Condensed paper

Incorporating climate change into a government bond allocation

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This is a condensed version of the paper, *How to Build a Climate-adjusted Government Bond Index*.

To view the full version of the paper, please visit https://www.lseg.com/en/ftse-russell/research/how-to-build-climate-adjusted-government-bond-index.

Overview

- Climate change is a substantial challenge, which is expected to have a significant impact on global economies, both in terms of its physical effects and mitigating efforts.
- There exist multiple, distinct design and methodological challenges associated with incorporating climate risks into government bond indexes. We characterize these risks into three distinct types: **Physical, Transition** and **Resilience**.
- To date, investors have focused mostly on climate risk at the corporate or asset level (particularly listed equities). Consequently, government bond investors risk overlooking the impact of climate change on their portfolios.
- As climate risks accelerate, they are increasingly gaining attention from government bond investors, However, there remains a lack of climate-based investment products in fixed income, particularly in sovereigns.
- We introduce the Advanced Climate Index Series in this paper, which builds on the pioneering launch of the Climate WGBI in 2019; it has been designed for index-users with a focus on improving the climate performance of their government bonds investments.

How to Build a Climate-Adjusted Government Bond Index

Why is climate change important for government bond investors?

Climate change is a substantial investment risk, which is expected to have a significant impact on global economies, both through physical effects and efforts to mitigate it.

The impact of climate change can be characterized into three distinct risk types: physical, transition and resilience. The costs associated with these risks, which already exceed hundreds of billions of dollars, are becoming increasingly material. As a result, climate risks are accelerating and increasingly entering the investment horizon of government bond investors.

Figure 1*: Climate Risk Pillars*

Physical	Transition	Resilience
Idiosyncratic geographical exposure to the adverse impacts of climate change	The level of future carbon emissions reduction needed to meet the Paris conference target*	The degree to which an individual economy is prepared for climate change

**Paris conference target of less than two degrees of global warming and the recent trend of historical carbon emissions*

Source: FTSE Russell & Beyond Ratings.

You can find more elements on these risk types and on how climate change could impact sovereign bonds in the more detailed report accompanying this document ("Section 1: Climate change and government bonds")

Spotlight: Transition Risk

Countries transitioning and reducing carbon emissions represent a significant opportunity. However, for some, the transition requires significant effort and the quality of implementation varies. For example, one reason is that carbon intensities decrease at different rates in different countries. As result, transition involves various policy and litigation risks or energy transition implementation challenges, which take time.

In this context, we assess transition risk using our innovative, forward-looking CLAIM methodology (Climate Liabilities Assessment Integrated Methodology). This statistical approach assesses the 2°C carbon budget of any country or its carbon budget for any temperature. Transition risk is determined through the scale of transition challenges for each country and based on how well countries are managing emissions.

Our approach is forward-looking to capture the non-linear dimension of climate risks. As the BIS recently put it, the current situation requires a change of paradigm in a context of "green swan" risks ("potentially extremely financially disruptive events that could be behind the next systemic financial crisis"). This need is highlighted by the fact that "traditional backward-looking risk assessment models that merely extrapolate historical trends prevent the full appreciation of the future systemic risk posed by climate change."[1]

*2020 Morgan Stanley survey of 110 asset owners worldwide.

[1] BIS, The green swan - Central banking and financial stability in the age of climate change, 2020.

Why does the government bond market lack climate products?

To date, investors have focused mostly on climate risk at the corporate or asset level (particularly listed equities). In 2017, a CFA Institute study assessed that ESG integration was higher globally in equity (76%) than in fixed income (45%)[2]. It can also be noted that, according to the Global Sustainable Investment Alliance, fixed income accounted for just 36% of the 2018 sustainable investment asset class allocation reported in Europe, the US, Japan and Canada, compared to 51% for equity[3]. In addition, fixed income investors' ESG focus tends to be stronger on corporates than on government bonds, even if this gap is narrowing. The PRI reported that, in 2019, 82% of its signatories were incorporating ESG issues in the SSA asset class[4] (69% in 2016), compared with about 90% in corporate fixed income (more than 80% in 2016), and more than 95% in equity (in both 2019 and 2016)[5]. Moreover, the focus of ESG investment in government bonds tends to be more limited on environmental factors, rather than social and governance (S&G). Although ESG investors currently integrate S&G issues in government bonds in various ways, there is no clear, standard approach. S&G aspects are less overlooked by standard credit ratings and some of their impacts are partly priced into government bond valuations, while the impact of climate change is not significantly priced in.

