Decarbonization in equity benchmarks: Smoke still rising

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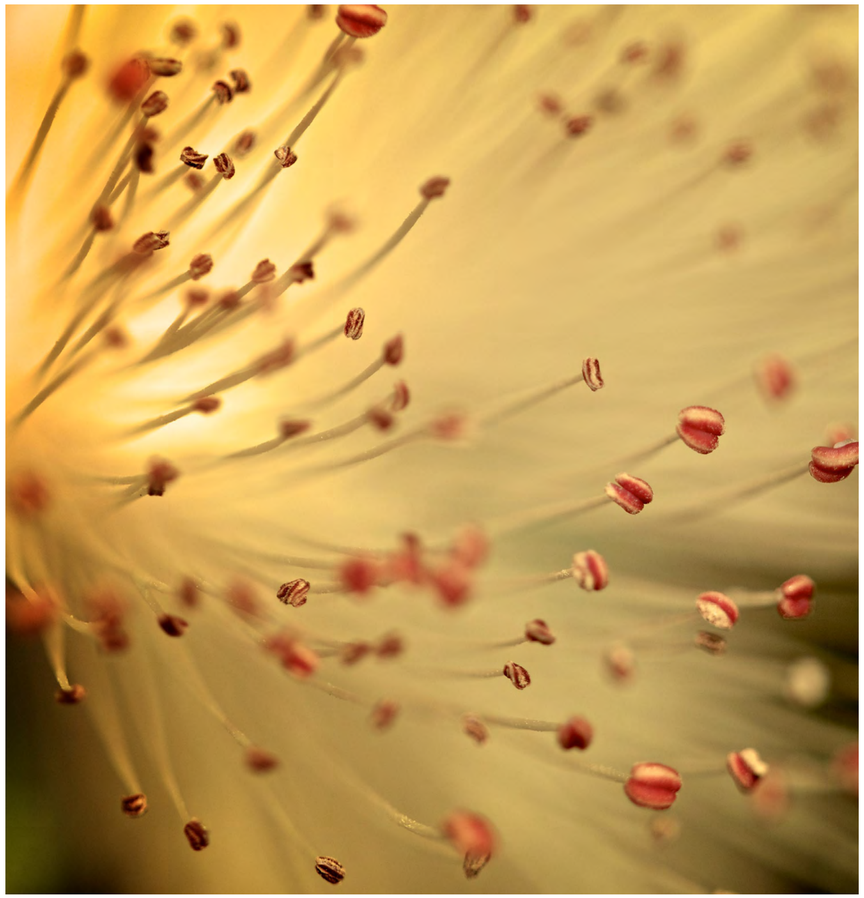

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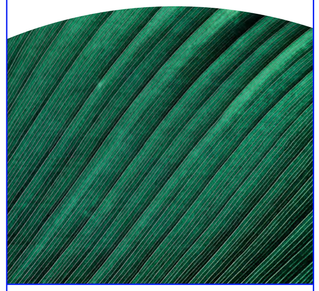
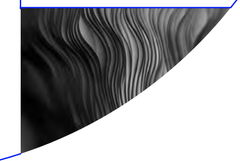




Foreword

Asset owners have been setting emission reduction targets for some years now, and are monitoring progress against those targets. Early on, the UN Convened Net-Zero Asset Owner Alliance (NZAOA), identified that it would be important for asset owners not only to gauge progress against their own targets, but also to consider how this compares to decarbonization in a more general 'reference portfolio' – a standard index weighted by market capitalization that is designed to be broadly representative of the (public equity) investment universe. This reference portfolio would be representative of the default for passive investing, and tracking its carbon characteristics should allow us to identify broad trends in the economy, such as changes in carbon efficiency.

Prepared by LSEG in collaboration with the Data and Targets working group of the Alliance, this report is the first of an annual series to identify decarbonization trends in such a 'reference portfolio' (in this case the FTSE All-World). It focuses on the most up-to-date data available for common portfolio metrics, capturing operational emissions/energy efficiency (Scope 1 and 2 emissions), and highlights benefits and challenges with each metric. Scope 3 emissions – vital to capturing the full picture on progress towards net zero – is not yet included, but it is intended that this will add to future iterations of this report.

The analysis shows that it is very important to look behind the headline data to what drives change in the reported numbers, which we believe will be of relevance to asset owners interested in decarbonization. Particularly, this analysis has the potential to help investors:

- Develop an understanding of the relationships between various metrics over time and portfolio level drivers of portfolio carbon efficiency (e.g., sector weight, carbon intensity change, constituent churn).
- Understand longer term decarbonization trends (though for listed equities only), that are broken down by geography and sector, in a relatively stable portfolio, which should assist comparison.
- Provide a comparator for their climate performance across a range of metrics, which will help with baselining or rebaselining their climate targets.

We hope you find the report insightful.

Dr Stephen Barrie, Church of England Pensions Board, Co-Chair of the Data and Targets Working Group of the NZAOA

Dr Udo Riese, Allianz SE, Co-Chair of the Monitoring, Reporting and Verification Track of the NZAOA

Executive summary

Publicly listed corporations account for a significant share of global greenhouse gas emissions. We estimate that the Scope 1 and 2 emissions of listed large and mid-cap firms in developed and emerging economies account for approximately one fifth of all global emissions;[1] and recent research has suggested that this figure would double if value chain (Scope 3) emissions are considered.[2]

Faced with growing climate risk, investors are increasingly focused on tracking and reducing their portfolio emissions exposure. Members of the UN-convened Net-Zero Asset Owners Alliance, with whom we are partnering on this report, and other investor-backed organizations (such as the Net Zero Asset Managers Initiative), have committed to develop ambitious emissions reduction targets for their portfolios and regularly report on their progress.[3]

However, investors face practical and methodological challenges in tracking these reduction targets, and a consensus has yet to develop around the best metrics and measures to assess portfolio carbon exposure. Against this backdrop, this paper – the first in an annual series – analyzes trends in the carbon exposure for the FTSE All-World Index, a global benchmark of over 4,000 companies capturing large and mid-cap companies in developed and emerging markets.

Portfolio emissions trends and their drivers are considered over time and through the lens of the most commonly used carbon exposure metrics, including both absolute and intensity metrics. However, we find that there is no single best measure for portfolio carbon exposure. Indeed, we find that all measures proposed have their unique weaknesses, which drive volatility in results and can confound portfolio-level trends – with reductions of weights for carbon-intensive industries-for example accounting for most of the reductions in Weighted Average Carbon Intensity (WACI) between 2017 and 2020.

Results therefore require careful interpretation, as they are not only affected by changing emissions profiles, but also by shifts in the index composition and macroeconomic volatility (including commodity price shocks or inflationary pressures). We recommend investors take a dashboard approach, relying on multiple metrics to track the decarbonization of portfolios over time.

Our analysis for the FTSE All-World between 2014 and 2020 highlights the following key findings:

- Absolute emissions in public equities increased in this period, driven partially by an expanding investment universe. Adjusting for constituent changes in the underlying universe (what we term “chained emissions”), emissions reductions are evident beginning in 2019, with over half of constituents seeing year-on-year declines in emissions.
- This reduction can also be seen in carbon intensity trends; between 2014 and 2020, global equity portfolios saw a modest decline in both Weighted Average Carbon Intensity (WACI) and Carbon Footprint (based on Enterprise Value including cash, EVIC) decreasing at a rate of 2% p.a. and 5% p.a., respectively.
- This partially reflects the COVID pandemic, with the typical firm-level emission reduction accelerating from 1% to 5%[4] and sharp declines in both the WACI (-10%) and Carbon Footprint (-13%) in 2020.
- Emissions reductions can particularly be observed in Utilities, where material declines in absolute emissions and emissions intensity have contributed to portfolio level emissions reductions in the FTSE All-World.
- Technology was the only sector to materially increase its contribution to WACI, due to emissions increases in constituent firms and consistent growth in index weight.[5]
- Churn in the Energy Industry was a significant contributor to portfolio intensity reductions. This raises some concerns around potential carbon leakage, with the removal of 40 firms contributing to an almost 2% WACI reduction during 2017-2020.

1 Considers Large and Mid-caps constituents in the FTSE All-World; figure ignores potential double counting between Scope 2 emissions and Scope 1 emissions of Electrical Utilities
2 Generation investment management, Listed Companies Account for 40% of Climate-Warming Emissions, Reveals New Research by Generation Investment Management, accessed 06/05/2022.
3 NZAOA recommends a target of 22-32% CO2e reduction by 2025. See UN-convened Net-Zero Asset Owners Alliance, ‘Target Setting Protocol’, accessed 27/04/22. IIGCC, ‘Net Zero Investment Framework’, accessed 16/12/21.Net Zero Asset Managers Alliance, ‘Our Commitment’, accessed 16/04/22.
4 The conversationalist, Global emissions almost back to pre-pandemic levels after unprecedented drop in 2020, accessed 05/05/2022.
5 As represented in the FTSE All-World Index, 9 out of 11 ICB Industries have shrunk between 2017 and 2020 while the weight of Technology has almost doubled.

1. Introduction

Following the launch of the Greenhouse Gas (GHG) Protocol standard for corporate carbon accounting in 2004,[6] various methodologies for assessing portfolio carbon exposure have emerged (e.g., from PCAF[7] and TCFD).[8] However, there is still no consensus on the single best metric or approach to use, and different metrics and methodological choices can drive material divergence in portfolio-level results.[9] This paper analyzes trends in carbon emission exposure for global equity markets represented by the FTSE All-World Index (see Box 1) over time and across sectors, before presenting a contribution analysis for changes in the index emissions profile for 2014 to 2020.

It aims to improve understanding of the yardstick against which investors measure the decarbonization of their portfolios. We focus on absolute emissions and the two most common intensity measures of carbon in portfolios – Weighted Average Carbon Intensity (WACI), and Carbon Footprint. These respectively normalize emissions over two financial metrics, revenue (a proxy of emissions per firm output), and enterprise value including cash or EVIC (a measure of emissions 'owned' by the investor).

Box 1. FTSE All-World Index

The FTSE All-World Index is a market capitalization weighted index representing the performance of large and mid cap stocks globally, and covers over 90% of the world's investable market capitalization.[1] The index comprises over 4,000 large and mid-cap firms from Developed and Emerging markets. Over time, constituents are added and removed depending on their size in the equity market, investability of their shares, as well as additional governance constraints.

