and remain market value weighted. Screening of Japanese Yen corporate bonds to these screens will be subject to review should the JPY corporate exposure exceed 1% of the WorldBIG corporate universe.

4.2 Liquid ESG screen

4.2.1 Issuers are screened based on amount outstanding and minimum bond issuance to represent the more liquid portion of the market, from which a subsequent ESG screening is applied.

Issuers are excluded if they are:

- non-compliant with the United Nations Global Compact (UNGC) Principles; and
- exceed the revenue thresholds in the following product involvement (PI) areas: weapons, civilian firearms, tobacco, thermal coal and oil sands. The exclusions criteria are outlined in Appendix A, missing PI data.

4.2.2 Corporate issuers are screened for compliance with UNGC Principles and issuers that are non-compliant are removed. Issuers in compliance or where there is no UNGC coverage remain included in the index.

4.2.3 The UNGC assessments and PI data are provided by Sustainalytics[5].

4.3 Fundamental screen

4.3.1 The liquid ESG universe is ranked based on year-on-year change in fundamental indicators within the respective country of risk and which would represent 90% of the eligible corporate issuers after the fundamental screen. For issuers domiciled in countries of risk that constitute at least 3% of the market capitalisation, bonds from the lowest ranked 10% of issuers are excluded[6]. The remaining bond subset, along with bonds of issuers that satisfy the size screening criteria but have neither fundamental indicator available nor are domiciled in countries of risk that constitute less than 3% of the market capitalisation are included in the final bond subset. Furthermore, a final issuer capping is performed to help manage the concentration risk.

[5] UNGC and PI Involvement assessment is conducted against Sustainanlytics Research Universe. Issuers not in scope for SA research are included in the benchmark.

[6] For issuers subject to screening domiciled in countries of risk that are at least 3% of market capitalisation, those issuers remain screened until the next rebalancing quarter (e.g. end of February, May, August and November) when new fundamental rankings will be calculated.
For screened issuers, in the event that the size of the country of risk they are domiciled decreases below 3% between rebalancing quarters, the issuers remains screened until the next rebalancing quarter.

4.4 Optimisation

4.4.1 The optimisation aims to maximise one-month projected return by ensuring the return volatility of the sector remains below a preset level, the term structure is constrained within a band relative to the Base Corporates Index and the duration matches the Base Corporates Index.

Figure three: design criteria and calculation assumptions for the Global IG corporates sector

Coupon	Fixed rate
Currency	EUR, GBP, JPY, USD
Minimum maturity	At least one year
Minimum issue size and bond count	USD 500 million EUR 500 million GBP 300 million JPY 50 billion Minimum two bonds per issuer
Minimum credit quality	BBB- by S&P or Baa3 by Moody's
Composition	US and non-US corporate securities issued in registered form and bonds issued under Rule 144A with registration rights (excludes convertibles).
Weighting	Market capitalisation subject to capping and duration adjustments as described in reconstitution.
Rebalancing	Once a month on the last business day of the month (pricing as of the last business day of the monthly and settlement as of the last calendar day of the month.) (Additional screening details to follow.)
Reinvestment of cash flows	Intra-month cash flows from interest and principal payments are not reinvested as part of monthly index total return calculations[7].
Calculation frequency	Daily
Settlement date	Monthly: settlement is on the last calendar day of the month. Daily: same-day settlement except if the last business day of the month is not the last calendar day of the month; then, settlement is on the last calendar day of the month.
Term buckets	For duration match, two term sectors around the weighted average life.
Capping	Issuer weights are capped at currency level at: 5% for issuers where fundamental indicators are applied; or 3% for issuers where fundamental indicators are not observable.
ESG screen	Issuers are screened based on: – non-compliance with UNGC Principles; and – exceeding revenue thresholds in the following PI activities: weapons, firearms, tobacco, thermal coal and oil sands (see appendix A).
Reconstitution	Applies to corporates denominated in USD, EUR, GBP. Corporates denominated in all other currencies will retain the market weight of the base index. If and when new currencies are added to WorldBIG corporate universe, the re-weighting methodology may expand to new currencies when the currency exposure exceeds 1% of the WorldBIG corporate universe. Liquid universe and ESG screen 1. Apply minimum issue/issuer screen per currency group of the base corporate index. 2. Removal of non-compliant issuers from PI screening and UNGC screening. Issuers are screened on a quarterly basis (February, May, August, November). On the non-quarterly rebalance months, a monthly reconstitution will occur whereby newly issued bonds will be mapped to existing issuers and based on the issuer inclusion/exclusion will permit new bonds entering. New Issuers will be excluded until such time data permits and included on quarterly review.