Consequently, government bond investors risk overlooking the impact of climate change at the national level and their portfolio being exposed to additional investment risk. The lack of climate-based investment products in fixed income, particularly in sovereigns, has affected investors' ability to address climate risk in their government bond portfolios.

Incorporating climate risks into government bond indexes comes with many challenges such as creating indexes that combine countries with similar environment performance, while meeting the demand from investors not to diverge materially away from traditional market-value weighted benchmark characteristics. However, some approaches allow to assess the risks of climate change for sovereigns, as done by the FTSE Russell & Beyond Ratings methodology. While climate risks can affect corporates and sectors, they are also inherently macro and, thus, material at country level. In this context, our methodology provides solutions to assess climate risks for sovereigns, thanks to its integrated three-pillar framework and forward-looking dimensions.

You can find more elements on the lack of "pricing in" of sovereign climate risks in the more detailed report accompanying this document ("Section 2: Are sovereign climate risks "priced in" today?"). You can also find further details in the same report on the challenges of climate risk measurement, the need for innovative approaches and potential solutions ("Section 3: Quantifying Sovereign Climate Risk").

[2] Based on 1,588 respondents in May 2017, and only based on those who take at least one ESG issue into consideration.

[3] 2018 Global Sustainable Investment Review.

[4] Sovereigns, Supranationals and Agencies

[5] PRI, RI trends: in conversation with Thalia Vounaki, the PRI's Senior Manager, Data, 2019.

Quantifying Sovereign Climate Risk

Introducing the FTSE Advanced Climate Index Series

During the summer 2019, FTSE Russell launched the Climate Risk-Adjusted World Government Bond Index ("Climate WGBI"), which was the first climate risk government bond index. The goal of this index was to allow investors to incorporate climate change risk considerations into sovereign debt portfolios.

Building on the pioneering launch of the Climate WGBI in 2019, we now introduce the Advanced Climate Index Series, which has been designed for index-users with an increased focus on improving the climate performance of their government bonds investments.

The Advanced Climate Index Series uses a tilting methodology to finesse market value weights according to the physical risk, transition risk and resilience at the national level (i.e., their three-pillar climate, country scores). Each of these three pillars is considered equally, as they reflect various complementary dimensions of climate risks.

The FTSE Advanced Climate Risk Adjusted Government Bond Index Series offers investors a compromise between a 2-degree pathway alignment and deviations in market-value weighted portfolio characteristics, while at the same time effectively positioning investors to benefit from the potential mispricing of government bonds. The series comprises the FTSE Advanced Climate World Government Bond Index ("Advanced Climate WGBI") and the FTSE Advanced Climate European Monetary Union (EMU) Government Bond Index ("Advanced Climate EGBI"). Crucially, the series applies a tilt strength of 1 to each climate risk pillar.

You can find more information on the developed methodology (pillars, indicators, scoring process) and the resulting country scores in the more detailed report accompanying this document ("Section 4: FTSE climate risk methodology"). You can also find further elements on the implementation of this approach into sovereign indexes in the same report ("Section 5: Implementation into a climate risk-adjusted government bond index").

Figure 2*:* Climate Index Design Criteria

	FTSE Climate WGBI	FTSE Climate EGBI
Country Climate Scores	Updated annually and applied each May month-end rebalance. The cut-off for input data is May 1 of each year.	Updated annually and applied each May month-end rebalance. The cut-off for input data is May 1 of each year.
Country Climate Score Assessment Cohort	Local currency sovereign bond markets eligible for the WGBI.	Local currency sovereign bond markets eligible for the EGBI.
Climate Pillars and tilt calibration	Geometric tilt: • Transition risk: 1 • Physical risk: 1 • Resilience: 1	Geometric tilt: • Transition risk: 1 • Physical risk: 1 • Resilience: 1
Rebalancing	Once a month at the end of the month	Once a month at the end of the month
Base date	December 31, 2001	December 31, 2001

Source: FTSE Russell & Beyond Ratings.