1 FTSE Russell, FTSE All-World Factsheet as of 31st May 2022, accessed 20/06/2022.

Finally, our contribution analysis demonstrates how portfolio carbon intensities are impacted not only by the emissions of the underlying constituents, but also by financial factors and evolving index composition (including price fluctuations, churn of constituents, and changes in sector and constituent weights). It should be noted that this study mainly focuses on results up until year-end 2020 to ensure completeness and consistency of emissions data (though we analyze prospective changes as a result of macroeconomic volatility in 2021 and 2022).[10]

The initial analysis focuses on operational emissions – i.e., direct emissions and indirect emissions ownership via energy consumption (Scope 1 and 2, respectively. See Box 2 for additional information). This is due to the relatively wide availability of data, as well as the maturity and consistency of the emissions accounting methods, which enable systematic comparison between entities and portfolios. Though Scope 3 emissions are a growing focus for investors and required for full portfolio emissions accounting, the present study only considers Scope 1 and 2 emissions, due to the limited quality of available Scope 3 disclosures and methodological complexities, such as the treatment of double counting.

6 GHG Protocol, 'Corporate Standard,' accessed 06/05/2022.
7 Partnership for Carbon Accounting Financials, The Global GHG Accounting and Reporting Standard for the Financial Industry, accessed 06/05/2022.
8 Task Force on Climate-related Financial Disclosures, 'Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures', accessed 06/05/2022.
9 Ducoulombier, F. and Liu V. "Carbon Intensity Bumps on the Way to Net Zero." The Journal of Impact and ESG Investing Spring 2021, 1 (3) 59-73; DOI: https://doi.org/10.3905/jesg.2021.1.013
10 Complete FY2021 emissions and revenue data will be available by the end of 2022.

Box 2. Accounting for corporate carbon exposure

Carbon emissions generally refer to seven greenhouse gases (“GHGs”), which accumulate in the atmosphere and contribute to climate change. For accounting purposes, emissions of other greenhouse gases such as methane and nitrous oxide are converted to carbon dioxide equivalent emissions (CO2e) through the application of global warming potential (GWP) factors.

Though there are multiple standards for emissions accounting, most companies and disclosure frameworks have adopted the standards set out by the GHG Protocol.[1] The GHG Protocol recommends that firms report emissions relative to equity stake or either operational or financial control of operations. Emissions are divided into three categories relative to source and relation to the reporting entity. While Scope 1 and 2 or ‘operational’ emissions are clearly defined and straightforward to calculate, Scope 3 calculation requires complex assumptions involving external counterparties and value chain, where a company may have limited visibility. Scope 1 and 2 emissions disclosures, though incomplete, have thus far outpaced Scope 3 reporting.

Figure 1. Emissions scopes

Source		Definition
Direct	**Scope 1**	Emissions from sources that are owned or controlled by the reporting company.
Indirect	**Scope 2**	Emissions from consumption of electricity, heat, steam, and cooling. This can be calculated via two methods (See Appendix): – **Location-based** refers to emissions calculated through emission rates of the local power grid. – **Market-based** refers to emissions calculated based on purchasing agreements with electricity suppliers. For most corporates, this tends to result in lower estimations than location-based emissions.[2]
	Scope 3	**Upstream**: GHG emissions embedded by processes in the value chain that contribute to a company’s products or services.
		Downstream: GHG emissions originating from the activities of customers using a company’s products and services.

1 Greenhouse Gas Protocol. Scope 2 Guidance, accessed 10/03/2022.

2 Jerry Patchell, Can the implications of the GHG Protocol’s scope 3 standard be realized? Journal of Cleaner Production, Volume 185, 2018, Pages 941-958, ISSN 0959-6526, https://doi.org/10.1016/j.jclepro.2018.03.003.

2. Carbon emissions of global equity benchmarks

Absolute emissions

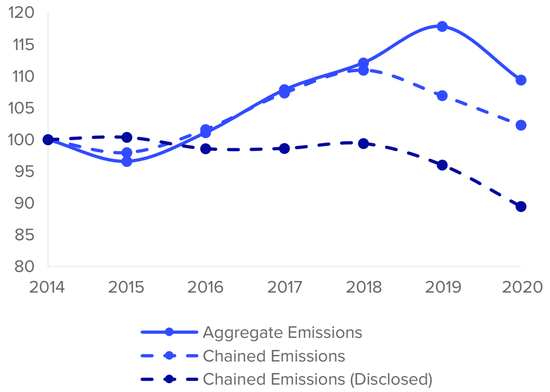
Absolute emissions provide in many ways the most straightforward way to measure a portfolio's emissions, simply assuming 100% of each constituent firm's emissions are attributable to the investment portfolio and aggregating emissions across all constituents. As of 2020, total absolute emissions of FTSE All-World constituents include more than 10 billion tonnes of CO2 equivalent, growing annually by 5% from 2016 to 2019, before showing a 7% reduction in 2020 during the global pandemic (see Figure 2 and 3).

Absolute emissions are particularly sensitive to changes in portfolio composition. Indeed, the number of constituents (and thus sources of emissions), in the FTSE All-World index has increased significantly over the period in question, with 900 firms added between 2015 and 2020, mainly due to the inclusion of China A Shares in 2019.[11] To adjust for this while maintaining a focus on absolute emissions, we calculate the change in absolute emissions each year for persistent constituents only – i.e., firms that were also in the index prior to a given year. We refer to this series of yearly changes in absolute emissions as 'chained change in absolute emissions.'

After controlling for the change in FTSE All-World constituents in this way, we find that absolute emissions in the FTSE All-World peak in 2018 (see Figure 2). We also find a notable reduction in absolute emissions in 2019 prior to the pandemic – driven primarily by a large drop in the emissions from utilities – but masked in the unadjusted results by the addition of China A constituents in the same year.

Figure 2. Absolute emissions trends in global equities

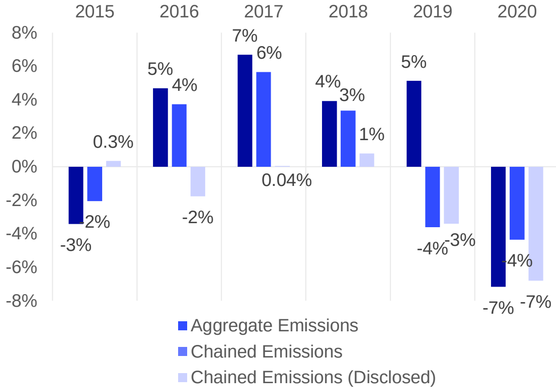
Aggregate and chained absolute emissions, FTSE All-World Index (2014=100)



Source: FTSE Russell, July 2022.

Figure 3. Absolute emissions decline accelerates in recent years

Annual change in aggregate and chained absolute emissions



Source: FTSE Russell, July 2022.

We further note that we need to be mindful of disclosure gaps when interpreting absolute emissions results. Around 40% of index constituents (c. around 20% of the index weight) do not currently disclose their emissions, requiring the use of estimated data instead.[12] When calculating chained absolute emissions for disclosing companies only, we find these to have been largely flat over the period, with an accelerated rate of decrease from 2018 to 2020 (5% p.a.). This is partly offset by non-disclosers, where estimation models that often rely on intensity-based models broadly assume that their emissions are tracking their increasing revenues.

11 FTSE Russell, Reclassification of China A Shares to Secondary Emerging Market Status, accessed 25/7/2022.

12 For an overview of disclosure gaps and trends and estimation models, see FTSE Russell, Mind the gaps: Clarifying corporate carbon, accessed 25/7/2022.

Figure 4: Overview of key carbon exposure metrics

	Description	Included in	Unit	Absolute or intensity	Normalization factor[13]	Attribution factor[14]	Complexities when applying to equity benchmarks over time
Aggregate emissions	Total emissions of all investee firms		Tonnes	Absolute	None	None	– New constituents introduce volatility – Does not factor in portfolio weight – Can result in double counting of emissions
Weighted Emissions	Sum of firm emissions multiplied by index weight		Tonnes	Absolute	None	Index weight	– Index weight reduces volatility introduced by new constituents – Result not analogous to owned emissions
Weighted Average Carbon Intensity (WACI)[15]	Average of carbon intensity (revenues) of investee firms, weighted by portfolio exposure	TCFD	Tonnes per USD revenue	Intensity	Revenues	Index weight	– Significant revenue volatility for high-emitting sectors – Revenues differ in meaning across firms and sectors
Owned Emissions	Total emissions owned by portfolio through its investee firms	TCFD PCAF	Tonnes	Absolute	None	AUM invested as a % of ownership (based on market capitalization or EVIC[16])	– Significant volatility of underlying asset values, requiring inflation adjustment – Does not factor into carbon efficiency of individual firms – Unnormalized outputs makes point-in-time crossportfolio comparison difficult
Carbon Footprint	Total emissions owned by portfolio through its investee firms, per USD invested	TCFD PCAF	Tonnes per USD invested	Intensity	Amount invested	AUM invested as a % of ownership (based on Market Cap or EVIC)	– Significant volatility of underlying asset values, requiring inflation adjustment – Does not factor into carbon efficiency of individual firms' outputs
Owned Intensity	Total emissions owned by a portfolio divided by total revenues owned by a portfolio	TCFD PCAF	Tonnes per USD revenue	Intensity	Revenues	AUM invested as a % of ownership (based on Market Cap or EVIC)	– Significant volatility of underlying asset values, requiring inflation adjustment – Revenues differ in meaning across firms and sectors
Physical intensity	Total Emissions divided by total physical production of firms	TCFD PCAF	Tonnes per unit output	Intensity	Production unit[17]	None	– Production units differ between sectors and commoditized outputs do not exist for most firms, making cross-sector applications difficult

13 Intensity measures are generally derived by dividing emissions by a normalization factor, which contextualizes emissions against a firm's revenues, physical outputs, or overall size (e.g., by EVIC).

14 Attribution factors provide the proportion of emissions that a portfolio is responsible for – traditionally this involves estimating the proportion of a firm a portfolio owns as related to its overall enterprise value or market capitalization.

15 In their Handbook for the construction of Paris Aligned and Climate Transition Benchmarks, the Technical Expert Group of the EU Commission recommends a WACI with EVIC as a normalization factor, in place of revenues. This – when implemented as part of an index, with (assumed) constant assets under management – is proportionally equivalent to an implementation of Carbon Footprint as listed above. See Handbook of climate transition benchmarks, Paris-aligned benchmark and benchmarks' ESG disclosures (europa.eu)

16 Though market capitalization has been cited as a factor by TCFD, recommendations from PCAF, as well as an overall incentive to align metrics for both equity and fixed income portfolios have contributed to the salience of EVIC-derived metrics. While overall the metrics are quite similar (with market capitalization a predominant building block of EVIC), the use of balance sheet metrics along with market data can complicate data alignment when creating point-in-time estimates (see Appendix II for more details).

