Index Insights

Sustainable Investment | Factor

SI indexes: Top-down targets or bottom-up aesthetics?

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Introduction

A debate is brewing as to whether headline (or "top-down") Sustainable Investment (SI) targets, such as carbon emission reductions or ESG uplifts, are inconsistent with stock level (or "bottom-up") conditions required for successful corporate engagement.

In this paper, we present a transparent portfolio construction technique that:

- Allows multiple and precisely set portfolio level SI targets to be achieved
- Has the flexibility to include various stock level constraints and exclusions
- Retains a simple relationship between stock weighting and SI characteristics that is essential for engagement purposes.

Contents

1. Introduction

Investors are increasingly focused on the Sustainable Investment (SI) characteristics of their portfolios. As the SI landscape evolves, it has become clear that, while individual stocks may be excluded or underweighted for engagement purposes [4], portfolio-level attributes such as carbon emission reductions and green revenue uplifts must be explicitly targeted and reported. Furthermore, the introduction of Paris Aligned Benchmarks (PAB) and Carbon Transition Benchmarks (CTB) means that these index level quantities will be required to have precisely set values [3].

The aim of this note is to address the debate as to whether headline (or “top-down”) portfolio-level targets are necessarily inconsistent with stock-level (or “bottom-up”) conditions required for successful corporate engagement. In other words, is it possible to target multiple portfolio outcomes and retain the relationship between portfolio weights and scores necessary for engagement? The answer to this is, as always, a function of portfolio construction.

It is well known that optimized methods can be used to deliver a portfolio or index-level outcome such as a tracking error target, subject to a set of constraints. However, due to their “black box” nature, it is less clear that SI characteristics of individual stocks can be readily attributed to the resulting set of portfolio weights. Indeed, this type of portfolio may overweight certain stocks for perfectly valid reasons from a top-down perspective, which are viewed as undesirable in terms of their SI characteristics. Such “portfolio aesthetics” can of course be folded into the solution by imposing stock-level constraints. The drawback with this additional level of complication is that it moves us further away from an intuitive understanding of how the portfolio allocates weight.

An alternative method of portfolio construction that allows multiple portfolio-level targets to be set in a way that is consistent with stock-level (or “bottom-up”) aesthetics, is the target exposure methodology [1, 2, 5]. In contrast to optimized methods, the ability to transparently attribute portfolio weights is retained, with no loss in the ability to satisfy multiple portfolio and stock-level objectives. Essentially, since this technique builds from the bottom-up, all stock, industry and country-level constraints may be folded into the construction process in a simple manner that is consistent with top-down/portfolio-level targets.

The structure of this discussion is as follows. In Section 2, we create a simple tilted index that not only reduces the aggregate portfolio level of a single SI characteristic relative to its benchmark but also results in outcomes that are consistent with engagement at the stock-level. In Section 3, we construct a more complex index that targets two SI portfolio outcomes and demonstrate that potential engagement is now more nuanced, with a composite of the SI scores now explaining portfolio weightings at the stock-level. In Section 4, we demonstrate how the index constructed in the previous section may be modified should stock specific rules be required. In Section 5, we confirm that the portfolio-level targets and desired stock-level characteristics are maintained when ESG exclusions are added to the index created in section 4. We draw our conclusions in Section 6.

2. Targeting one SI portfolio objective

We begin with an index that targets a 50% reduction in the index level of carbon emissions intensity relative to a benchmark represented by the FTSE USA Index. The index is constructed by multiplying the benchmark market capitalization weights by a carbon emissions intensity score that overweights (underweights) stocks with relatively low (high) carbon emissions:

$$W = M * {S_{Em}}^{p} \quad (1)$$

Here M represents a vector of market capitalization weights, S_{Em} is a positive score that increases with the emissions intensity of stocks and W is the final set of index weights. The exponent p controls the strength of the tilt, and therefore the degree of emission reduction. Typically, p will be negative in order to tilt away from stocks with high emissions and vary through time to achieve the 50% emission reduction target. In addition, to ensure the resulting index remains practical from an implementation perspective, we limit the maximum stock weight to the minimum of 10% and 10 times the market capitalization weight and remove stock weights of less than half a basis point. For more details on the "Target Exposure" construction approach and emissions intensity definitions, see [1] and [7] respectively.

Table 1 displays simulated results for the resulting "Low Emissions Index" based on the FTSE USA universe.