Advanced Climate WGBI (ACWGBI) and Advanced Climate EGBI (ACEGBI)

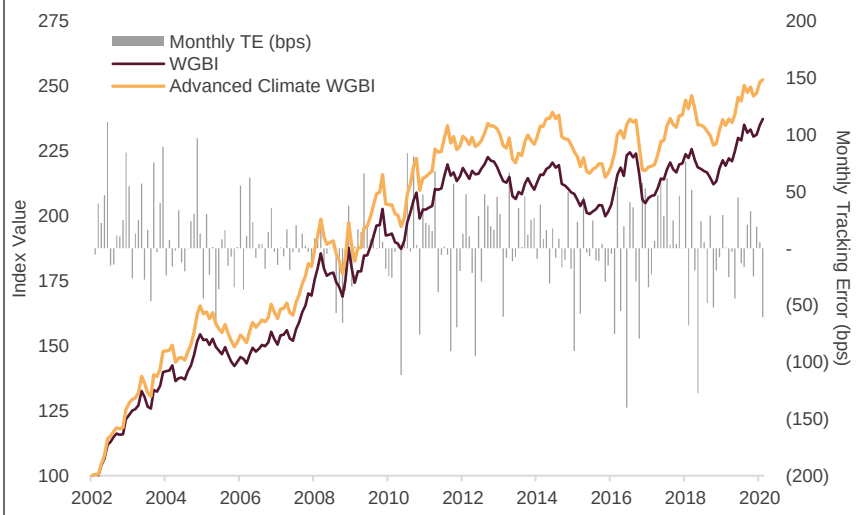
1. Advanced Climate WGBI (ACWGBI)

Figure 3 presents the back-tested historical performance of the ACWGBI vs the World Government Bond Index (WGBI).

- As can be seen, the ACWGBI is closely correlated with the WGBI, with annualized tracking error of just 1.48% (see figure 3).
- Over the period the ACWGBI outperforms the WGBI, although it is also characterized by a slightly higher volatility and an increase in average monthly turnover. The annualized return of the ACWGBI stands at 5.13% compared with 4.81% for the WGBI (see figure 3).
- However, **the portfolio's distance to a 2-degree pathway is 28% lower than in the parent index (100% would be 2-degree aligned). It provides an average annual GHG reduction of 2,717 MtCO2e, more than the combined GHG emissions of Japan (1,249) and Germany (901)** – the two largest GHG emitters in the WGBI after the US, based on the most recent emissions data (see figures 3 and 4). By comparison, 2,717 MtCO2 also corresponds to the lifecycle CO2 emissions of about 70 million cars in Europe[6], or the annual residential GHG emissions (households' heating, cooling and power use) of 900 million people by U.S. standards[7].

Figure 3: Advanced Climate WGBI (ACWGBI) Performance vs WGBI

Advanced Climate WGBI vs WGBI (USD unhedged, rebased Jan 2002)



