

Ground Rules



FTSE Climate Risk-Adjusted World Government Bond Index ("Climate WGBI")

July 2019

FTSE Climate Risk-Adjusted World Government Bond Index

The FTSE Climate Risk-Adjusted World Government Bond Index measures the performance of fixed rate, local currency, investment grade sovereign bonds incorporating a tilting methodology that adjusts index weights according to each countries' climate risk profile.

The FTSE Climate Risk-Adjusted World Government Bond Index is an alternatively weighted version of the standard FTSE World Government Bond Index (WGBI), a widely used market value weighted benchmark that currently comprises sovereign debt from over 20 countries, denominated in a variety of currencies, and has more than 30 years of available history. Unlike the standard WGBI where country weights are based on the market capitalization of outstanding index eligible debt, index weights also account for each countries' exposure to climate change risks capturing the impact climate change could have both on the ability of a country to repay its debt and on the need for a country to raise additional debt in future.

The FTSE Climate Risk-Adjusted World Government Bond Index follows the rebalancing mechanics of the standard WGBI with respect to universe membership. However, each month the standard WGBI market value weights are tilted by their respective country's climate scores. Climate scores are calculated and updated on an annual basis each April month-end (with input data cut-off on April 1). The country climate scores are derived by assessing each countries' relative climate risk across three core climate change pillars (each with multiple sub-indicators):

- **Transition risk** represents the impact on the country and its economy from the required efforts to mitigate climate change encompassed by GHG emission reduction needed to meet the Paris conference target of less than 2 degrees of global warming and the recent trend of historical carbon emissions
- **Physical risk** represents the climate related risk to the country and its economy from the physical effects of climate change
- **Resilience** represents a country's preparedness and actions to cope with climate change

Countries are scored across each of the pillars and a single combined score is derived for each country. Country scores are then used to reweight the country's exposure in the index to provide higher exposures to countries with a better climate risk profile and lower exposures to countries that are more exposed to climate change risks.

Methodology Overview

The base universe for the FTSE Climate Risk-Adjusted World Government Bond Index is the same as the standard WGBI. As of July 2019, markets included in the standard WGBI are:

Americas	Asia Pacific and Japan
Canada	Australia
Mexico	Japan
United States	Malaysia
	Singapore
EMEA	
Austria	Denmark
Belgium	Norway
Finland	Poland
France	South Africa
Germany	Sweden
Ireland	United Kingdom
Italy	
Netherlands	
Spain	

To be included to the WGBI, markets must meet minimum credit quality and similarly exit the index if the market's credit quality falls below investment grade. Markets must also meet minimum size and Accessibility Levels for inclusion to the WGBI as assigned through the [FTSE Fixed Income Country Classification](#) framework. Securities must meet minimum amount outstanding, be fixed rate, and at least one year to maturity.

For full details on the design criteria and calculation assumptions for the standard WGBI please refer to the [FTSE Fixed Income Index Guide](#).

Figure 1. FTSE Climate Risk-Adjusted World Government Bond Index design criteria & methodology

Weighting	Alternatively Weighted
Country Climate Scores	Updated annually and applied from the end of April rebalance
Climate Pillars and tilt calibration	Geometric tilt <ul style="list-style-type: none"> • Transition risk: 0.25 • Physical risk: 1 • Resilience: 1
Rebalancing	Once a month at the end of the month
Calculation frequency	Daily
Fixing date	Each month, the upcoming month's index constituents are "fixed" on the profile fixing date. Each year's scheduled fixing dates are published on the website.
Base date	December 31, 2001

Climate Pillars and Underlying Indicators

Country climate scores are derived from assessments across three climate pillars. Each pillar contains multiple underlying indicators, details of which are shown in the table below. Raw data inputs are typically normalized to ensure countries are scored between 0 and 1 for each indicator.

Figure 2. FTSE Climate Risk-Adjusted World Government Bond Index Climate Pillars and Indicators

Climate Pillar	Indicator	Indicator description	Source(s)	Lag	History	Ref
Transition Risk	Territorial distance to target	Required annual reduction of total territorial GHG emissions including LULUCF in order to reach 2°C-compliant territorial GHG budgets in 2050 (expressed as CAGR). Budgets are estimated using the FTSE Climate Liabilities Assessment Integrated Methodology ¹ (CLAIM).	Various ²	2-3 years	2000	TRI.01
	GHG emissions gap between trend and distance to target	Gap between the 5-year historical trend of total territorial GHG emissions including LULUCF and the required annual reduction of these emissions to reach 2°C-compliant territorial GHG budgets in 2050 (based on CAGRs).	Various ³	2-3 years	2005	TRI.02
Physical Risk	Sea level exposure	Population living in areas where elevation is below 5 meters (% of total population).	World Bank	0-5 years	1990	PRI.01
	Agricultural exposure	Agricultural production coefficient of variation (standard deviation / mean) weighted by share of agriculture in GDP.	FAO	0-5 years	1961	PRI.02
	Climate natural disaster exposure	95 th percentile of the distribution of the proportion of population killed by climate related natural disasters in a given year.	EM-DAT	0-1 year	1990	PRI.03
Resilience	Institutional resilience	<u>NDC temperature equivalent</u> : intended country CO2 emissions in 2030 as explicitly or implicitly targeted in the country National Determined Contribution (NDC) is translated into an equivalent climate trajectory (temperature increase) thanks to FTSE Climate Liabilities Assessment Integrated Methodology (CLAIM)	Beyond Ratings	Not relevant ³	2016	RI.01
		<u>Government effectiveness</u> : captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	World Bank WDI	1-2 years	2000	RI.02
		<u>External debt percentage of GDP</u> : outstanding amount of debt owed to non-residents expressed as a share of GDP.	Oxford Economics	0-1 year	2000	RI.03