[7] Prior to 1 November 2022, reinvestment income was included in the total return calculation.

	Each month, after filtering for minimum issue, issuer size and PI/UNGC screening, securities are ranked, capped and weighted through an iterative process to make sure all criteria are met and apply a fundamental screen. 1. Issuer capping – issuer weights are capped at 5% for issuers with fundamental indicators and 3% for issuers where fundamental indicators are not observable[8]. The capping is applied within the currency groups of issuers subject to screening and optimisation detailed below. 2. Duration adjustment – bonds are divided into currency groups and maturity buckets based on the weighted average life. The weight of each currency bucket and maturity bucket is adjusted to match the weighted average effective duration of the relevant currency maturity bucket in the WorldBIG Corporate Index. Within each maturity bucket, constituents are assigned weights in proportion to their market capitalisation. 3. Repeat steps three and four until duration and cap criteria is met. 4. Fundamental screening[9] and ranking – the bond universe is initially screened for issuers with a country of risk greater than 3%, which is measured by currency group (USD, EUR, GBP). These issuers are then subject to further screening by two fundamental indicators reported by the issuers: by looking at improvements on a year-on-year absolute change in (1) operating margin and (2) leverage. Operating margin is measured by earnings before interest and taxes margin (EBIT margin), while leverage is measured by debt to enterprise value (debt to EV). The issuers are ranked within their respective country of risk – positively by operating margin and negatively by leverage, accounting for market capitalisation. The percentile rankings of individual indicators are combined to calculate each issuer's composite rank. When only a single indicator is available, that single indicator will be used to calculate the issuer's composite rank. The issuers within the lowest 10% composite rank are excluded and the index is formed with the remaining eligible bonds captured post initial ESG and liquidity screening. 5. The remaining bond subset, including those that did not meet the 3% minimum country criteria for fundamental screening, along with bonds of issuers that satisfy the size screening criteria but have neither fundamental indicator available, are included in the final bond subset, in accordance with their market capitalisation. 6. Finally, the currency components are kept in line with the currency exposure in the WorldBIG Corporate Index. 7. For the non-quarter-end months, bonds that no longer meet the liquidity, rating or maturity requirements are removed from the profile. Newly issued bonds from the qualified issuers of the most recent quarterly rebalancing will be included. The monthly profiles will reflect the latest par amount and market value of all included bonds. Final index 1. Carry and roll down optimisation (detailed in next section). Screening utilises pricing and amounts outstanding of the base index in order to reconstruct index holdings and weights.
Reconstitution/ optimisation*	Each month, eligible bonds are divided into currency, country and maturity sectors based on their weighted average life (WAL) in years as of the month-end date (maturity sectors) as follows: one to three, three to five, five to seven, seven to 10, 20 and 20+, except for GBP, where the 10 to 20 and 20+ maturity sectors are combined. JPY denominated bonds are excluded from the optimisation and are included at market value. The bond weights are optimised with a goal to maximise projected one-month return. Projected returns for each security are computed by setting the settlement date forward by one month and assuming constant yield curve and OAS. The optimisation selection constraints include: 1. Each currency maturity sector's (e.g. GBP one to three years) market value can vary from 50% to 200% relative to the corresponding maturity sector of the base index. 2. Allocations to the bonds within a maturity bucket is weighted in proportion to the security's market capitalisation). 3. Index return variance (weekly over the prior year) is not to exceed 125% of that of the base index in USD. 4. The modified duration and total market value of the Index is set to the base index. 5. Each currency is market value and duration matched to the base index.