17 Depending on the sector – production units can include barrels of oil equivalent of Oil and Gas, tonnes of Coal, Steel, Cement, or minerals, as well as other homogenized products

Emissions intensities

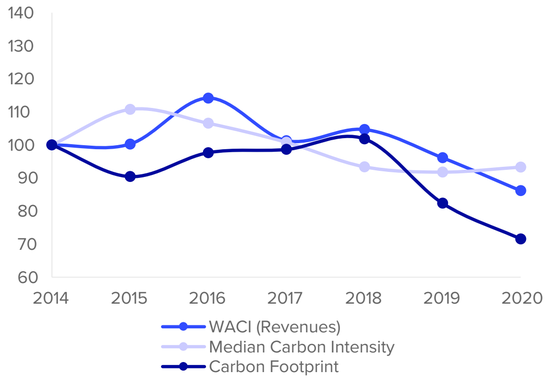
Another key challenge with absolute emissions measures is that they can make it difficult to meaningfully compare different investment portfolios or indeed individual portfolio constituents of different sizes. To illustrate, the absolute emissions of the Russell 1000 (which includes approximately 1,000 of the largest securities of the US equity universe) are approximately five times higher than those of FTSE100 (containing the 100 largest UK stocks), just by virtue of the size and number of its constituents.

To deal with this challenge, investors often use carbon intensities rather than absolute emissions. While carbon intensities can be calculated in many ways, we focus our analysis here on two measures – the weighted average carbon intensity (WACI), and the Carbon Footprint (with the latter being roughly equivalent to the WACI normalized over EVIC rather than revenues, see Appendix II).[18] These widely used metrics have been most systematically studied in the literature,[19] and have been recommended by standard setters (such as the TCFD and PCAF), and regulators (such as the European Commission).

Global equity portfolios, as proxied by the FTSE All-World,[20] saw a modest decline in carbon intensity between 2014 and 2020. The WACI normalized by revenue decreased by 2% p.a. over the past six years,[21] from 173 to 149 tonnes per million USD, with the rate of reductions accelerating to over 5% p.a. over the last three years (see Figures 5 and 6). Other intensity metrics also saw similar long-term trends with Carbon Footprint (see Appendix I) decreasing by 5% p.a. over the last six years.

Figure 5. Carbon intensity, three ways

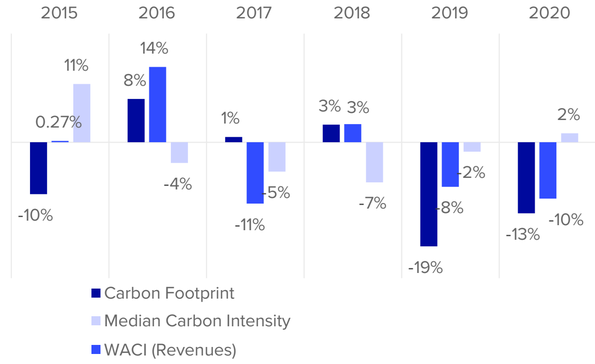
Scope 1 and 2 intensity, FTSE All-World (2014=100)



Source: FTSE Russell, July 2022.

Figure 6. Year-on-year changes in intensities

Annual change in Carbon Footprint, WACI and Median Carbon Intensity



Source: FTSE Russell, July 2022.

18 Carbon Footprint calculates the emissions per USD invested, based on the activities of the proportion of a company the portfolio owns. More details on methodologies and assumptions underlying carbon intensity measures can be found in Appendix II.

19 Janssen, A., Dijk, J., Duijm, P. (2021). Occasional study - misleading footprints final. De Nederlandsche Bank N.V. Retrieved July 31, 2022, from https://www.dnb.nl/media/3n1mbtnj/os-misleading-footprints.pdf; Brightman, C., Kalesnik, V., Polychronopoulos, A., & Shim, J. (2022, July). Carbon intensity for climate mitigation: Clearing up "scaling" confusion: Research affiliates. Retrieved July 31, 2022, from https://www.researchaffiliates.com/publications/articles/924-carbon-intensity-for-climate-mitigation

20 The FTSE All-World Index provides currently comprises of over 4,000 firms from Developed, and Emerging markets. See: https://www.ftserussell.com/products/indices/geisac

21 Revenues (and thus carbon intensity) have been controlled for inflation, adjusted against US GDP deflator for the year 2020.

While following similar trends, different portfolio carbon intensity metrics are often volatile year-on-year. In 2016 and 2017, the WACI rose by 14% and fell by 11%, respectively. Other metrics also demonstrate volatility, though at different times. The portfolio Carbon Footprint22 shows less volatility in 2016 (+8%) and 2017 (+1%) but decreases drastically by 16% p.a. between 2018 and 2020. Differences across portfolio metrics are driven by the dynamics of their respective factors; while WACI can be driven by volatile revenues in carbon-intensive sectors due to commodity price movement, Carbon Footprint is more sensitive to changes in market values of constituent firms (see Appendix II).

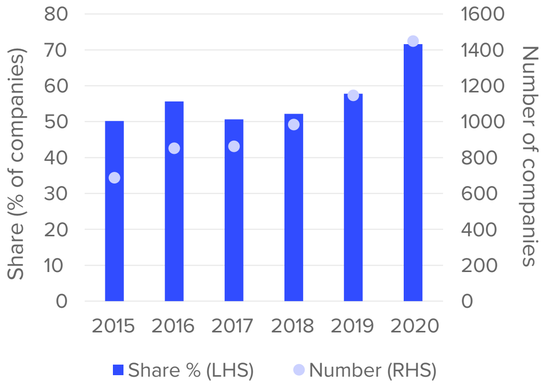
2020 results are heavily impacted by the Covid pandemic. 2020 shows a reduction in both WACI (-10%) and Carbon Footprint (-13%), though this reduction is likely to be short-lived, with emissions expected to rebound to pre-pandemic levels.[23]

Firm level intensities

At the firm level, carbon intensity has decreased at a somewhat slower rate. The Median Carbon Intensity of a firm reporting their carbon emissions decreased at 1% p.a. between 2014 and 2020 and 3% over the last three years, and accelerating to a 2% increase between 2019 and 2020. The share of companies in the index with decreasing emissions has steadily increased, comprising 60% of the constituents that report their emissions already prior to the Covid pandemic (see Figures 7 and 8).

Figure 7. Two thirds of companies that report their emissions see year-on-year reductions

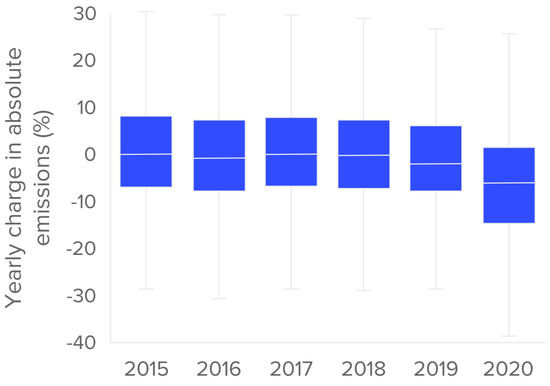
Number of companies reporting emissions with decreasing absolute emissions



Source: FTSE Russell, July 2022.

Figure 8. Recent emissions reductions at company level

Distribution of annual change in absolute emissions for companies reporting their emissions



Source: FTSE Russell, July 2022.

22 The portfolio Carbon Footprint (tonnes per million USD invested) is roughly equivalent to the WACI normalized over EVIC (tonnes per million USD EVIC) rather than revenues (see Appendix II).

23 The conversationalist, Global emissions almost back to pre-pandemic levels after unprecedented drop in 2020, accessed 05/05/2022.

3. What drives changes in carbon intensity of global equities?

As the evolution of carbon intensities in global equities is driven by a complex mix of underlying factors, below we disaggregate the driving factors, with a focus on WACI (results for EVIC are shown in the Appendix, but are directionally similar to those for WACI).

A single company's contribution to the overall portfolio carbon intensity is proportional to its emissions and overall index weight, and inversely proportional to the normalization factor (in this case, revenues). As any of these factors can drive changes in WACI, we base our analysis on the constituent level, assigning changes in the carbon intensity of the FTSE All-World Index to four principal sources.[24]

1. **Carbon emissions of constituent firms**. Key metric to quantify action against climate goals. While firms often have unique issues to consider while reducing emissions, aggregate emissions must halve by 2030 to align with 1.5C temperature goal.
2. **Revenues of constituent firms (normalization factor)**. An approximation of a company's output to contextualize emissions uniformly across firms of different sizes and business exposures. This requires an inflation adjustment to equalize the worth of a dollar across time (see Appendix II for more information).
3. **Weight of constituent firms**. The index weight for each constituent regularly changes due to increases or decreases in a firm's investable market capitalization.[25] If a company's (or sector's) index weight decreases, this decreases the degree to which its carbon intensity contributes to the overall index level intensity.
4. **Constituent firms comprising the index (churn)**. Weights can also change from the addition or removal of individual firms based on meeting (or no longer meeting) the eligibility rules for the index.[26]

After first performing this contribution analysis at the company level by calculating the proportion of log changes for each factor relative to the sum of the intensity changes, we then aggregate to the sector and market level to better understand underlying trends, as shown in Figure 9.[27]

24 See Appendix II for more information on the metric construction and contribution analysis

25 This is a company's full market capitalization adjusted for free float restrictions and foreign ownership limits. See the Glossary of Terms used in FTSE Russell Equity Methodology Documents for further details. Constituent weights in the FTSE All-World are rebalanced semiannually in March and September.

26 These are typically company-driven events (such as IPOs, delistings, mergers or spin-offs), or result from market capitalization changes that result in the addition or removal of the company to the index. But there are also instances where entire countries become eligible for index inclusion (e.g., China A Shares in 2019). Please see the FTSE Global Equity Index Series Ground Rules for further details.