Table 1: Summary Statistics for the Low Emissions Index

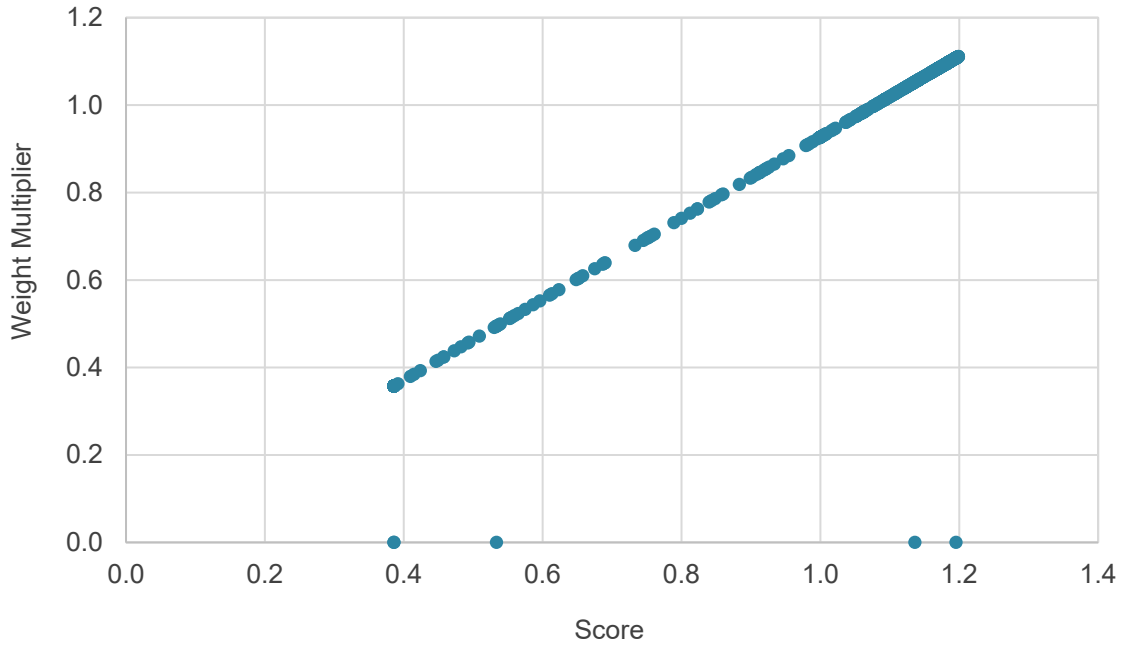
	FTSE USA	Low Emissions Index
Performance		
Geometric Mean (%p.a.)	12.49	13.20
Volatility (% p.a)	18.14	18.25
Tracking Error (% p.a.)		0.66
Implementation		
Two Way Turnover (% p.a.)		9.48
Capacity (%)	100.00	96.14
Diversification		
Effective N	145.00	124.00
SI Characteristics		
Emission Reduction (%)		50.01
ESG Uplift		0.88

Source: FTSE Russell. Trucost data based on the FTSE USA Universe from September 2014 to February 2021. Performance shown for the Low Emissions Index is hypothetical and for illustrative purposes only. Past performance is no guarantee of future results. Please see the end for important legal disclosures.

The utility of this construction approach lies in the simple relationship between stock weights and carbon emissions intensity. Figure 1 demonstrates this by plotting the weight multiplier of the constituent stocks against their emissions intensity score "$S_{Em}{}^{p}$." Here the "weight multiplier" is the ratio of the Low Emissions Index weight to benchmark weight. Note that since the tilt strength is negative, the higher this score is, the lower the carbon emissions intensity. This linear relationship is a suitable tool for engagement because there is a direct relationship between carbon emissions intensity and index weights.

The four stocks with a zero-weight multiplier are those that have fallen below the minimum weight threshold of half a basis point, and therefore have had their weights set to zero.

Figure 1: Relationship between Carbon Emissions Score and Weight Multiplier for the Low Emissions Index



Source: FTSE Russell. Data based on the FTSE USA Index as of September 2020 review.

Table 2 illustrates how this feeds through to the active weights by emission intensity quartile, where Quartile 1 contains stocks with the lowest carbon intensity levels. As expected, the index overweights stocks in the least carbon intensive quartile, and underweights stocks in the most carbon intensive quartile.