¹ Powered by Beyond Ratings, a FTSE Russell company. Further details on the CLAIM model can be provided by Beyond Ratings on request.

² Various underlying data sources including: PRIMAP-hist; UNFCCC; CAIT; National data; United Nations; CDIAC; World Bank; OECD; Enerdata.

³ Because NDC temperature equivalent reflect countries' targets, they do not change every year.

Climate Pillar	Indicator	Indicator description	Source(s)	Lag	History	Ref
		<u>Disaster preparedness</u> : an indication of a country's capacity to deal with climate-related nature disasters.	ND-GAIN	2-3 years	2000	RI.04
Social resilience		<u>Fuel subsidies</u> : ratio of subsidies vs. taxes on fuels. Indicator compares actual fuel prices to international prices to determine the level of subsidies/taxes.	Enerdata / EIA	1-2 years	2000	RI.05
		<u>GINI index</u> : measures the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution.	World Bank WDI	0-5 years	2000	RI.06
		<u>Human development index</u> : measures three key dimensions of human development: <ul style="list-style-type: none"> • a long and healthy life – life expectancy at birth • being knowledgeable – expected years of schooling and mean years of schooling, and • standard of living – Gross National Income per capita. 	UNDP	1-2 years	2000	RI.07
		<u>Voice and accountability</u> : captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.	World Bank WDI	1-2 years	2000	RI.08
		<u>Use of sanitation services</u> : percentage of population with access to improved sanitation facilities.	World Bank WDI	3-4 years	2000	RI.09
		<u>Access to electricity</u> : percentage of population with access to electricity.	World Bank WDI	2-3 years	2000	RI.10
Economic resilience		<u>CDP performance ratio</u> : percentage in terms of market capitalization of companies in a country that communicate on their impact on the environment.	CDP and Factset	0-1 year	2017	RI.11
		<u>Insurance penetration</u> : the ratio of premium underwritten in a given year to the GDP. Includes life-insurance and non-life insurance.	OECD	1-2 years	2007	RI.12
		<u>R&D expenses</u> : Gross domestic expenditures on R&D, expressed as a percent of GDP. Includes both capital and current expenditures in the four main sectors: Business enterprise, Government, Higher education and Private non-profit.	World Bank WDI	2-3 years	2000	RI.13
		<u>Logistics performance</u> : reflects perceptions of a country's logistics based on: efficiency of customs clearance process, quality of trade- and transport-related infrastructure, ease of arranging competitively priced shipments, quality of logistics services, ability to track and trace consignments, and frequency with which shipments reach the consignee within the scheduled time.	World Bank WDI	0-1 year	2007	RI.14
		<u>Ease of doing business</u> : the distance of an economy to the "frontier," which represents the best performance observed on each Doing Business topic across all economies.	World Bank Doing Business	0-1 year	2009	RI.15
		<u>Green bonds performance ratio</u> : 3 year moving average of green bond new issuance as a percentage of GDP.	World Bank	0-1 year	2016	RI.16
		<u>Water productivity</u> : indicates the efficiency by which each country uses its water resources. Water productivity is calculated as GDP in constant prices divided by annual total water withdrawal.	World Bank WDI	0-5 years	2000	RI.17