27 Other attribution methods are employed for specialized purposes. While analyzing portfolio returns against a benchmark, asset managers often attribute components of portfolio performance to asset allocation (e.g., towards a sector or asset class) or to the selection of specific securities via a 'Brinson' analysis. This is especially helpful when constituents are not common between the benchmark and portfolio, and is often adapted to decompose portfolio carbon exposures. See: Guido Bolliger, Dries Cornilly. Sustainability Attribution: The Case of Carbon Intensity. The Journal of Impact and ESG Investing Aug 2021, 2 (1) 93-99

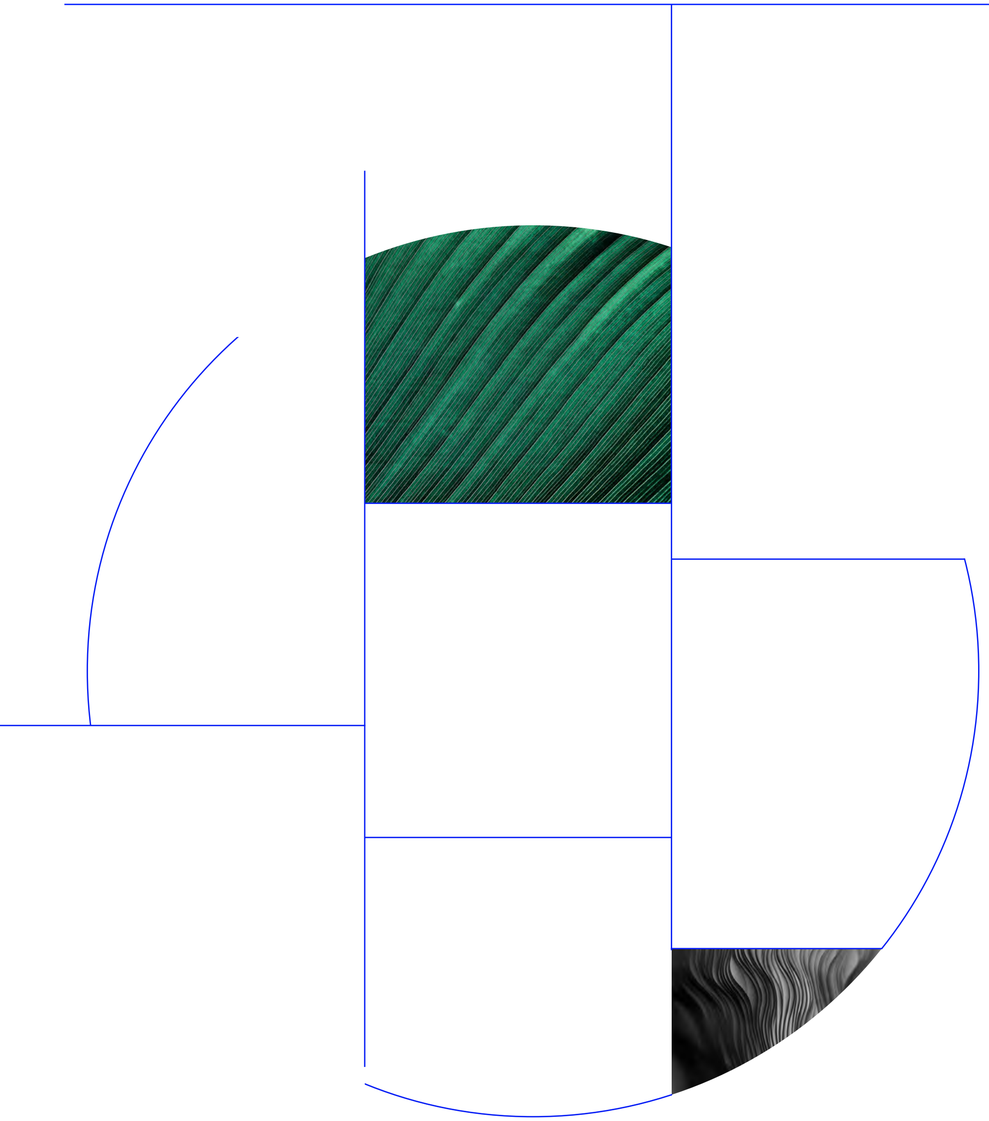
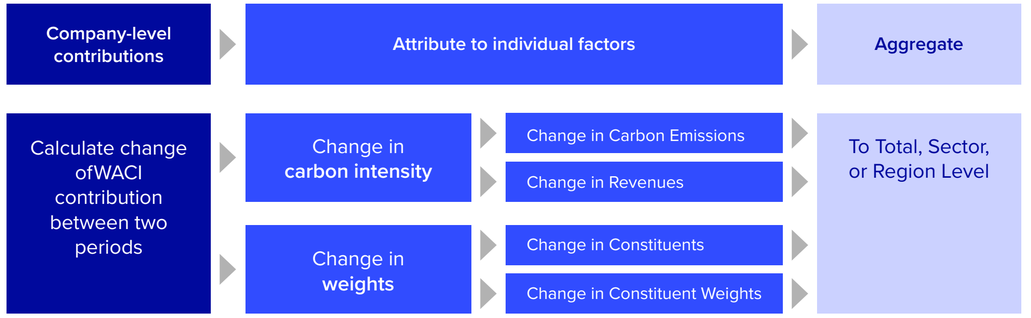


Figure 9. Contribution analysis breaks down factor influences on a constituent level

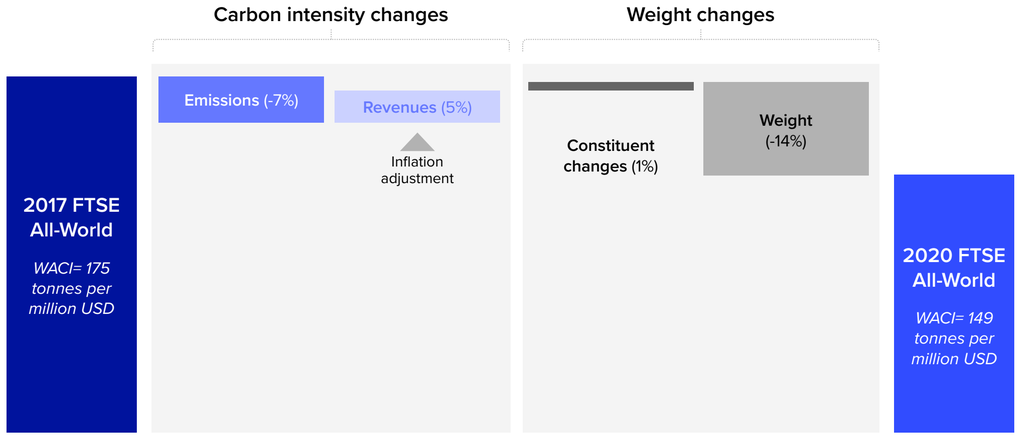
Steps of contribution analysis



Source: FTSE Russell.

Figure 10. Disaggregating portfolio carbon intensity changes

Waterfall of contributors to the change of WACI (2017-2020)[28]



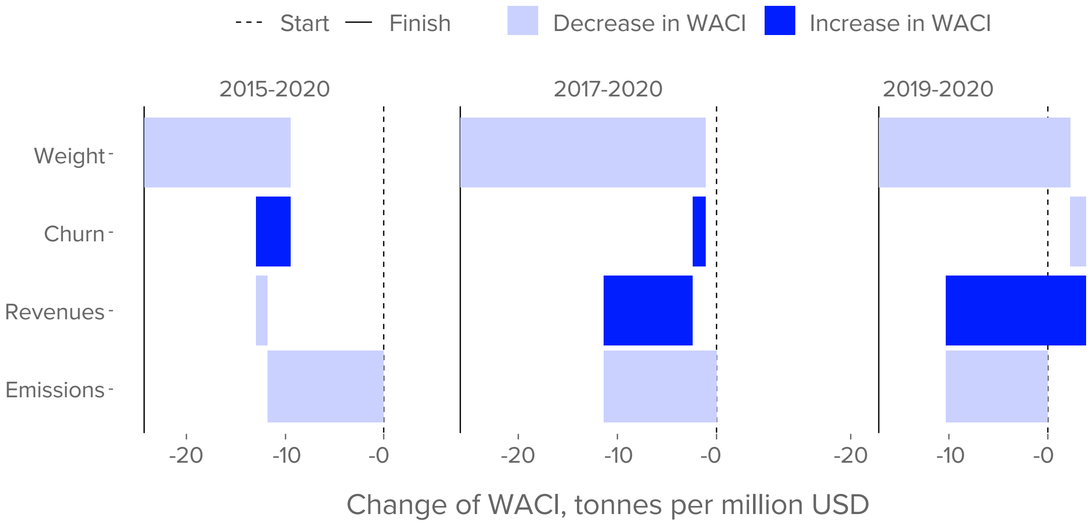
Source: FTSE Russell, July 2022.

28 Chart is not to scale.

On aggregate, reductions in portfolio carbon intensity over the last 3 years have been dominated by changing constituent weights. During 2017-2020, the 17% WACI reduction was predominantly attributed to changes in the weights of constituents (-14%), with reductions in emissions (-7%) broadly offset by a simultaneous reduction in inflation-adjusted revenues[29] (5%), and constituent changes (1%). By contrast, in the last year (as depicted in the right side of Figure 11), changes in carbon intensity of constituents would have increased the portfolio-level WACI by 2%, as declines in emissions were offset by even faster declines in revenues in the same period.[30]

Figure 11. Reduction of revenues contributes more to change in WACI than reduction of emissions

Contribution analysis of sources of annual change in WACI



Source: FTSE Russell, July 2022.

Sectoral contribution

WACI is sensitive to changes in index weights of Industries where emissions are concentrated. The five highest-emitting Sectors account for 76% of emissions intensity but only 10% of the index weight (see Figure 12),[31] with typical intensities of these Sectors reaching over 100 times the typical stock in the investable universe (see Figure 13). Due to these disproportionate intensities, these Industries contribute a larger proportion of the overall portfolio intensity level than would be expected from their portfolio weight (see Figure 14), and thus are responsible for an overwhelming proportion of the yearly changes observed.

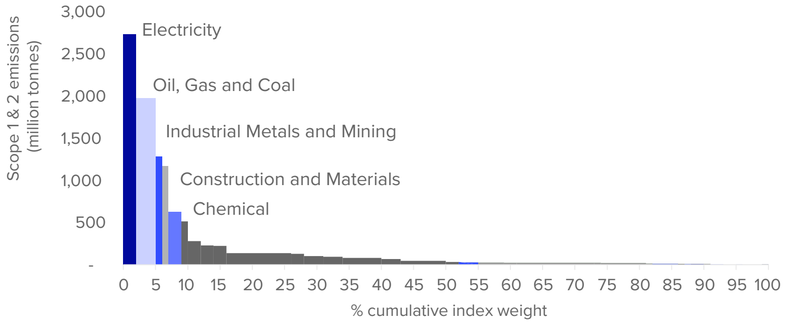
29 See Appendix for more information

30 Aggregate energy revenues decreased by 30% between FY2019 and FY2020, more than the 10% decrease in emissions over the same period, causing carbon intensity to rise.

31 Electricity, Oil, Gas, and Coal, Industrial Metals and Mining, Construction and Materials, and Chemicals are the most emissive Sectors while only considering Scope 1 and 2. It should be noted that if Scope 3 (and especially Use of Sold Products) was considered, Oil, Gas, and Coal would be the most emissive Sector.