Table 2: Active Weights for the Low Emissions Index by Carbon Emission Intensity Quartile

	Carbon Emission Intensity Quartiles				
	1	2	3	4	All
Active Weight	3%	2%	1%	-6%	0%

Source: FTSE Russell. Data based on the FTSE USA Index as of September 2020 review.

3. Targeting multiple SI portfolio objectives

Now consider two SI characteristics – low carbon emissions and ESG ratings [6]. We target the same 50% reduction in the index level carbon emissions intensity, and add a 20% increase in weighted average ESG ratings relative to the benchmark. We achieve this with an additional tilt towards higher scoring ESG stocks:

$$W = M * {S_{Em}}^{p} * {S_{ESG}}^{q} \quad (2)$$

where S_{ESG} is a positive score that increases with an increasing ESG score. The strengths of the tilts, p and q, are chosen to result in weights such that both index objectives are satisfied.

Table 3 displays simulated results of the resulting ESG Low Emissions Index. Note that the additional uplift in the ESG index level rating is achieved at the expense of higher tracking error, turnover and portfolio concentration compared to the Low Emissions Index in Section 2 that targeted a reduction in emission intensity alone.

Table 3: Summary Statistics for the ESG Low Emissions Index

	FTSE USA	ESG Low Emissions Index
Performance		
Geometric Mean (%p.a.)	12.49	13.16
Volatility (%p.a.)	18.14	18.44
Tracking Error (%p.a.)		1.87
Implementation		
Two Way Turnover (%p.a.)		27.56
Capacity (%)	100.00	60.85
Diversification		
Effective N	145	63
SI Characteristics		
Emission Reduction (%)		50.10
ESG Ratings Uplift (%)		20.08

Source: FTSE Russell. Trucost data based on the FTSE USA Index from September 2014 to February 2021. Performance shown for the ESG Low Emissions Index is hypothetical and for illustrative purposes only. Past performance is no guarantee of future results. Please see the end for important legal disclosures.

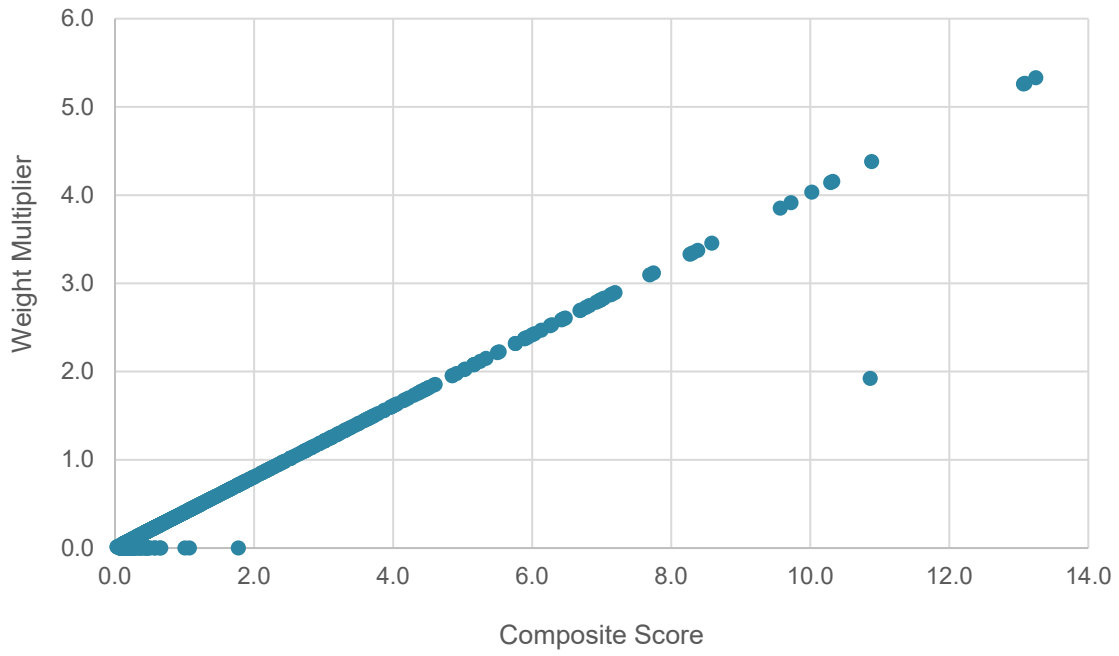
The extent to which stocks are over or underweighted is now determined by a combination of two competing SI characteristics – the ESG rating and emissions intensity measure. Figure 2 plots the weight multiplier of the constituent stocks against a composite score of the emissions intensity and ESG rating given by "${S_{Em}}^{p} * {S_{ESG}}^{q}$." Engagement around stock weighting for this index can now be achieved through its linear relationship to this composite score.