[8] If an issuer has at least one bond with available fundamental data, all bonds of that issuer are subject to the 5% cap. The cap is first assessed by currency group (e.g. USD, EUR and GBP bonds) for the fundamental screen, then once again in aggregate for the carry and roll down optimisation.

[9] Fundamental screen data determined in February, May, August and November of each year, while also being applied for monthly rebalancing.

	In the case where the optimisation produces lack of feasible results, constraints will be loosened to achieve a solution. First the volatility cap will be repeatedly increased by multiplying by 1.02. If that optimisation fails to find a feasible result, the sector caps are repeatedly increased by 0.05% until a viable solution is found. Optimisation utilises pricing and amounts outstanding of the base index in order to reconstruct index holdings and weights.
Pricing	Americas: Refinitiv mid 16:00 New York EMEA: Refinitiv mid 16:15 London APAC: Refinitiv mid 18:00 Tokyo

For more information on the FTSE WorldBIG Index, please see the FTSE Fixed Income Index Guide.

Section 5

ESG data inputs

5. ESG data inputs

5.1 The following ESG datasets are used in the construction of the indices.

ESG data inputs	Details	Used for selection, weighting or exclusion[10]
Product related data- Sustainalytics	Sustainalytics Product Involvement data identifies the nature and extent of a company’s involvement in a range of product and business activities. More information can be found here: https://www.sustainalytics.com/investor-solutions/esg-research/esg-screening/esg-criteria	Exclusion
Conduct related data - Sustainalytics	Sustainalytics Global Standards Screening (GSS) assess companies' impact on stakeholders and the extent to which a company causes, contributes or is linked to violations of international norms and standards. More information can be found: https://www.sustainalytics.com/investor-solutions/esg-research/esg-screening/global-compact-norms-based-screening	Exclusion

5.1.1 Further information on ESG data provided by FTSE Russell and third parties used in this index (index series) can be found in the following guide:

Guide_to_FTSE_and_Third_Party_Sustainable_Investment_Data_used_in_FTSE_Russell_Indices

5.1.2 This includes information on the data and standards used for these ESG data inputs. These data sets may include estimated data.

[10] Definitions
Selection- ESG data is used to select or rank constituents, or calculate minimum scores or thresholds
Weighting- ESG data is used to calculate the weight of a constituent in an index
Exclusion- ESG data is used to exclude securities from the index

Appendix A
Global corporates exclusions

On a quarterly basis (February, May, August, November), FTSE Russell will exclude companies from the underlying eligible corporate universe of the FTSE WorldBIG Index. This data is provided by third-party data vendor, Sustainalytics.

Exclusions	Threshold
Weapons	
Anti-personnel mines, nuclear weapons, cluster weapons, biological and chemical weapons, depleted uranium, and white phosphorus munitions	Greater than 0% revenues
Companies providing core weapon systems or components/services of the core weapon system that are considered tailor-made and essential for these weapons.	
Firearms	
Civilian assault and non-assault production	Greater than 0% revenues
Civilian assault and non-assault retail	Greater than or equal to 5% of revenues
Tobacco	
Tobacco production	Greater than 0% revenues
Tobacco retail	Greater than or equal to 5% of revenues
Coal	
Thermal coal extraction	Greater than 0% revenues
Companies generating electricity from thermal coal	Greater than or equal to 25% of revenues
Oil sands	
Oil sands extraction	Greater than or equal to 5% of revenues
UN Global Compact (UNGC) violation	
Companies responsible for egregious and severe violations of commonly accepted international norms related to human rights, labour rights, the environment and business ethics	All companies deemed to be non-compliant

Additional index references – classifications

FTSE Euro Broad Investment-Grade Bond Index – industry sector classification

The industry classification of the EuroBIG reflects the current structure of the market and is in line with the structure of the FTSE World Broad Investment-Grade Bond Index (WorldBIG).