Figure 12. Relatively few stocks account for most corporate emissions

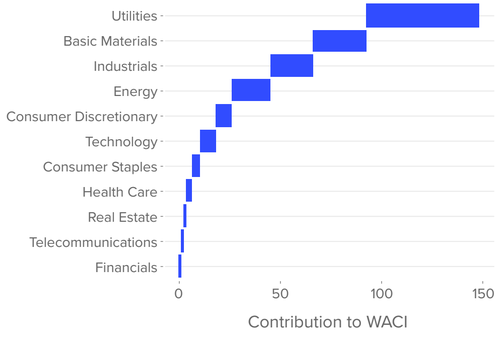
Distribution of Scope 1 and 2 emissions and index weight in the FTSE All-World Index by Sector



Source: FTSE Russell, July 2022.

Figure 13. Carbon-intensive industries constitute the majority of WACI

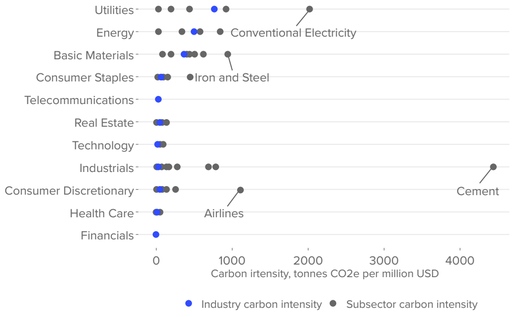
Contribution to WACI of each ICB Industry in 2020



Source: FTSE Russell, July 2022.

Figure 14. Variability in carbon intensity of ICB classifications

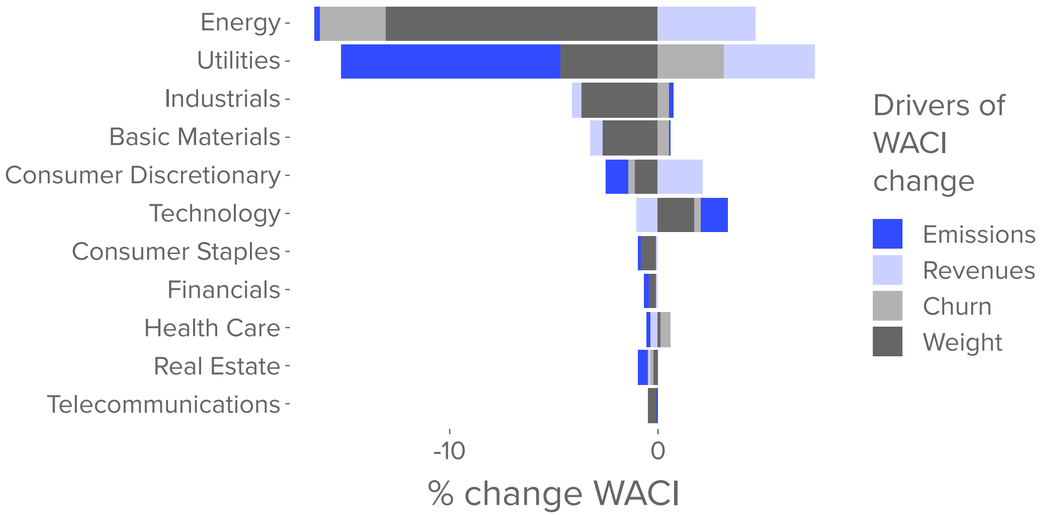
Median intensity for ICB Industries and Subsectors



Source: FTSE Russell, July 2022.

Figure 15. Decarbonization in Utilities and changing index weights driving change in WACI

Contribution analysis of change in WACI, 2017-2020



Source: FTSE Russell, July 2022.

Figure 15 decomposes changes in WACI of the FTSE All-World over three years from 2017 to 2020, enabling us to identify key trends that have been driving changes in the index level carbon intensity:

- The most carbon-intensive industries – Utilities, Energy, Basic Materials, and Industrials – have contributed more than 100% of the decline of the WACI over the last three years.
- However, only in the case of Utilities have actual emissions reductions been the main driver (contributing over 40% of the decline in aggregate index level WACI).[32]
- In Energy, actual emissions reductions played only a very minor role, while Basic Materials and Industrials saw positive contribution from emissions increases. Instead, declining index weights for carbon-intensive industries have been the primary driver, with a particularly pronounced decline in Energy.
- Revenue reduction (linked to lower commodity prices) for Energy and Utilities over the period partially offset the impact from declining weights of these Industries.[33]
- Churn in the Energy Industry made a significant contributor to portfolio intensity reductions. This raises some concerns around potential carbon leakage, with the removal of 40 firms contributing to an almost 2% WACI reduction during 2017-2020 (also see Figure 16).
- Technology was the only Industry to materially increase its contribution to WACI, due to emissions increases in constituent firms and consistent growth in index weight.[34]

32 The WACI for Utilities is decreasing in five out of eight regions with particularly rapid reductions in overall median intensity (-10% annually over the 2015-2020 period).

33 WACI contribution of the Energy Industry is often driven by changes in revenues rather than carbon intensity, with aggregate Energy revenues decreasing by 30% relative to the 10% decrease in emissions between 2019 and 2020, often reflecting fluctuating returns associated with volatile commodity prices. Throughout 2014-2020, changes in oil prices explaining 92% of the change of aggregate revenue observed on an annual basis.

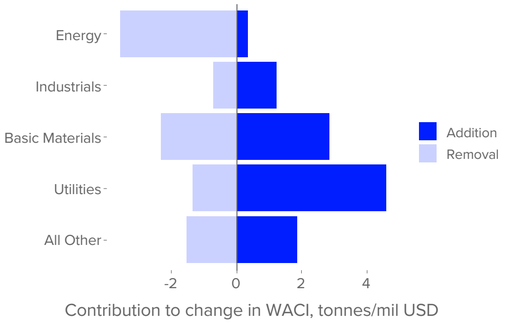
34 As represented in the FTSE All-World Index, 9 out of 11 ICB Industries have shrunk between 2017 and 2020, while the weight of Technology has almost doubled.

Similar conclusions can be drawn for the contribution trends of Carbon Footprint over time, with reductions in EVIC somewhat offsetting reductions in weight for carbon intensive firms (see Appendix).

The large contribution from changing revenues in carbon-intensive industries highlights the importance of volatile commodity prices on portfolio carbon intensity. Though not available for portfolio-level calculations, many investors utilize production-based intensities for Oil and Gas firms to provide sector-specific context of emissions performance (see Appendix), with emissions rates relative to barrels produced showing less than half of the volatility of the revenue-based intensity (see Figure 17).

Figure 16. Delisting of Energy firms contributes to lower portfolio intensity

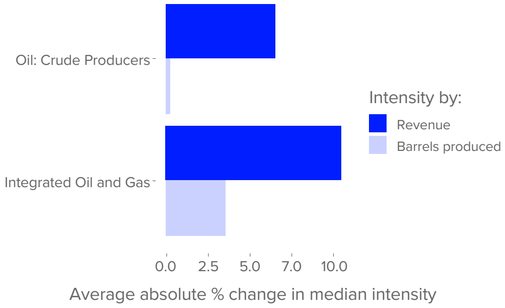
Contribution to WACI from entrants and exits to each Industry from 2017-2020



Source: FTSE Russell, July 2022.

Figure 17. Revenue intensity more volatile than production intensity for oil firms[35]

Average percent change in median intensity from 2014-2020



Source: FTSE Russell, July 2022.

Impacts of recent macroeconomic volatility

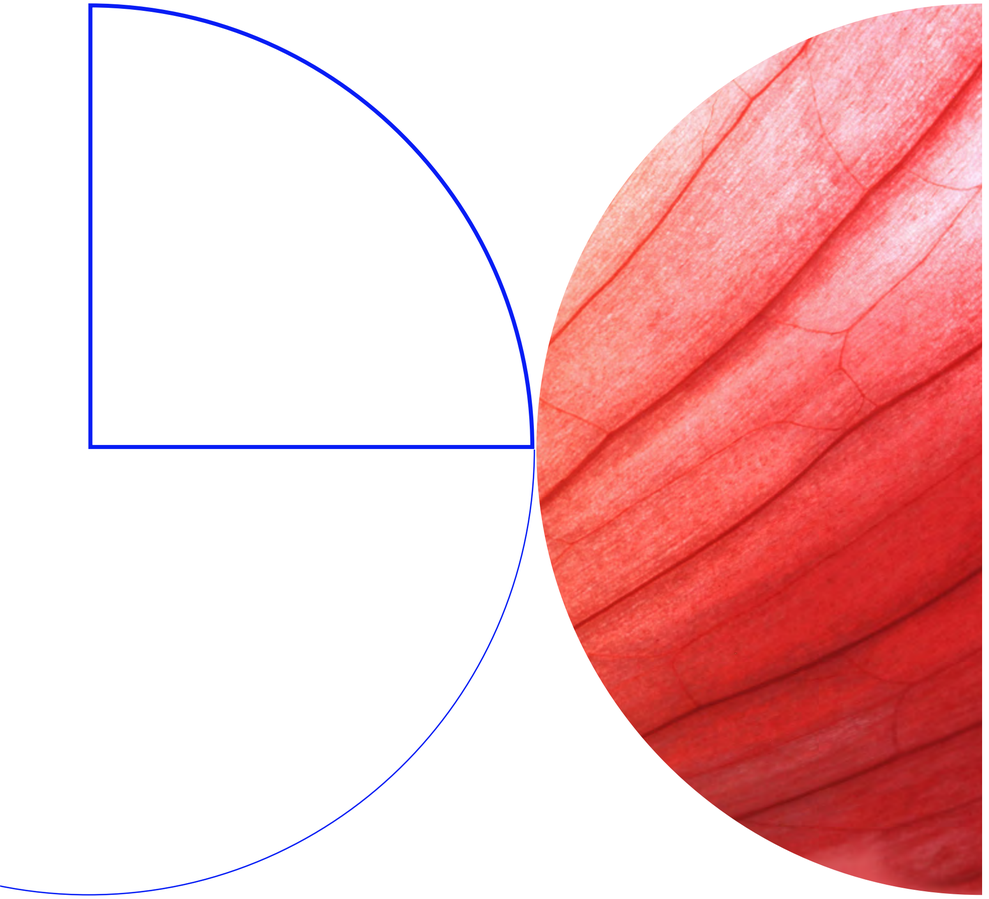
Carbon intensities beyond 2020 cannot be analyzed at the time of writing as we lack a full set of the underlying financial data (for 2022) and emissions data (for 2022 and partially for 2021). However, the available data allows us to draw some preliminary conclusions.