In this approach, stocks with weight multiplier less than one get penalized for their poor SI properties while those with weight multiplier greater than one are being rewarded for their favorable SI properties. The latter reward is only possible when a quantitative score is used to

determine the overweighting and is not possible when SI screens are used merely to remove stocks [8]. This highlights the limitations of such a purely exclusionary approach.

Again, stocks with a zero multiplier are those that have fallen below the minimum weight threshold. The single stock that sits apart from the trend line has a benchmark market capitalization weight of approximately 5%. Its weight adjustment factor is therefore limited to approximately two in order to satisfy the maximum stock weight constraint of 10%.

Figure 2: Relationship between Carbon Emissions + ESG Ratings Composite Score and Weight Multiplier for the ESG Low Emissions Index



Source: FTSE Russell. Data based on the FTSE USA Index as of September 2020 review.

It is instructive to examine how the additional objective of improving the ESG rating of our index has affected its stock weightings. Table 4 is a matrix that shows active weight grouped into quartiles by emissions intensity and ESG rating. In particular, to achieve the required ESG uplift, stocks in the top quartile of ESG ratings that are also in the top two high emissions intensity quartiles, are overweighted. Technically speaking, this is because these stocks have a higher-than-average composite emissions intensity and ESG rating score. From a holistic viewpoint such stocks are beneficial, since although they are “dirty,” their excellent ESG ratings more than compensate for this.

In general, this approach is more nuanced than merely stipulating that only high ESG stocks and low emissions stocks should make it into a portfolio or should have positive active weights. Here we accept that there is a trade-off when scores of competing objectives are in conflict.

Table 4: Active Weights for the ESG Low Emissions Index by Carbon Emission Intensity and ESG Rating Quartiles

		Carbon Emission Intensity Quartile				
		1	2	3	4	All
ESG Rating Quartile	1	-3%	-4%	-3%	-3%	-13%
	2	-3%	-3%	-6%	-3%	-15%
	3	-1%	-2%	-2%	-2%	-8%
	4	11%	16%	6%	2%	35%
	All	5%	6%	-5%	-6%	0%

Source: FTSE Russell. Data based on the FTSE USA Index as of September 2020 review.

However, it may be that overweighting high emission intensity stocks with favorable ESG scores is unacceptable – this would be the case if engagement on carbon emissions were a priority. In the next section, we demonstrate how this may be addressed.

4. Stock Specific Constraints

Suppose that we now wish to impose a constraint on our ESG Low Emissions index such that stocks in the top two high emission intensity quartiles cannot be overweighted relative to the benchmark. How should we do this while retaining attributional transparency?

It turns out that it is relatively simple to do within the tilt framework. We apply an additional "maximum weight tilt" that ensures that no stock in the top two emission intensity quartiles can have positive active weight:

$$W = M * {S_{Em}}^{p} * {S_{ESG}}^{q} * S_{Max\,W} \quad (3)$$

Broadly, whenever a stock in the top two emission intensity quartiles attains a weighting greater than the benchmark weight due to its relatively high ESG rating, applying the maximum weight tilt $S_{Max\,W}$, restores the weight back to the benchmark weight. Note that applying this correction to facilitate engagement on highly polluting stocks does not break the relationship between the composite SI score and weight of other stocks.

The resulting "ESG Low Emissions Capped Index" properties are shown in table 5. Note that we continue to achieve the dual objectives of reducing emission intensity by 50% and improving ESG outcomes by 20%. The remaining index properties remain similar to those of the previous index.