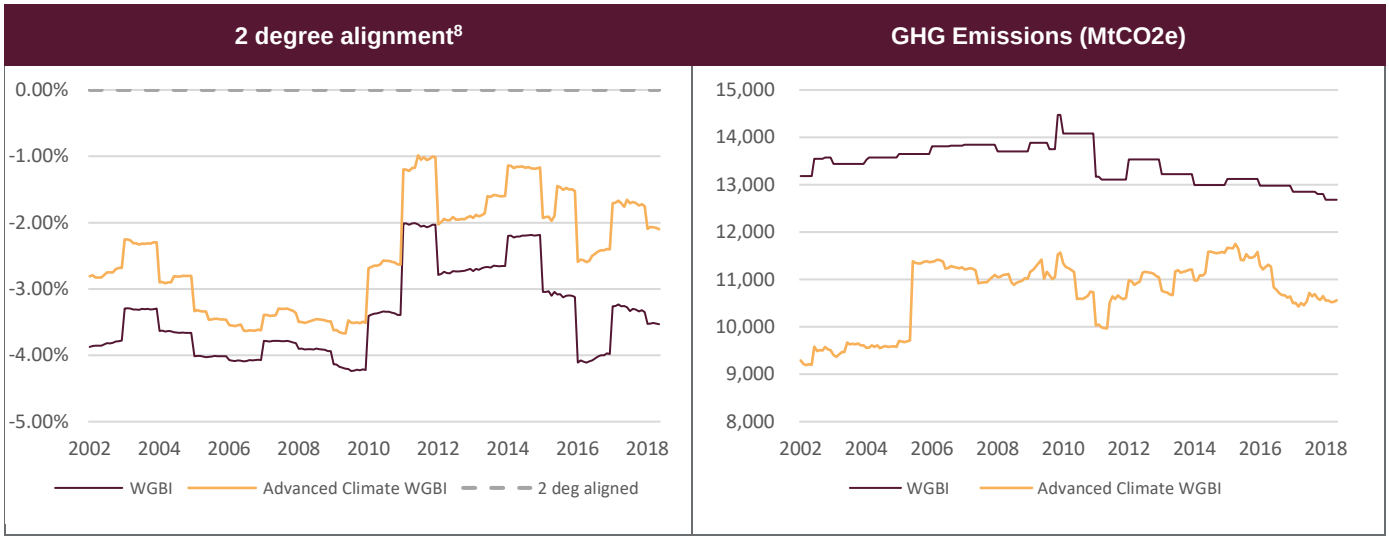
Metric	WGBI	ACWGBI
Annualized Return	4.81%	5.13%
Annualized Volatility	6.52%	7.20%
Risk-Adjusted Returns	0.738	0.713
Tracking error		1.48%
Return Correlation		98.5%
Av. Monthly Turnover	1.83%	2.60%
Max Drawdown (End Date)	-10.26% (Nov-2015)	-10.54% (Oct-2008)
GHG emissions GAP between trend and target	3.20%	2.33%
Av. Improvement in 2 degree alignment		+28%
Av. Total GHG Emissions	13,434	10,717
Av. Total GHG Emissions reduction		2,717 (20%)

Source: FTSE Russell & Beyond Ratings. June 2020 Past performance is no guarantee of future results. Returns shown represent hypothetical, historical performance. Please see the end for important legal disclosures.

[6] Conventional European cars (internal combustion engine), for a total distance of 150,000 km.
Source: ICCT. In: Carbon Brief, Factcheck: How electric vehicles help to tackle climate change, May 2019. See also: EEA Signals 2017.