Corporate – utility	Corporate – industrial	Corporate – financial
Electric	Consumer	Banks
Gas	Energy	Independent finance
Telecommunication	Manufacturing	Insurance
Other utility	Service	Other finance
	Transportation	
	Other industrial	

FTSE US Broad Investment-Grade Bond Index – industry sector classification

Industrial manufacturing	Aerospace/defense, auto manufacturers, building products, chemicals, conglomerate/diversified manufacturing, electronics, information/data technology, machinery, metals/mining, paper/forest products, textiles/apparel/shoes, vehicle parts and manufacturing – other
Industrial energy	Gas – pipelines, oil and gas, and oilfield machinery and services
Industrial service	Cable/media, gaming/lodging/leisure, healthcare supply, pharmaceuticals, publishing, restaurants, retail – food/drugs, retail stores – other and service – other
Industrial transportation	Airlines, railroads and transportation – other
Industrial consumer	Beverage/bottling, consumer products, food processors and tobacco
Industrial other	Industrial – other
Utility	Electric, power, telecommunications, gas – local distribution and utility – other
Finance	Banking, independent finance, life insurance, mortgage banking, property and casualty, REITs, securities and finance – other

Additional index references – index pricing, conventions and analytics

Reliable pricing of each security is necessary to ensure reliable index values and returns. A combination of third-party pricing providers that vary based on asset class are used to price the indices. A robust vendor selection process is applied to pricing inputs to ensure that the quality of valuations within the indices remains high. This selection process includes both a qualitative review of the pricing methodology and operational capabilities of the provider, and a quantitative review of coverage metrics, historical pricing data and statistical analysis.

The remainder of this section provides further details on specific sources and conventions used within the FTSE fixed income indices.

Index price sources and snap times

Figure 4 shows the local market pricing source and snap time used for the pricing of the fixed income indices. Prices are bid-side with the exception of Mexican government bonds for which mid-prices are used in order to conform to market conventions.

Verification and price challenges

Statistical techniques are used to identify pricing anomalies based on day-over-day changes and comparisons across peer groups by maturity, asset type, etc. Any price challenges from index users and possible outliers from the verification process are reviewed with our third-party pricing providers. In the event that an issue is not able to be resolved in a timely manner, FTSE Russell may exercise expert judgement and roll prices from the previous day. Any exercise of expert judgement is recorded.

Index holiday calendars

The indices are calculated Monday through Friday except Christmas Day (observed) and New Year's Day (observed). When a market observes a holiday, the closing prices from the previous available day are used as the closing prices for index calculations on such holiday for that market.

Each local market will observe its own holiday calendar: if a local market is on holiday, the closing prices used for that day will be the closing prices from the previous day. For example, USD-denominated indices such as the US Broad Investment-Grade Bond Index, Eurodollar Bond Index, Sukuk Index and Emerging Markets US Dollar Government Bond Index follow the holiday calendar applicable to New York. On any day where the US observes a holiday, the closing prices used for these indices are the prices from the previous available day.

Eurozone countries are considered as a single bloc and they use the European Central Bank's Trans-European Automated Real Time Gross Settlement Express Transfer (TARGET2) calendar in place of the local market calendars to determine holidays. As such, the closing prices used for all Eurozone countries on any holiday under the TARGET2 closing days calendar are the previously available closing prices of the respective countries.

Settlement

For daily calculations, it is assumed that indices settle on a same-day basis except if the last business day of the month is not the last calendar day of the month; then settlement is on the last calendar day of the month. The last business day of the month is based on the local market holiday calendar. Monthly holding periods, therefore, are exactly one calendar month. For example, the January return period would run from the close on 31 December to the close on 31 January, regardless of the last business day.

Index quality

An index quality is assigned to each index bond as of profile fixing. The quality is first mapped to the Standard & Poor's Financial Services LLC (S&P) rating. If a bond is not rated by S&P but it is rated by Moody's Investors Service, Inc (Moody's), the S&P equivalent of the Moody's rating is assigned to the index quality. If a bond is rated by neither S&P nor Moody's, the bond is not assigned an index quality. If a bond is rated as investment grade by one rating agency and high yield by the other, the S&P equivalent of the investment-grade rating is assigned to the index quality. These ratings remain unchanged for the entire performance month.