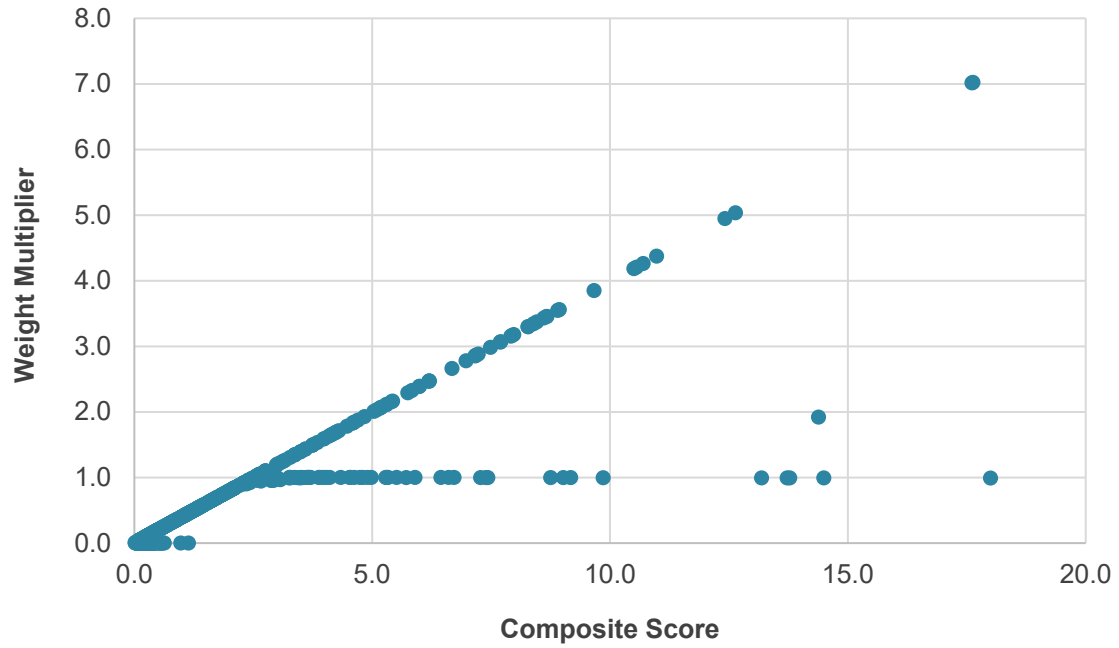
Table 5: Summary Statistics for the ESG Low Emissions Capped Index

	FTSE USA	ESG Low Emissions Capped Index
Performance		
Geometric Mean (%p.a.)	12.49	13.34
Volatility (%p.a.)	18.14	18.85
Tracking Error (%p.a.)		2.02
Implementation		
Two Way Turnover (%p.a.)		27.29
Capacity (%)	100.00	55.54
Diversification		
Effective N	145.00	56.00
SI Characteristics		
Emission Reduction (%)		50.06
ESG Ratings Uplift (%)		20.06

Source: FTSE Russell. Trucost data based on the FTSE USA Index from September 2014 to February 2021. Performance shown for the ESG, Low Emissions Capped Index is hypothetical and for illustrative purposes only. Past performance is no guarantee of future results. Please see the end for important legal disclosures.

Figure 3 shows the relationship between the weight multiplier and the composite emissions intensity and ESG score. Note that the linear relationship necessary for engagement still exists, but now there are a group of stocks whose weight multipliers are set to one. These are precisely the stocks with the highest emission intensities, whose high ESG ratings made them overweight in the previous section, but whose weight is now held at the benchmark weight.

Figure 3: Relationship between Carbon Emissions, ESG Rating Composite Score and Weight Multiplier for the ESG Low Emissions Capped Index



Source: FTSE Russell. Data based on the FTSE USA Index as of September 2020 review.

The effect of applying this correction to our ESG Low Emissions Index can be seen in Table 6, where we examine the distribution of active weights. Since no stocks in the top two emission intensity quartiles can be overweighted, the aggregate weight of stocks in the intersection of the top two emission intensity quartiles and the top ESG quartile is now equal to the benchmark index weight.

Table 6: Active Weights for the ESG Low Emissions Capped Index by Emission Intensity and ESG Rating Quartile

		Carbon Emission Intensity Quartiles				
		1	2	3	4	All
ESG Rating Quartiles	1	-3%	-4%	-3%	-3%	-13%
	2	-3%	-3%	-7%	-3%	-15%
	3	-1%	-2%	-2%	-2%	-7%
	4	16%	20%	0%	0%	35%
	All	9%	11%	-12%	-8%	0%

Source: FTSE Russell. Data based on the FTSE USA Index as of September 2020 review.

We could of course impose more stringent limits on stocks in the top two emission intensity quartiles, perhaps by requiring them to achieve a weight that is no more than half of their benchmark weight. In the extreme, this mechanism may be used to exclude specific stocks. We will address this in the next section.