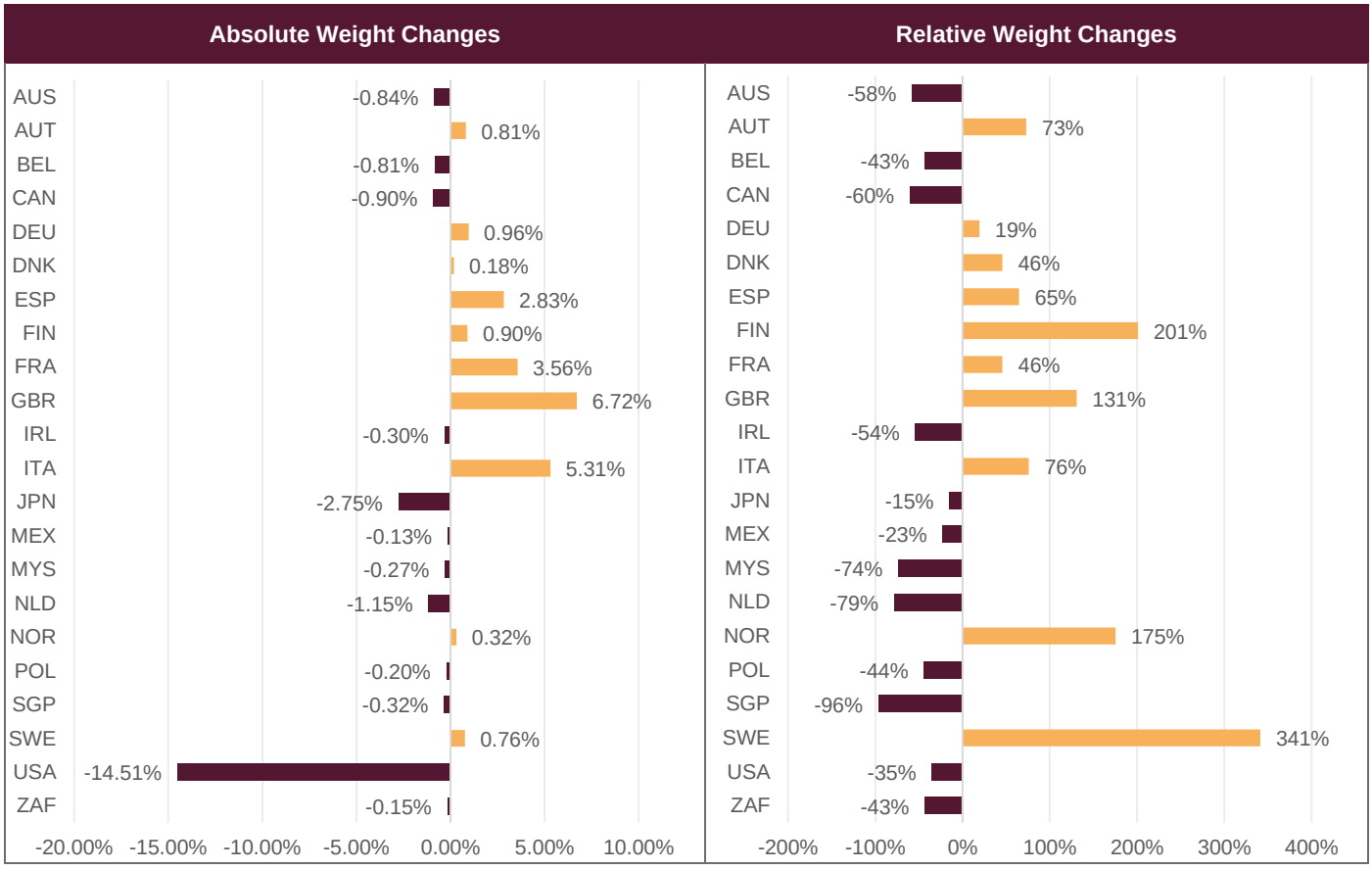
[7] Sources: EIA, Where greenhouse gases come from, 2020; PNAS, The carbon footprint of household energy use in the United States, 2020.

Figure 4: Advanced Climate WGBI (ACWGBI) Environmental Performance



Source: FTSE Russell & Beyond Ratings. June 2020 Past performance is no guarantee of future results. Returns shown represent hypothetical, historical performance. Please see the end for important legal disclosures.

Figure 5: Advanced Climate WGBI (ACWGBI) Weight Adjustments (April 2020)



Source: FTSE Russell.

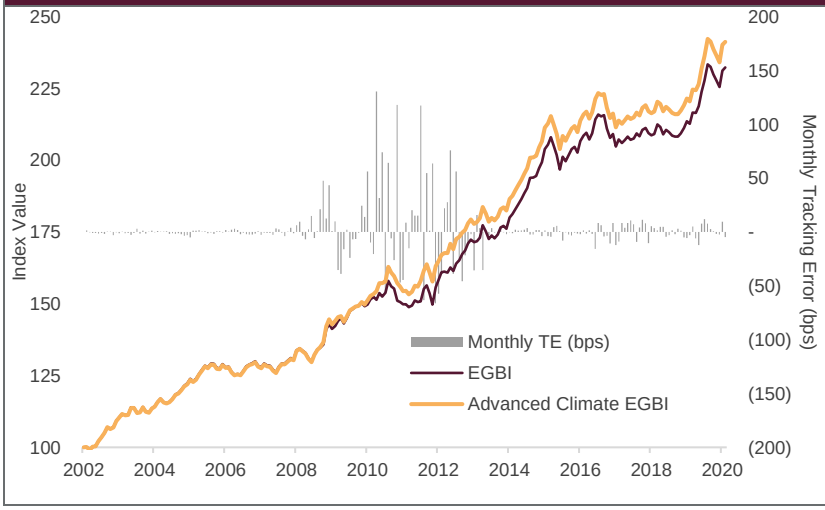
[8] Measured by annualized GHG emissions cuts GAP between trend and distance to target compliant with a 2 degree aligned 2050 scenario

2. Advanced Climate EGBI (ACEGBI)

Figure 6 presents the back-tested historical performance of the ACEGBI vs the EGBI.