Defaults

When an issuer defaults, is assigned a D rating by S&P regardless of whether that issuer has filed for bankruptcy protection or enters into Chapter 7 or Chapter 11 bankruptcy protection in the US (or equivalent in its local market), its bonds remain in the index until the end of the month. However, the bonds will not be included in the calculation of the current month's average profile statistics of the index. The returns are calculated without coupon payment or accrued interest, where applicable.

FTSE Fixed Income index analytics

Index users rely on single security analytics to assess the risk profile of their investments, provide insights into the behaviour of the fixed income markets and drive their investment decisions. FTSE fixed income indices rely on analytics provided by The Yield Book Inc., which is a leading analytics platform with 30 years of experience in providing single security, risk and performance data for fixed income. While some calculations are relatively straightforward in nature, others rely on sophisticated models, which are rigorously tested by market participants who provide feedback into their evolution and development. A description of the major types of analytics calculated for FTSE fixed income indices can be found below. For more details on their calculations, please see the Glossary of Terms in appendix 4.

Duration generally represents the sensitivity in price of a security to changes in the interest rate environment. FTSE Russell publishes a number of duration measures, including effective duration, modified duration and Macaulay duration. The most widely used measure, effective duration, is a measure of sensitivity to yield for bonds with optionality, such as callable bonds and agency mortgages with prepayment optionality.

Spread metrics provide investors with a relative measure for the riskiness of a fixed income instrument and are often quoted to a comparable risk-free asset, such as a Treasury bond or curve. The most commonly used spread metric, option adjusted spread (OAS), accounts for embedded optionality in a bond and the variability of future cash flows. FTSE Russell also published gross spread, which compares the yield of a bond to the interpolated yield of two Treasury bonds at the same weighted average life point.

Yield represents the expected return of a security given a certain set of assumptions. Yield to maturity is computed as the single yield, which equates the sum of the discounted expected cash flows to the current price of the bond. Since it is not guaranteed that an investor will be able to hold a bond to its maturity date, yield to worst is calculated to quantify the lowest yield that could be realised by an investor given its optionality.

Model-driven analytics, such as those calculated for the FTSE Mortgage Index, utilise prepayment models maintained by The Yield Book. In addition to the incorporation of these models into standard risk measures, such as duration, spread and yield, these models also produce asset-class specific measures, such as projected prepayment rates for agency MBS.

For further information about The Yield Book, please visit https://www.lseg.com/en/ftse-russell.

Additional index references – index return calculations

Return computation

For treasury, government-sponsored, corporate and ABS securities, total returns are computed on the assumption that each security is purchased at the beginning of the period and sold at the end of the period. An issue's total rate of return is the percentage change in its total value over the measurement period. The components of total return are price change, principal payments, coupon payments and accrued interest. The total returns are market capitalisation weighted using the security's beginning-of-period market value (see figure four).

Figure seven: total rate of return calculation methodology

Beginning-of-period value

(Beginning Price + Beginning Accrued) x Beginning Par Amount Outstanding

End-of-period value

[(Ending Price + Ending Accrued) x (Beginning Par Amount Outstanding - Principal Payments)] + Coupon Payments + Principal Payments

Total rate of return (%)

$$\left[\left(\frac{\text{End-of-Period Value}}{\text{Beginning-of-Period Value}}\right)-1\right]\times 100$$

A note on precision: returns are computed to at least six decimal places but reported to a maximum of five. In addition, owing to rounding inaccuracies inherent in computer floating-point arithmetic, the last digit in any reported value may sometimes be off by one from its true value.

Additional index references – index currency returns and hedging methodology

Currency-hedged returns calculation

In addition to returns expressed in local currency terms, the fixed income indices returns are also computed in base currency terms, with and without the effects of currency hedging. The monthly currency-hedged returns are based on the assumption of a rolling strategy of buying the foreign currency at the beginning of each month and selling the foreign currency one-month forward. The source for spot and forward rates is the published WM/Refinitiv closing rates.

The convention used in the foreign exchange market for computing and quoting one-month forward rates results, from time to time, in a forward period that is longer (never shorter) than the actual number of calendar days in the month in question. This is inconsistent with the common index convention of using last-calendar-day settlement for the calculation of accrued and re-investment income in computing monthly returns.