Emissions data is difficult to predict; however, we expect a meaningful rebound as the impact of the Covid contraction abates.[36] Impacts on the other components of carbon intensity – namely, index constituents and weights, as well as company value and revenues – are more straightforward to anticipate.

Broader inflationary pressures and the commodity price rally through 2021 and 2022 will, all else being equal, decrease carbon intensity, through their impact on firm revenues (see Figures 18 and 19). For the median firm in carbon-intensive Industries, such as Energy and Basic Materials, inflation-adjusted revenues are set to increase by 46% and 10%, respectively, between 2020 and 2022. Simultaneously, after eight years of losing market share, high carbon Industries such as Energy and Basic Materials have increased their index weight (by 55% and 8%, respectively) from December 2020 to July 2022, increasing the WACI of the index (all else equal).

35 Calculations include firms reporting Oil and Gas production in the FTSE All-World Index from FY2014 through FY2020. Gas has been converted to Barrels of Oil Equivalent (BOE), assuming 1KCF = 5.8 BOE

36 IEA, Global Energy Review 2021, accessed 05/05/2022.

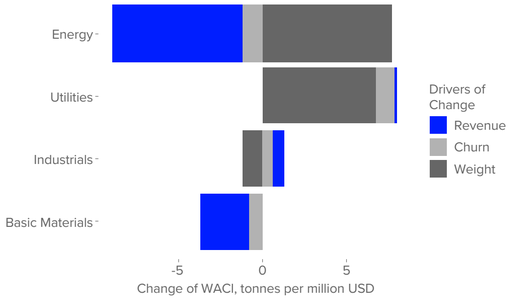


By using the 2022 revenue forecast[37] and market capitalizations and index weights as of end July 2022, we find that these countervailing trends would broadly cancel each other. Holding emissions constant, we project that WACI of the FTSE All-World in 2022 would be relatively similar to 2020, increasing by less than one percent.

For Carbon Footprint (EVIC approximated here by market capitalization, as 2022 numbers only become available in 2023), we project that financial factors will likely contribute to a material decline. As with WACI, higher index weights of carbon-intensive Industries increase the carbon intensity of the index. However, this is likely to be more than offset by the associated increase in market capitalizations (the denominator in the Carbon Footprint calculation) of large emitters.

Figure 18. For WACI, rotation into carbon-intensive sectors is offset by increasing revenues

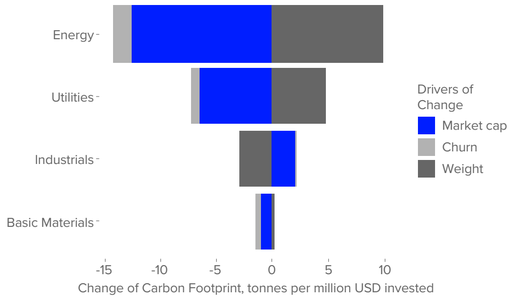
Contribution to WACI 2020-2022, assuming constant emissions



Source: FTSE Russell, July 2022.

Figure 19. For Carbon Footprint, rotation into carbonintensive sectors is offset by increased market cap

Contribution to Carbon Footprint 2020-2022, assuming constant emissions



Source: FTSE Russell, July 2022.

37 If Revenues are not available, analyst estimates for used in their stead; Refinitiv, I/B/E/S Estimates, accessed 05/08/2022.

Appendix I. Data and aggregated metrics

Figure 20. Common metrics for carbon footprinting[38] of FTSE All-World index[39]

	2014	2015	2016	2017	2018	2019	2020
WACI (tonnes per million USD Sales)	173	173	197	175	181	166	149
Aggregate emissions (million tonnes)	9,345	9,026	9,448	10,079	10,475	11,011	10,222
Average Carbon Intensity (tonnes per million USD)	284	310	329	311	310	302	314
Median Carbon Intensity (tonnes per million USD)	36	39	38	36	33	33	33
Carbon Footprint (tonnes per million USD invested)	77	69	75	76	78	63	55
Owned Intensity (tonnes per million USD sales)	230	318	326	288	276	209	214

Figure 21. Regional breakdown of WACI and Median Carbon Intensity (Scope 1 and 2, in 2020) of FTSE All-World Index

	WACI	Median Carbon Intensity	Weight in index
All-World	149	33	100%
North America	130	25	59%
Developed Europe	127	18	16%
Developed Asia	143	40	13%
China	162	37	4%
Emerging Asia ex China	397	77	4%
Middle East & Africa	239	53	2%
Latin America	296	61	1%
Emerging Europe	593	77	0.5%

Figure 22. ICB Industry breakdown of WACI and Median Carbon Intensity (Scope 1 and 2, in 2020) FTSE All-World Index

	WACI	Median Carbon Intensity	Weight in index
All ICB Industries	149	33	100%
Technology	34	17	22%
Consumer Discretionary	49	26	16%
Financials	9	3	14%
Industrials	153	40	14%
Health Care	25	20	11%
Consumer Staples	61	53	7%
Basic Materials	662	435	4%
Telecommunications	34	38	4%
Energy	593	484	3%
Utilities	1836	924	3%
Real Estate	54	33	3%

38 When WACI is taken for a subgroup – such as a particular region or sector – weights are renormalized to obtain a sum of 100% for that subgroup. Therefore, an increasing WACI for a subgroup will indicate either 1) changing carbon intensity of constituents, or 2) increase of weight carbon-intense constituents

39 EVIC data used in the Carbon Footprint calculation have been adjusted for inflation using the methodology outlined in the EU Handbook for Paris Aligned Benchmarks. The inflation adjustment factor is calculated by dividing average annual EVIC by the average EVIC of the previous year. All inflation adjustments have been made relative to the latest year, 2020 in this case.

Appendix II. Calculation of carbon exposure metrics

In addition to differences that can arise from different data sources (e.g., reported carbon data, estimated carbon data, revenues, enterprise value, market cap), and from different methods for reconstructing point-in-time information, there are several methodological choices involved in the construction of carbon exposure metrics, with the main sources of differences highlighted below.

1) Normalization factors are often applied to absolute emissions to obtain carbon intensity, increasing comparability between companies and over time. The most common normalization factors are as follows:

- **Revenues.** Annual revenues generated during the same time period of emissions provide a universal measure of company output or activity across the investable universe. However, revenues are not a perfect proxy for output across sectors, and revenue intensities are sensitive to price changes between sectors or over time (e.g., inflation).
- **Enterprise value including cash (EVIC)**. By dividing emissions by EVIC, the resulting metric links emissions directly to the value of the company an investor owns, rather than tying them to an 'output' metric such as revenues. However, this also exposes the intensity measure to volatility in market valuations, while also rewarding higher debt levels.[40]
- **Physical units**. Carbon intensity in terms of physical production units (e.g., per car or tonne of cement) is often seen as a particularly reliable metric of a company's carbon efficiency. However, these units are sector-specific and will not cover the entirety of the investable universe, limiting the usefulness of physical intensities for inter-sector and portfolio level analysis.[41]

2) Attribution factors dictate the share of a constituent's emissions, which are included in overall portfolio emissions figures. Where intensity metrics (e.g., WACI) often attribute emissions from each company based on their weight in the portfolio, other metrics calculate the proportion of a firm's activities owned by a portfolio, by dividing the amount invested by total market value of the firm and attributing this proportion of the firm's emissions to the portfolio. The most common attribution factors are as follows:

- **Weight**. A simple multiplication of portfolio or index weight to the quantity in question.
- **Ownership by market capitalization**. As determined by USD invested as a percentage of firm market value. Current value of the equity, but not viable for fixed income. Allows alignment of individual firms with point-in-time market estimates.
- **Ownership by EVIC**. EVIC is equivalent to market capitalization plus debt (cash is kept, avoiding negative values). Point-in-time estimates can be misaligned with respect to market volatility, as EVIC values are typically taken for the end of the fiscal year for individual firms.

3) Inflation adjustments can increase comparability when the meaning of financial values drifts over time. The most common inflation adjustments are as follows:

- **Asset Values**. As asset values (e.g., market capitalization or EVIC) are generally volatile year over year, the EU Handbook for Paris Aligned Benchmarks[42] suggests that EVIC can be adjusted by dividing the average EVIC of the current year by that of the previous year.
- **Revenues**. As purchasing power decreases over time, the value of a constant amount of revenues declines – thus changing the interpretation of carbon efficiency (or carbon intensity by revenues). This can be adjusted either relative to individual currencies, or by converting all revenues to USD and applying a GDP deflator to the overall time series. Despite these adjustments, revenues – especially for commodity driven sectors like Oil and Gas – can show significant volatility as seen in the commodity volatility throughout 2022.

40 Enterprise value is normally calculated by adding Net Debt to the Market Capitalization, which involves the subtraction of Cash and Short-Term investments from the balance sheet. It is often recommended to keep cash to avoid negative numbers when normalizing for emissions, however by including cash – a company taking on more debt and cash on the balance sheet will, by definition, increase its EVIC thus decrease its resulting carbon intensity.

41 Sector-specific targets can still offer insights into alignment of significant portions of a portfolio's emissions. Many investor-backed groups are specifying the setting of sector-specific targets – often calibrated according to relevant Sectoral Decarbonization Pathways. UNconvened Net-Zero Asset Owners Alliance, 'Target Setting Protocol', accessed 27/04/22.