- The ACEGBI is even closer correlated with the EGBI than the ACWGBI vs WGBI, with annualized tracking error of just 0.77% (see figure 6).
- Over the period the ACEGBI outperforms the EGBI with slightly lower volatility but increased average monthly turnover. The ACEGBI presents an annualized return of 4.78% compared with 4.57% for the EGBI (see figure 6).
- **The portfolio's distance to a 2-degree pathway is 26% lower than in the parent index (100% would be 2-degree aligned) and it provides an average annual GHG reduction of 204 MtCO2e.** The improvement in 2-degree alignment is close to that achieved by the ACWGBI and the lower absolute GHG reduction is to be expected given the lower starting emissions (due to the smaller pool of countries in the EGBI) and the relatively better starting position in terms of emissions performance (see figures 6 and 7). By comparison, 204 MtCO2 also corresponds to the lifecycle CO2 emissions of about 5 million cars in Europe[9], or the annual residential GHG emissions (households' heating, cooling and power use) of 70 million people by U.S. standards[10].

Figure 6: Advanced Climate EGBI (ACEGBI) Performance vs EGBI

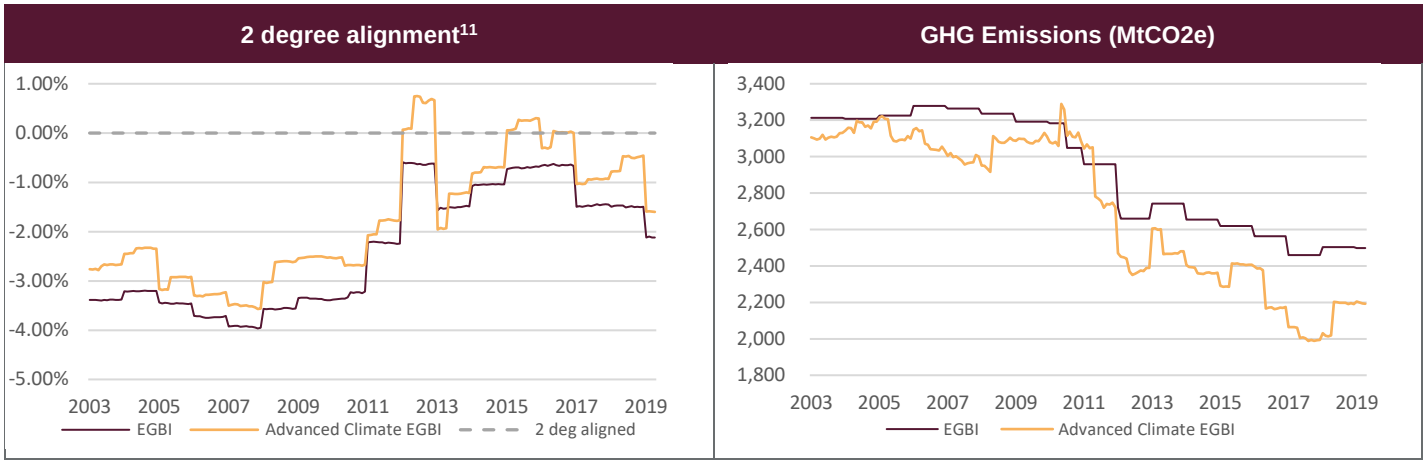


Metric	EGBI	ACEGBI
Annualized Return	4.57%	4.78%
Annualized Volatility	4.02%	3.97%
Risk-Adjusted Returns	1.138	1.203
Tracking error		0.77%
Return Correlation		98.0%
Av. Monthly Turnover	1.40%	2.58%
Max Drawdown (End Date)	-5.78% (Mar-2011)	-5.87% (Mar-2011)
GHG emissions GAP between trend and target	2.35%	1.73%
Av. Improvement in 2 degree alignment		+26%
Av. Total GHG Emissions	2,921	2,717
Av. Total GHG Emissions reduction		204 (7%)

Source: FTSE Russell & Beyond Ratings. June 2020 Past performance is no guarantee of future results. Returns shown represent hypothetical, historical performance. Please see the end for important legal disclosures.