Furthermore, the use of one-month forwards poses philosophical questions relating to the interpretation of intra-month currency-hedged returns.

To address and simplify both of these issues, FTSE Russell calculates monthly and intra-month currency-hedged returns.

Spot settlement convention

Spot rates quoted on the screen are for settlement on a day that is calculated using the following steps:

1. The date on which the quotes are displayed is taken to be the trade date.

2. Spot settlement date is two days after the trade date in the local (non-USD) currency. It must be a valid trading and settlement date for both currencies; furthermore, the intervening days must be valid trading and settlement dates for the local currency[11].

One-month forward settlement convention

One-month forward rates quoted on the screen are for settlement on a day that is calculated using the following steps:

1. The date on which the quotes are displayed is taken to be the trade date.
2. Spot settlement date is calculated as above.
3. Move forward from the spot settlement date to the same date in the following calendar month.
4. If this is a valid settlement date in BOTH currencies, then it is the forward settlement date.

[11] Prior to 1 February 2011, the spot settlement date must be a valid trade and settlement date for both currencies but the intervening days only needs to be a valid trade date for the local currency. It does not have to be a valid settlement date.

5. If it is not, then the forward settlement date is the first date after that which is valid for both currencies.

Thus, from step five, it is clear that, from time to time, the number of calendar days between the spot settlement date and the forward settlement date will exceed (but never be less than) the number of calendar days in the month.

Take the USD/CAD one-month forward contract for the month of August 2010 as an example. For the month-end currency forward rates quoted on 31 July 2010, the spot settlement date is 4 August 2010. Because 4 and 5 September 2010 is the weekend and 6 September is a Canadian holiday, the settlement date for the one-month forward contract is bumped to 7 September 2010. Thus, the number of calendar days between the spot settlement date and the forward settlement date is 34 days, in contrast to the 31 calendar days in August 2010.

Impact on monthly returns

The effect of this bumping of settlement dates is material because the difference between the quoted spot and forward rates (the drop) is calculated by applying the one-month interest rates in each currency, over the actual number of days between the two settlement dates and not over the number of calendar days in the month. The implicit assumption in the monthly currency-hedged returns is that the foreign currency is purchased spot at the beginning of the month and sold forward to the end of the month and, furthermore, that the following month's spot purchase coincides with the previous month's forward sale. Due to the incorporation of settlement day bumping into the calculation of the quoted forward rates, the forward drops will occasionally exaggerate the correct calendar-based premium or discount of a true calendar month hedge. The extent of this impact will depend on the number of instances when bumping occurs in any given year and the magnitude of the difference between the two currencies' short-term interest rates. In any one month, however, the difference rarely exceeds one to two basis points.

Adjusting the forward rates

In order to correct for the bumping of settlement dates effect, the published forward drops will be adjusted for the US Dollar-based forward rates to reflect a drop that corresponds to the number of actual calendar days in the month. This will be achieved by determining the number of convention days used to calculate the published drops and then scaling the drops by the ratio of the number of days in the month to the number of convention days. This scaled drop will then be applied to the quoted spot rate to produce the adjusted one-month forward rate. The adjusted forward rates will also be used to derive adjusted forward cross rates. The following table illustrates this process.

Adjustment of USD/CAD one-month forward rate for August 2010	
Spot: 1.02995	Spot settlement date: 4 August 2010
Forward: 1.03032	Forward settlement date: 7 September 2010
Forward drop (%): -0.0359	Drop days: 34
Days in the calendar month for August: 31	
Adjust forward drop = -0.00037*31/34=-0.00037	
Adjusted forward rate = 1.02995+0.00037 = 1.030287	
Adjusted forward drop (%): -0.03275	

The spot and forward settlement dates and the adjustment factor are published monthly. They are available by subscription on the website: www.lseg.com/en/ftse-russell/

Month-to-date and daily currency hedged returns

Intra-month index levels and returns are helpful for return attribution calculations when money enters or leaves the benchmarked portfolio but they pose the following philosophical dilemma:

a. Should the month-to-date return on the 10th, for example, be calculated as if one had hedged only 10 days forward – as if planning to liquidate the fund on the 10th?

b. Should the return from the 10th of the month to the end of the month reflect the effect of a forward hedge entered into on the 10th out to the end of the month – as if setting up the fund on the 10th?

c. Should the daily currency-hedged return on the 10th of the month reflect only an overnight forward contract entered into on the 9th?