5. Applying ESG Exclusions

In this section, we apply ESG exclusions to the capped index (ESG Low Emissions Capped Index) but still require a 50% reduction in emission intensity and a 20% improvement in the ESG rating. We exclude securities that are involved in controversial weapons, coal mining, coal energy generation and UNGC violations. This may be achieved by removing stocks on the relevant exclusion lists from the underlying benchmark, renormalizing the benchmark weights and then tilting from the resulting set of weights. Equivalently, we can incorporate such exclusions into the maximum weight tilt discussed in Section 4 by simply setting their maximum weights as zero.

Table 7 shows the September 2020 weightings of the excluded categories of stocks for the benchmark, the ESG Low Emissions Capped Index from section 4 and the comparable index with exclusions, the “ESG Low Emissions Capped + Exclusions Index.” Note that the total weight of the excluded stocks is around 5% in the benchmark, and about 10% in the ESG Low Emissions Capped Index. This could be viewed as an undesirable feature since controversial stocks have a higher weighting in the SI index. However, removing these stocks to form the ESG Low Emissions Capped + Exclusions Index resolves this problem.

Table 7: Weight of exclusions in the FTSE USA Index, ESG Low Emissions Capped Index and ESG Low Emissions Capped + Exclusions Index

Indexes	Exclusions			
	Controversial Weapons	Coal & Coal Energy Generation	UNGC Violations	Rest
Benchmark	2.15%	1.26%	1.76%	94.83%
ESG Low Emissions Capped Index	1.07%	0.48%	7.90%	90.55%
ESG Low Emissions Capped + Exclusions Index	0.00%	0.00%	0.00%	100.00%

Source: FTSE Russell. Data based on the FTSE USA Index as of September 2020 review.

The performance, implementation, diversification as SI properties of the ESG Low Emissions Capped + Exclusions Index are displayed in table 8. Note the pleasing result that index level properties are almost identical to the ESG Low Emissions Capped Index in Section 4, where no exclusions were applied.

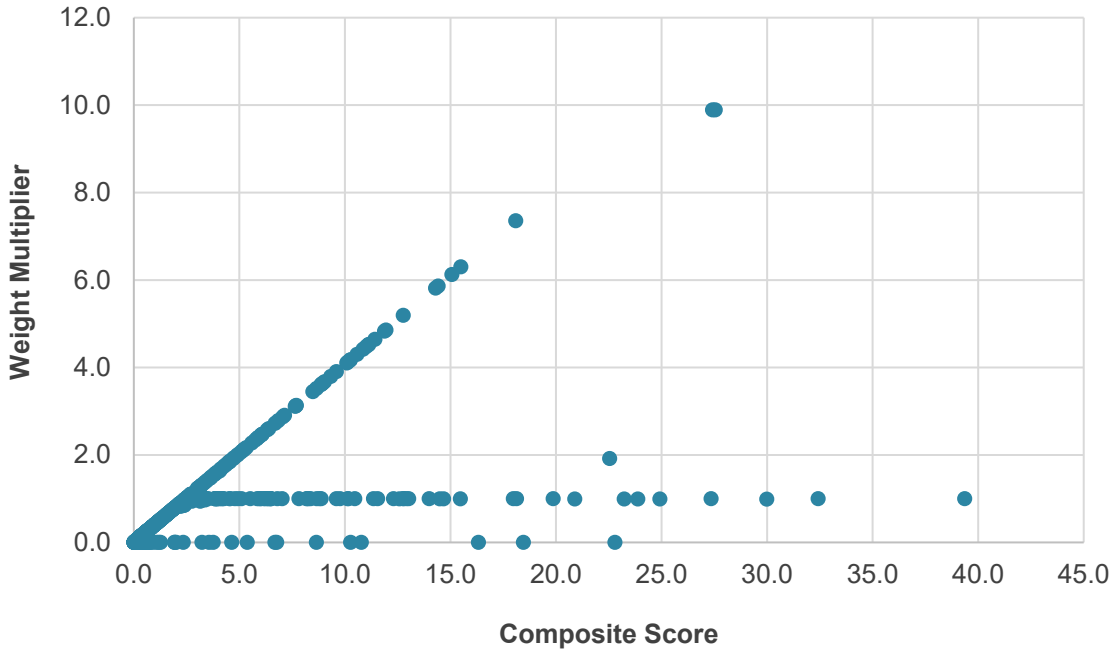
Table 8: Summary Statistics for the ESG Low Emissions Capped + Exclusions Index