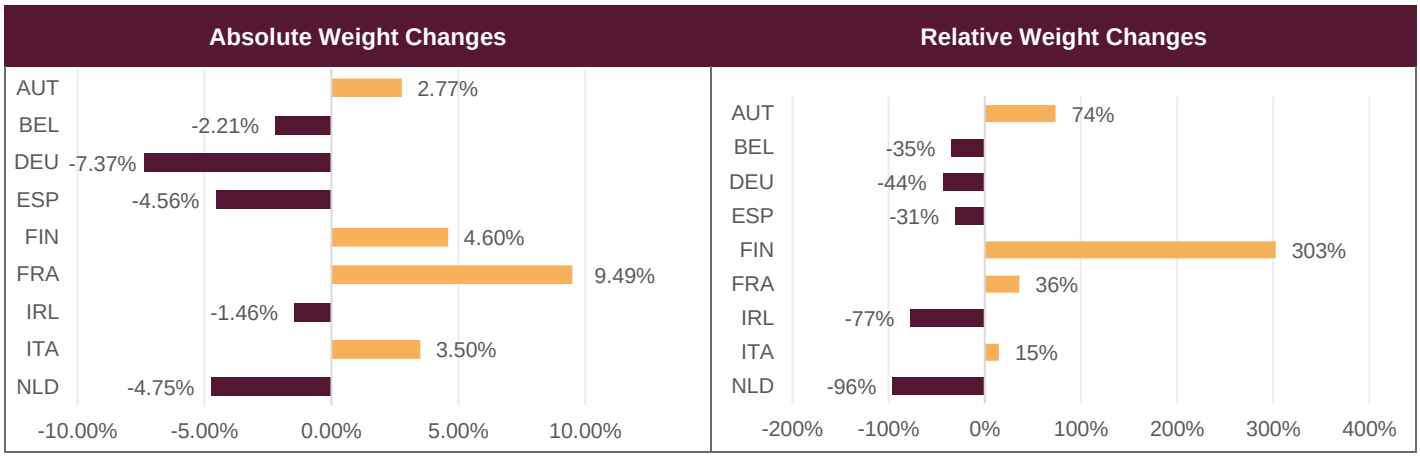
[9] Conventional European cars (internal combustion engine), for a total distance of 150,000 km.
Source: ICCT. In: Carbon Brief, Factcheck: How electric vehicles help to tackle climate change, May 2019. See also: EEA Signals 2017.
[10] Sources: EIA, Where greenhouse gases come from, 2020; PNAS, The carbon footprint of household energy use in the United States, 2020.

Figure 7: Advanced Climate EGBI (ACEGBI) Environmental Performance



Source: FTSE Russell & Beyond Ratings. June 2020 Past performance is no guarantee of future results. Returns shown represent hypothetical, historical performance. Please see the end for important legal disclosures.

Figure 8: Advanced Climate EGBI (ACEGBI) Weight Adjustments (April 2020)



Source: FTSE Russell. June 2020

[11] Measured by annualized GHG emissions cut GAP between trend and distance to target compliant with a 2-degree aligned 2050 scenario.

About FTSE Russell

FTSE Russell is a leading global provider of benchmarks, analytics and data solutions with multi-asset capabilities, offering a precise view of the markets relevant to any investment process. For over 30 years, leading asset owners, asset managers, ETF providers and investment banks have chosen FTSE Russell indexes to benchmark their investment performance and create investment funds, ETFs, structured products and index-based derivatives. FTSE Russell indexes also provide clients with tools for performance benchmarking, asset allocation, investment strategy analysis and risk management.

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