Climate Pillar	Indicator	Indicator description	Source(s)	Lag	History	Ref
		<p><u>Agricultural adaptive capacity</u>: Composite index that reflects countries' capacity to adapt their agricultural system to environmental issues, especially climate change. The indicator corresponds to the average score on seven sub-indicators:</p> <ul style="list-style-type: none"> (i) Agricultural capital stock (in US\$) relative to agricultural production (in US\$) (ii) Agriculture Orientation Index, reflects public support to agricultural sector (iii) Agrobiodiversity, i.e. the variety of crops cultivated in the country (iv) The share of organic agriculture (as a % of agricultural land) (v) The long-term cereals yield trend (calculated as second derivative) (vi) The share of irrigated agriculture (as a % of land) (vii) The share of conservation agriculture (as a % of land). 	FAO	2-3 years	2016	RI.18
	Ecological resilience	<p><u>Freshwater withdrawals</u>: percentage of total annual freshwater withdrawals on internal resources. Annual freshwater withdrawals refer to total water withdrawals, not counting evaporation losses from storage basins. Withdrawals also include water from desalination plants in countries where they are a significant source. Withdrawals can exceed 100 percent of total renewable resources where extraction from nonrenewable aquifers or desalination plants is considerable or where there is significant water reuse.</p>	World Bank Indicators	1-3 years	2002	RI.19
		<p><u>Share of protected areas</u>: percentage of protected areas (terrestrial and marine) on total territorial area.</p> <ul style="list-style-type: none"> • Terrestrial protected areas are totally or partially protected areas of at least 1,000 hectares that are designated by national authorities as scientific reserves with limited public access, national parks, natural monuments, nature reserves or wildlife sanctuaries, protected landscapes, and areas managed mainly for sustainable use. • Marine protected areas are areas of intertidal or subtidal terrain--and overlying water and associated flora and fauna and historical and cultural features--that have been reserved by law or other effective means to protect part or all of the enclosed environment. Sites protected under local or provincial law are excluded. 	UNEP/IBAT	2-3 years	2016	RI.20
		<p><u>Share of biodiversity threatened</u>: percentage of the total number of species in the country (Biodiversity Stock), both animal and vegetal, that are threatened according to International Union for Conservation of Nature - IUCN categories. Species referred as 'Threatened' include 'Critically endangered', 'Endangered' and 'Vulnerable' species, corresponding to different levels of extinction risk.</p>	IUCN	0-1 year	2017	RI.21
		<p><u>Biodiversity stock</u>: total number of species in the country (as reported by the International Union for Conservation of Nature - IUCN), both animal and vegetal.</p>	IUCN	0-1 year	2017	RI.22
		<p><u>Afforestation rate</u>: previous 5-year variation of forest cover based on FAO forestry data. All types of forest are considered, including primary, planted and naturally regenerated forests.</p>	FAO	2-3 years	2000	RI.23

Climate Pillar Scoring

Pillar Scores

Indicator values are combined for each pillar and are then converted into z-scores that have been mapped to scores that range from 0 to 1 using a cumulative normal distribution function. Some sub-indicators, where there are significant outlier country scores, have also been winsorized before normalization with values above the 95th percentile and below the 5th percentile set to 95th percentile and 5th percentile respectively.

Scope of Country Climate Assessments

The scope of countries assessed is in line with the universe of local currency sovereign bond markets actively tracked by FTSE Russell. This includes countries within the: WGBI, EMGBI and sovereigns on the Watch List published through the FTSE Fixed Income Country Classification framework.

Tilting Methodology

A single climate score is calculated for each sovereign and applied to its market value weight in the underlying index to derive adjusted weights. To do so, a similar tilting methodology to that employed in the FTSE Global Factor Index Series is used with some modifications to cater for the differences between equity and fixed income indexes.

First, the three pillars are combined to derive a climate score for each country:

$$CS = TRI^{\alpha} \times PRI^{\beta} \times RI^{\gamma}$$

where,

TRI, is the county's Transition Risk Index value

PRI, is the county's Physical Risk Index value

RI, is the county's Resilience Index value

α , is the TRI tilt power, set to 0.25

β , is the PRI tilt power, set to 1

γ , is the RI tilt power, set to 1

CS, is the final country climate score

Raising the Transition Risk Index values to the power of 0.25 reduces the tilt impact from transition risk, which is the most volatile measure. Each of the tilt powers can be adjusted for custom index requests. The configuration for the Climate WGBI has been set to: TRI – 0.25, PRI – 1 and RI – 1. This configuration has been calibrated to:

- Achieve meaningful climate benefit for sensible deviations from the underlying index characteristics and minimal tracking error
- Ensure other index characteristics do not deviate significantly from the original index e.g. index yield, duration, turnover and market value country weights relative to the standard market value weighted WGBI

Second, the climate scores are applied to each country's market value weight in the underlying index to derive adjusted weights:

$$\theta_i = \frac{\omega_i CS_i}{\sum_{i=0}^n (\omega_i CS_i)}$$

where,

ω , is the county's market value weight in the underlying index

θ , is the county's weight in the Climate Adjusted Index

Exchange rates

The closing WM/Reuters Spot Rates and The WM/Reuters Forward Rates, provided by Refinitiv, are used. WM takes several snapshots at regular intervals centered on the fixing time of 4:00 p.m. London time and selects the median rate for each currency. All rates are mid-market quotations and appear on Reuters (see WMRSPOT01).

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Data availability and accessibility

Index information, including index profiles, analytics and returns, and historical data, for the FTSE Climate Risk-Adjusted World Government Bond Index is available on <https://www.yieldbook.com/m/indices>. FTSE Russell also makes data for its indexes available through a number of data and analytic vendors.

Chronological summary of events

Figure 3. FTSE Climate Risk-Adjusted World Government Bond Index Event Summary

Year	Highlight
2019	July: FTSE Climate Risk-Adjusted World Government Bond Index is introduced. <i>Note: History is available from December 31, 2001</i>

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EMEA

+44 (0) 20 7866 1810

North America

+1 877 503 6437

Asia-Pacific

Hong Kong +852 2164 3333

Tokyo +81 3 3581 2764

Sydney +61 (0) 2 8823 3521