42 EU Handbook of Paris-Aligned Benchmarks, accessed on 22nd July 2022.

Figure 23. Carbon Exposure Metrics

Description and mathematic formula for carbon exposure metrics

	Description	Formula
Carbon Emissions Intensity	Normalized rate of carbon emissions per unit of economic activity. Typically, economic output indicators are used to normalize emissions. In portfolio level calculations, we use either net revenues or market value (e.g., market capitalization or EVIC) Physical production units can also be used to normalize emissions where relevant in certain sectors (e.g., Energy Utilities, Cement Steel, Oil and Gas, Coal)	Carbon Emissions Intensity = $\frac{E_k}{S_k}$ Where E_k is the annual carbon emissions of company k and S_k is the annual output of company k.
Aggregate Emissions Intensity	Total emissions divided by total revenues of all investee firms	Aggregate Emissions Intensity = $\frac{\sum_{k=f}^{n} E_k}{\sum_{k=f}^{n} S_k}$ Where Ek is the annual carbon emissions of firm k, and S_k is the annual output of firm k.
Weighted Average Carbon Intensity (WACI)	Portfolio level average of carbon intensity (by revenues) of investee firms, weighted by portfolio exposure	$WACI_{Revenue} = \sum_{k=f}^{n} W_k \frac{E_k}{R_k}$ Where Ek is the annual carbon emissions of firm k, R_k is the annual net revenues of firm, and W_k is the weight of firm k in a portfolio such that $\sum_{k=f}^{n} W_k = 1$
Carbon Footprint	Total emissions owned by portfolio through its investee firms, per million USD invested.	Carbon Footprint = $\frac{\sum_{k=f}^{n} \left(\frac{(W_k * AUM)}{EVIC_k} * E_k \right)}{AUM\ (\$M)}$ Where Ek are the carbon emissions of firm k and $EVIC_k$ is the enterprise value including cash of firm k.[43]
Owned Intensity	Total emissions owned by a portfolio divided by total revenues owned by a portfolio.	Owned Intensity = $\frac{\sum_{k=f}^{n} \left(\frac{(W_k * AUM)}{MarketCap_k} * E_k \right)}{\sum_{k=f}^{n} \left(\frac{(W_k * AUM)}{MarketCap_k} * S_k \right)}$ Where Ek are the carbon emissions of firm k, and S_k is the annual output of firm k, and $MarketCap_k$ is the market capitalization of firm k.[44]

43 EVIC is adjusted for annual change in average asset prices according to the methodology outlined in Appendix III. Along with other reported financial data such as revenues, EVIC is taken as of the end of each company's fiscal year.

44 Market capitalization is sampled at the end of each calendar year.

Appendix III. Contribution analysis

Contributions to change in WACI are calculated by taking the logarithmic change of individual factors (index weight, carbon emissions, revenues). The contribution to change in WACI from emissions ($CE_{k,t}$) between time **t** and **t-1** for a constituent **k** with greater than 0 index weight ($W_{j,t}$, $W_{j,t-1}$) is given by:

$$CE_{k,t} = \frac{ln\left(\frac{E_{k,t}}{E_{k,t-1}}\right)}{ln\left(\frac{W_{k,t}}{W_{k,t-1}}\right) + ln\left(\frac{E_{k,t}}{E_{k,t-1}}\right) - ln\left(\frac{R_{k,t}}{R_{k,t-1}}\right)} * \left(W_{k,t}\frac{E_{k,t}}{R_{k,t}} - W_{j,t-1}\frac{E_{k,t-1}}{R_{k,t-1}}\right)$$

Where $CE_{k,t}$ is contributions to change in WACI from emissions from constituent k at time t, $E_{j,t}$ is yearly carbon emissions, $R_{k,t}$ is annual revenues, and $W_{k,t}$ is index weight.[45] Similar calculations are done for contributions from weight and revenues. If index weight is 0 for either t or t-1, changes in WACI are assigned to index churn.

Figure 24. Waterfall of contributors to the change of Carbon Footprint

Contribution analysis of change in Carbon Footprint, 2017-2020[46]

Source: FTSE Russell, July 2022.

45 In the unlikely event that changes in individual factors exactly cancel (change of contribution to WACI is 0), the relative contributions of individual factors will also be 0.

46 Chart is not to scale.

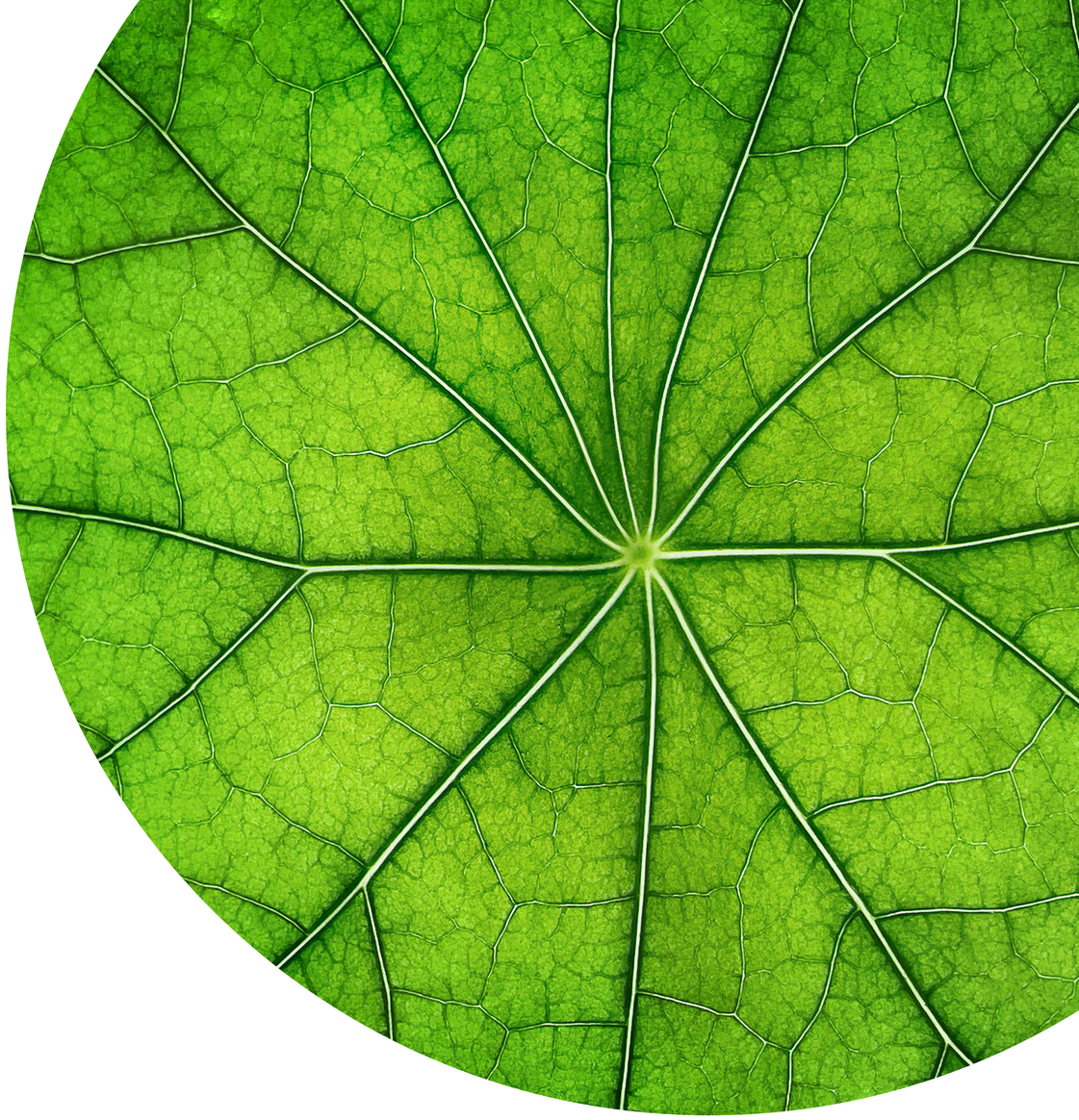
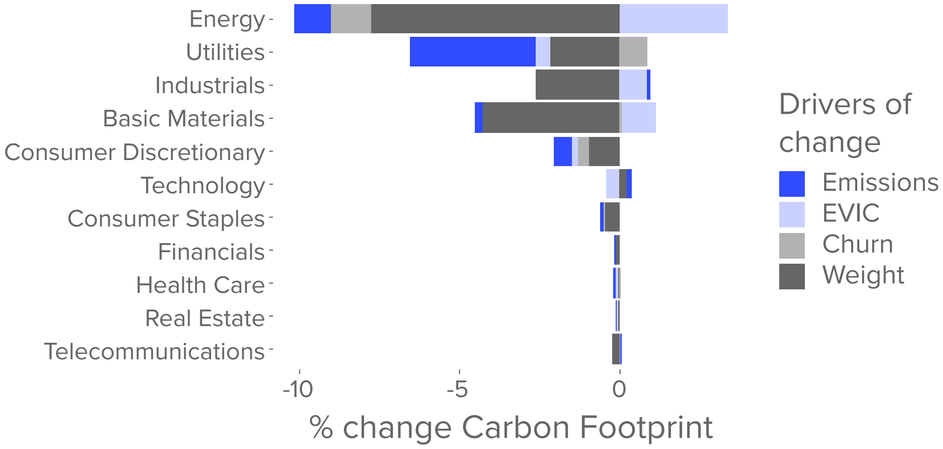


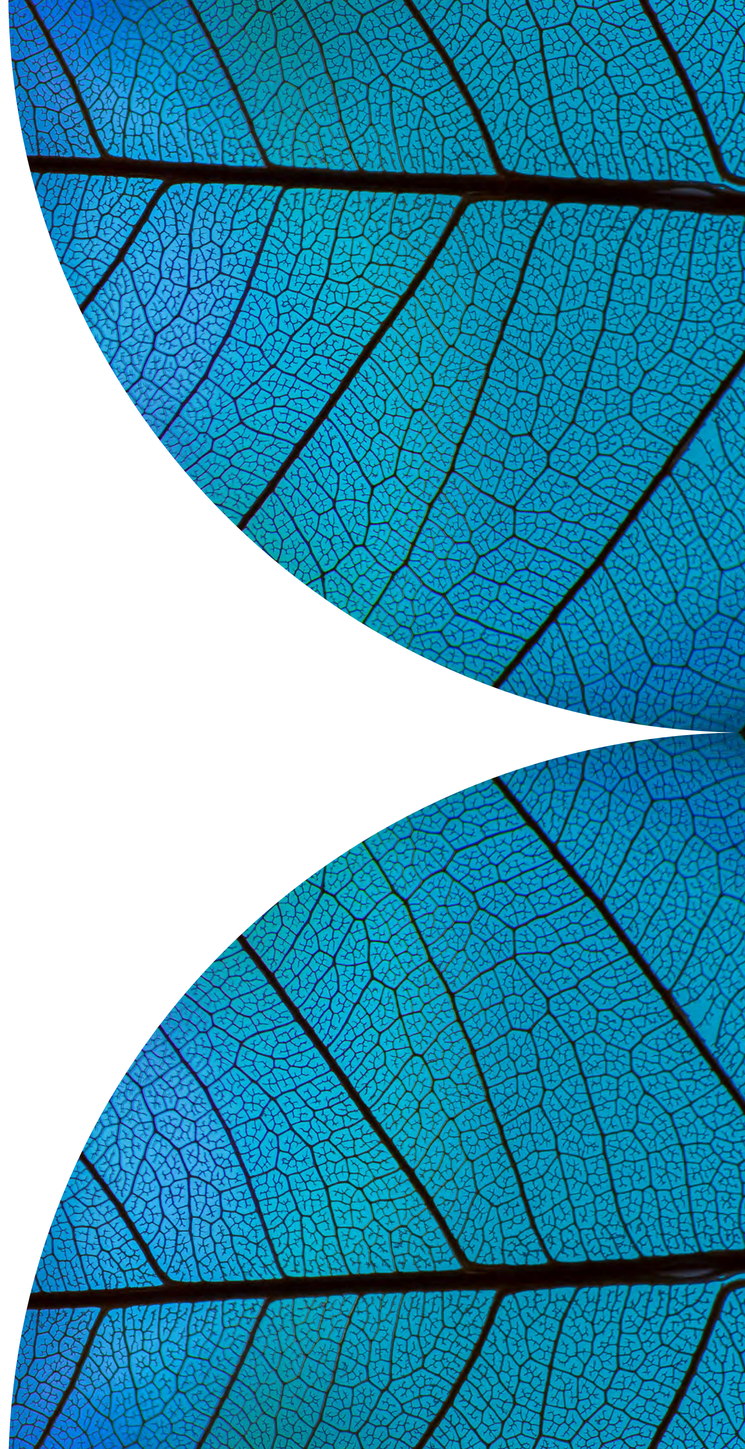
Figure 25. Decarbonization in Utilities and changing index weights driving change in Carbon Footprint

Contribution analysis of change in Carbon Footprint, 2017-2020



Source: FTSE Russell, July 2022.