	FTSE USA	ESG Low Emissions Capped Exclusions Index
Performance		
Geometric Mean (% p.a.)	12.49	13.38
Volatility (% p.a.)	18.14	19.25
Tracking Error (% p.a.)		2.28
Implementation		
Two Way Turnover (% p.a.)		28.20
Capacity (%)	100.00	47.56
Diversification		
Effective N	145	51
SI Characteristics		
Emission Reduction (%)		50.36
ESG Ratings Uplift (%)		20.06

Source: FTSE Russell. Trucost data based on the FTSE USA Index from September 2014 to February 2021. Performance shown for the ESG Low Emissions Capped + Exclusions Index is hypothetical and for illustrative purposes only. Past performance is no guarantee of future results. Please see the end for important legal disclosures.

Figure 4 shows the relationship of the weight multiplier versus the composite emissions intensity and ESG score. More stocks now stand at a weight multiplier of zero, representing our set of excluded stocks. This graphic gives us a transparent picture of the stock weights in our index that arise from our top-level targets and bottom-up constraints.

Figure 4: Relationship between Carbon Emissions + ESG Rating Composite Score and Weight Multiplier for the ESG Low Emissions Capped + Exclusions Index



Source: FTSE Russell. Data based on the FTSE USA Index as of September 2020 review.

Finally, table 9 demonstrates that we have preserved the property that no stock in the top two emission intensity quartiles is overweighted.

Table 9: Active weights for the ESG Low Emissions Capped + Exclusions Index by Carbon Emission Intensity and ESG Rating Quartiles

		Carbon Emission Intensity Quartile				
		1	2	3	4	All
ESG Rating Quartile	1	-3%	-5%	-3%	-3%	-14%
	2	-3%	-4%	-7%	-2%	-16%
	3	-1%	-2%	-3%	-1%	-8%
	4	21%	16%	0%	0%	37%
	All	14%	5%	-13%	-6%	0%

Source: FTSE Russell. Data based on the FTSE USA Index Universe as of September 2020 review.

In summary, we have demonstrated that applying ESG exclusions removes undesirable stocks from an index in a way that retains the aggregate index level objectives and maintains a transparent relationship between active weights and individual stock attributes, which may be used to facilitate the engagement process.

6. Conclusions

Portfolio level SI objectives have become increasingly important since the advent of the Paris Agreement on Climate Change. Signatories' requirement to commit to long-term temperature goals through carbon emission reduction has brought forth a new generation of SI indexes that aspire to be classed as "Paris Aligned" or "Climate Transition" Benchmarks. These benchmarks have specific targets for relative and absolute emission reductions, along with constraints that ensure the companies selected yield a representative view of the wider economy [3].

On average, such portfolio level targets should trickle down to the portfolio weights of individual companies in a transparent manner by lowering the weight of those with poor SI characteristics and amplifying the weight of those with good SI properties. The underweighting of a poorly performing company is, of course, an excellent tool for engagement. More generally, weighting stocks in a way that directly relates to their *quantitative* SI characteristics can be viewed as a carrot to encourage further adoption of SI principles [4], rather than merely employing the stick of exclusion [8].

However, as the number of targeted objectives and imposed constraints increases, inevitably there will be companies whose weightings appear at odds with an "aesthetic" sense of their SI profile. This may be because they score well on a characteristic that is in some sense "difficult to get" at the portfolio level, while scoring poorly on a characteristic that can be easily obtained by reducing the weightings of other poorly scoring companies. In other circumstances, it may be because the set of SI characteristics targeted, in some sense, fail to capture undesirable behavior.

With this in mind, this paper demonstrates how the target exposure methodology [1] can be used to construct indexes with multiple portfolio-level objectives that are consistent with desirable SI characteristics at the stock level. The simulated indexes cover a number of use cases that provide varying levels of engagement using tilts, stock level constraints and stock exclusions.

7. Appendix A

This Appendix provides more details on the index characteristics of all simulated SI indexes discussed in this note. All performance figures are annualized total return and measured in USD. Implementation and diversification measures and SI characteristics are averaged on a monthly basis. For definitions of these quantities see Appendix B.