It is evident that a single time series of intra-month index levels cannot incorporate more than one of these.

The month-to-date returns and index levels are calculated to reflect approach (a) (e.g. for the 10th of the month, as if a 10-day forward had been entered into at the beginning of the month). Rather than derive the 10-day forward rate from the forward rate term structure at the end of the previous month, the one-month drop (adjusted when necessary to a calendar month, as described earlier) will simply be scaled to a 10-day drop and the 10-day forward rate will be computed using this. Thus, the intra-month forward rates will linearly converge to the rate used for the full month. This will have a minimal impact on the month-to-date returns and these will still converge to the monthly returns.

The daily currency-hedged returns are calculated simply as the ratio of successive daily month-to-date returns, as described in the previous paragraph. This, by construction, ensures consistency between successive month-to-date returns and the daily returns and that daily returns compound to the monthly return.

How much is hedged?

Clearly, one cannot know at the beginning of the period what the market value of a security holding will be at the end of the period. Instead, an assumption must be made: sell this amount forward and convert any end-of-period excess or shortfall at the end of period spot rate.

Below is a summary of the methodology determining the amount of foreign currency sold forward for each security:

1. Reduce the par amount of the bond by any sinking fund payments, calls, prepays, etc.
2. Allow for these cash receipts plus any re-investment income on these amounts to the end-of-period date.
3. Add any coupons that will be paid during the period, together with re-investment income.
4. Re-price the remaining par amount, using the beginning-of-month yield and the end-of-period date as the new settlement date, including accrued interest on this date.
5. The sum of these amounts (two, three and four) will be the amount of foreign currency sold forward.
6. This amount, converted back to base currency at the appropriate forward rate to give the assumed hedged value, will be the predominant component of the end-of-period value in currency-hedged base-currency terms.

If the actual end-of-period price is higher than this assumed price, the excess in foreign currency is converted back to the base currency at the end-of-period spot rate and added to the assumed hedged value. If the price is lower, the shortfall is converted back to base currency at the end-of period spot rate and subtracted from the assumed hedged value. This gives the actual end-of-period hedged value.

The beginning-of-month value is the full market value of the security converted to the base currency at the beginning-of-month spot rate. The currency-hedged month-to-date return is the ratio of the end-of-period hedged value and beginning-of-month value, minus one.

It is worth pointing out that the approach described in step four does mean that the size of the hedge used in calculating the month-to-date currency-hedged return for, say, the 10th of the month is different from the size of hedge used in calculating the month-to-date currency-hedged return for the 20th of the month, and different again from that used for the full month. As noted earlier, the forward rate used for each of these dates is also different. Both of these effects are consistent with the idea that the month-to-date returns should reflect an intention to hedge only out to the date in question.

Additional index references – index data and data correction policy

Ticker for the FTSE Goldman Sachs ESG-Enhanced Global Investment-Grade Corporate Bond Index

Ticker	Index
CFIIEGCU	FTSE Goldman Sachs ESG-Enhanced Global Investment-Grade Corporate Bond Index, in USD terms

Chronological summary of events

FTSE Goldman Sachs ESG Enhanced Global IG Corporate Bond Index

Year	Monthly highlights
2022	**November:** intra-month cash flows from interest and principal payments are not reinvested as part of monthly index total return calculations.
2021	**June:** change in timing of pricing used in index.

Appendix C

Further information

A Glossary of Terms used in FTSE Russell's ground rule documents can be found using the following link:

Fixed_Income_Glossary_of_Terms.pdf

For contact details, please visit the FTSE Russell website or contact FTSE Russell client services at fi.index@lseg.com.

Website: www.lseg.com/en/ftse-russell/

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