Appendix IV. Data sources



Financial data

Company-level financial data are sourced from WorldScope as inputs into carbon intensity calculations and estimation strategies. This includes the following metrics:

- EVIC
- Revenue
- Segment revenues (see business segment taxonomy, below)

Revenue estimates for FY2022 were retrieved from I/B/E/S.

Reported emissions

Scope 1 and 2 emissions data are sourced from company disclosures (e.g., annual reports, CSR reports) and CDP annual surveys. Scope 2 location-based emissions are used as a default over market-based emissions. Location-based emissions are a more consistent proxy for electricity usage by operations,[47] and reflect changes in the underlying electricity mix of the grid and efficiency of company operations.[48] In the specific case of Real Estate Investment Trusts (REITs), emissions data from property portfolios is preferred over the REIT's office emissions alone.

We ask issuers to review the emissions data that we have collected and provide comments if they believe the information is incorrect or incomplete. We review all company feedback and incorporate changes to our dataset where appropriate. Subsequently, all reported data are quality checked for incorrect units, extreme observations and minimum boundary conditions of the observations. As part of this process, a small number of reported datapoints (less than 1 in 200) are typically corrected or screened out.

Scope 1 and 2 emissions data are winsorized at the 5% most extreme observations in terms of carbon intensity for a given fiscal year and Supersector (ICB2). Thus, carbon intensity observations lower than the 5th percentile or greater than the 95th percentile are set to the value of the 5th or 95th percentile respectively. The carbon emissions values are then rederived from the new carbon intensity value by multiplying by net revenue.

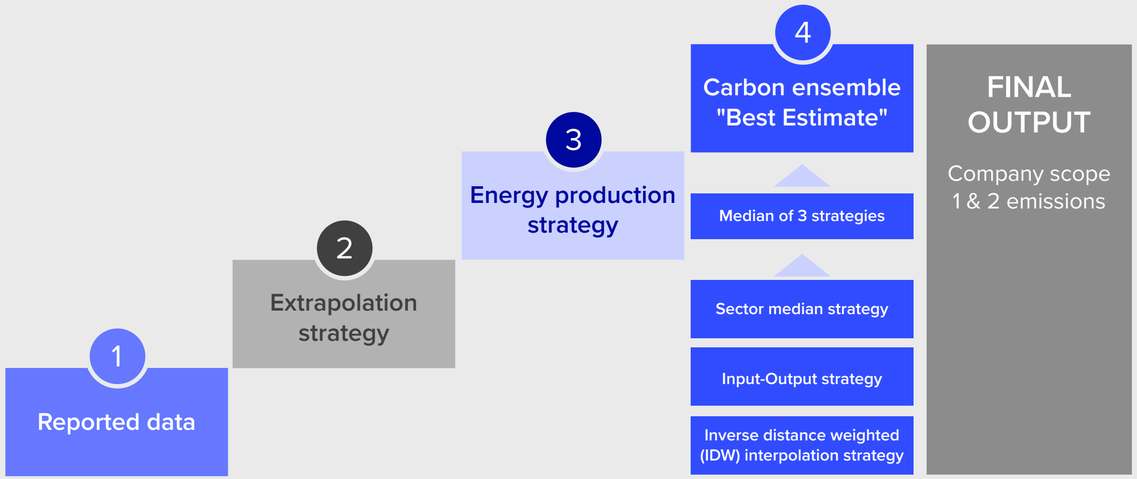
Estimated emissions

In practice, calculations are based on both reported and estimated data sourced from the FTSE Russell Hierarchical Multi-model framework (see details below). Due to lags in the publishing of company reported carbon numbers, we are currently utilizing fiscal year 2020 as our most recent disclosed sample.

47 Matthew Brander, Michael Gillenwater, Francisco Ascui. Creative accounting: A critical perspective on the market-based method for reporting purchased electricity (scope 2) emissions. Energy Policy, Volume 112, 2018, Pages 29-33.

48 Location-Based Scope 2 emissions use grid-average emissions factors to calculate emissions from electricity consumption, whilst market-based figures use emissions factors based on contractual energy purchase (e.g., via renewable energy credits or power purchase agreements).

Figure 26. FTSE Russell hierarchical carbon model process uses general estimation models as a last option[49]



Source: FTSE Russell.

Extrapolation strategy

If emissions data are no longer disclosed, company reported data from previous years are extrapolated to the current year assuming constant carbon intensity over time. In other words, previously reported carbon intensity is multiplied by current revenues to derive an emissions estimate. For this purpose, we consider up to three years of data, selecting the most recent available disclosure.

Energy Production strategy

For the Utilities Industry, the Energy Production approach estimates company carbon emissions by applying emissions factors (i.e., emissions per unit energy) to corporate reported energy production. Where a company reports a breakdown of the fuel sources it has used to generate energy (e.g., coal, gas, or hydroelectricity), emissions factors used to generate absolute emissions figures from each source are summed to produce an aggregate emissions total from energy generation.

Emissions factors are derived from the IPCC emissions factor database, using the life cycle emissions factor for each resource as the more consistent and conservative value. Energy sources considered include:

- Fossil Fuels - Coal, Oil, Gas and/or Combined Cycle Gas Turbines
- Hydroelectric
- Renewables - Wind, Solar, Geothermal, Biomass, Overall renewables (if not otherwise broken down)

49 FTSE All-World index constituents as at 31/12/2020. Estimated data is generated based on FTSE Russell's hierarchical estimation mode outlined. Calculations consider Scope 1 and 2 quantities separately.

Carbon Ensemble “best estimate”

Common approaches to estimating corporate carbon emissions draw on a range of inputs and statistical techniques. Most frequently, a company’s sector and region of operation, its reported financial metrics, and the emissions of peer firms are considered through an array of methods (e.g., simple peer comparisons, linear regressions) to generate an estimation of a company’s carbon intensity. Another common technique derives the carbon intensity of industrial activities from environmentally extended input-output (EEIO) tables rather than reported emissions figures.

There is overlap in the core steps followed by common estimation strategies. For example, most strategies rely on a sector mapping or revenue classification to appropriately designate a peer group for the firm. However, strategies differ in their statistical method, use of disclosed data, and how they classify and partition these industrial activities. Their effectiveness varies on a sector-to-sector and company-to-company basis, depending on the sector diversity and company activities, or how well strategies model the business context of a given firm.

The FTSE Russell Carbon Ensemble Model is the median of the Sector Median, Interpolation, and Input-Output strategies on the level of company and emissions scope. If a value for one or more of the strategies is not available, the median will be completed on the remaining values.

Sector taxonomies

FTSE Russell’s Industry Classification Benchmark[50] (ICB) is used to create peer groups for the Sector Median estimation strategy, as well as in the winsorization of extreme values.

Business segment taxonomy

Two business segment mappings, US SIC[51] and NACE taxonomies, are utilized to make use of multiple third-party data providers. By default, we utilize US SIC taxonomy to define business segments and segment revenues are sourced by WorldScope. Exiobase, provider for the input-output data, uses NACE taxonomy to map business activities. We use an internal conversion table to map estimated intensities by NACE code to SIC code.

Environmentally extended input-output (EEIO) tables

We use the Exiobase3 table to create Scope 1 and 2 business activity carbon intensities for the input-output strategy and energy-source based emissions intensities for the Energy Production model. Exiobase is a “multi-regional environmentally extended input-output table” (MRIOT-EE) derived from national resource-usage tables.[52] Exiobase uses its own product and industry classification, with any given industry producing one or more different products.

Inflation adjustments

Inflation adjustments have been made in carbon exposure metrics wherever necessary to eliminate the bias of inflation in trend analysis for carbon intensity. Currency and asset inflation adjustments have been made to revenues and EVIC, respectively.

- Values for carbon intensity have been adjusted against the US GDP deflator as retrieved from the World Economic Outlook database of the International Monetary Fund.[53] Company-specific revenue data are converted to USD according to the local, point-in-time exchange rate.
- The EVIC adjustment factor is calculated by dividing the average EVIC of the equity universe by that of the average EVIC of 2020, as suggested by the Climate Benchmark Handbook of the EU Commission.[54]

50 Industry Classification Benchmark (ICB), FTSE Russell, accessed 10/03/2022.
51 Standard Industrial Classification (SIC) Manual, Occupational Safety and Health Administration, accessed 10/03/2022
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Regional classification information

We assign companies to a region to create peer groups for several estimation strategies - the Sector Median and Regression strategies. For this, we largely align our regional definitions with those used within the FTSE Global Equity Index Series,55 but combine classifications for Japan, China, Asia Pacific, ex China and ex Japan to create a larger set of reported data for these regions where disclosure is often more limited.

Figure 27. Regional aggregation

Developed Europe	Emerging Europe	North America	Latin America	Developed Asia	Emerging Asia ex China	Middle East & Africa
Austria	Czechia	Canada	Brazil	Australia	India	Egypt
Belgium	Greece	United States	Chile	Hong Kong	Indonesia	Israel
Denmark	Hungary		Colombia	Japan	Malaysia	Qatar
Finland	Russia		Mexico	Korea	Pakistan	Saudi Arabia
France	Turkey		Peru	New Zealand	Philippines	South Africa
Germany				Singapore	Taiwan	UAE
Ireland					Thailand	
Italy						
Netherlands						
Norway						
Poland						
Portugal						
Spain						
Sweden						
Switzerland						
United Kingdom						

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