Table 10: Summary Statistics for FTSE USA Index and the SI indexes

	FTSE USA	Low Emissions Index	ESG Low Emissions Index	ESG Low Emissions Capped Index	ESG Low Emissions Capped + Exclusions Index
Performance					
Geometric Mean (%p.a.)	12.49	13.20	13.16	13.34	13.38
Volatility (%p.a.)	18.14	18.25	18.44	18.85	19.25
Sharpe Ratio	0.69	0.72	0.71	0.71	0.69
DD (%)	-34.08	-33.67	-33.23	-34.16	-34.67
Excess (%p.a.)		0.62	0.59	0.75	0.78
Tracking Error (%p.a.)		0.66	1.87	2.02	2.28
Information Ratio		0.95	0.32	0.37	0.34
Beta		1.01	1.01	1.03	1.06
Implementation					
2-Way Turnover (%p.a.)		9.48	27.56	27.29	28.20
Capacity (%)	100.00	96.14	60.85	55.54	47.56
Active Share (%)	0.00	6.87	31.48	30.83	33.89
Diversification					
Number of Stocks	629	622	568	562	513
Effective N	145	124	63	56	51
Top Ten Weight (%)	18.25	20.62	31.70	34.51	35.93
SI Characteristics					
Reserves Reduction (%)		47.80	57.12	53.97	20.16
Emission Reduction (%)		50.01	50.10	50.06	50.36
ESG Uplift (%)		0.88	20.08	20.06	20.06

Source: FTSE Russell. Trucost data based on the FTSE USA Index Universe from September 2014 to February 2021. Performance shown for the SI Index is hypothetical and for illustrative purposes only. Past performance is no guarantee of future results. Please see the end for important legal disclosures.

8. Appendix B

This Appendix contains the definitions for the implementation, diversification and carbon metrics used in this document.

8.1. Diversification

To assess the degree of diversification in portfolio, we define Effective N of a portfolio as the inverse of the Herfindahl measure of concentration:

$$\text{Effective N} = 1/\sum_{i=1}^{N} {W_i}^2 \tag{4}$$

where W_i is the portfolio weight of the i^{th} stock. Effective N attains its maximum under an equal weighting scheme when it is equal to the actual number of stocks. Hence, Effective N can be seen as a measure of "how far" a given portfolio is from this maximally diversified portfolio.

8.2. Active share

The active share is defined as half the sum of the absolute weight differences of two portfolios:

$$\text{Active Share} = \frac{1}{2}\sum_{i=1}^{N} |W_i - \widehat{W}_i| \tag{5}$$

where W_i and $\widehat{W}_i$ are two sets of portfolio weights.

8.3. Capacity

Portfolio capacity is defined as the reciprocal of the weighted sum of stock capacity ratios:

$$\text{Capacity} = 1/\left[\sum_{i=1}^{N} W_i * \frac{W_i}{W_{M,i}}\right] \tag{6}$$

where $W_{M,i}$ are the market capitalization weights. This yields a number between 0% and 100% and reflects the ease of investment relative to a market capitalization weighting (100%) scheme.

8.4. Weighted Average Carbon Intensity (WACI)

The Weighted Average Carbon Intensity is defined by:

$$\text{WACI} = \sum_{i=1}^{N} W_i * \frac{\text{Emissions}_i}{\text{Revenue}_i} \quad (7)$$

where, for the i^{th} stock, W_i is the portfolio weight, Emissions_i is the annual value of operational carbon emissions in metric tons of CO2 and Revenue_i is the annual sales in millions of USD.

9. References

[1] Target Exposure: Investment applications and solutions, FTSE Russell Research, 2020.

[2] Targeted Sustainability, FTSE Russell Research, 2020.

[3] FTSE Russell study on EU Paris aligned benchmarks, FTSE Russell Research, 2020.

[4] Achieving scale in active ownership and engagement through index investing, FTSE Russell Research, 2021.

[5] FTSE Global Factor Index Series Ground Rules, FTSE Russell, April 2020.

[6] FTSE ESG Index Series Ground Rules, FTSE Russell, April 2020.

[7] FTSE Global Climate Index Series Ground Rules, FTSE Russell, April 2020.

[8] Christiansen, E. and Ducoulombier, F., “Scoring Against ESG? Avoiding the Pitfalls of ESG Scores in Portfolio Construction”, Scientific Beta Publications, December 2020.

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