MSCI Minimum Volatility Extended ESG Reduced Carbon Target Indexes Methodology

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1 Introduction

The MSCI Minimum Volatility Extended ESG Reduced Carbon Target Indexes are designed to represent the performance of a strategy that seeks systematic integration of environmental, social and governance (ESG) norms along with the minimum volatility factor.

The Indexes are constructed by selecting constituents of a market capitalization weighted index (the 'Parent Index') through an optimization process that aims to minimize volatility risk, reduce the carbon-equivalent exposure to CO2 and other GHG as well as the exposure to potential emissions risk of fossil fuel reserves by thirty percent (30%) and improve the weighted-average industry-adjusted ESG Score of the Index by 20% with respect to their respective underlying market capitalization weighted indexes (the 'Parent Index') under certain constraints.

2 MSCI ESG Research

The Indexes use company ratings and research provided by MSCI ESG Research. In particular, the Indexes use the following MSCI ESG Research products: MSCI ESG Ratings, MSCI ESG Controversies, MSCI ESG Business Involvement Screening Research, and MSCI Climate Change Metrics.

For details on MSCI ESG Research's full suite of ESG products, please refer to: https://www.msci.com/esg-investing

2.1 MSCI ESG Ratings

MSCI ESG Ratings aim to measure entities' management of environmental, social and governance risks and opportunities. MSCI ESG Ratings are based on a seven-point scale from 'AAA' to 'CCC', indicating how an entity manages relevant key issues relative to industry peers.The MSCI ESG Ratings methodology can be found in: https://www.msci.com/esg-and-climate-methodologies.

2.2 MSCI ESG Controversies

MSCI ESG Controversies provide assessments of controversies concerning the potential negative environmental, social, and/or governance impact of company operations, products and services. The evaluation framework used in MSCI ESG Controversies is designed to be consistent with international norms represented by the UN Declaration of Human Rights, the ILO Declaration on Fundamental Principles and Rights at Work, and the UN Global Compact. MSCI ESG Controversies Score falls on a 0-10 scale, with "0" being the most severe controversy.

The MSCI ESG Controversies methodology can be found in: https://www.msci.com/esg-and-climate-methodologies

2.3 MSCI ESG Business Involvement Screening Research

MSCI ESG Business Involvement Screening Research (BISR) aims to enable institutional investors to manage environmental, social and governance (ESG) standards and restrictions reliably and efficiently.

For more details on MSCI ESG Business Involvement Screening Research, please refer to http://www.msci.com/resources/factsheets/MSCI_ESG_BISR.pdf

2.4 MSCI Climate Change Metrics

MSCI Climate Change Metrics provide climate data & tools to support institutional investors seeking to integrate climate risk & opportunities into their investment strategy and processes. This includes investors seeking to achieve a range of objectives, including measuring and reporting on climate risk exposure, implementing low carbon and fossil fuel-free strategies, alignment with temperature pathways and factoring climate change research into their risk management processes, in particular through climate scenario analysis for both transition and physical risks.

The dataset spans across the four dimensions of a climate strategy: transition risks, green opportunities, physical risks and 1.5° alignment.

For more details on MSCI Climate Change Metrics, please refer to https://www.msci.com/climate-solutions.

3 Index Construction Methodology

Constructing the MSCI Minimum Volatility Extended ESG Reduced Carbon Target Indexes involves the following steps: Defining the Eligible Universe

- Defining the Parent Index and the base currency for optimization
- Defining the exclusion criteria
- Defining the Security Level Carbon Exposure
- Defining the optimization constraints
- Determining the optimized index

The steps mentioned above are defined in detail in the subsequent sections.

3.1 Defining the Parent Index and the Base Currency for Optimization

Constructing the MSCI Minimum Volatility Extended ESG Reduced Carbon Target Index (herein, 'the Index') begins with selecting the Parent Index and Eligible Universe to perform total risk minimizing optimization. The Parent Indexes serve as the universe of eligible securities for optimization. The optimization is performed from a base currency perspective and does not allow short selling of securities. The default currency is the US Dollar.

Please refer to Appendix I for more details.

3.2 Defining the Exclusion Criteria

3.2.1 Values and Climate Change Based Exclusions

The Indexes use MSCI ESG Business Involvement Screening Research to identify companies that are involved in the following business activities.

Companies that meet the business involvement criteria are not eligible for inclusion in the Indexes.

Please refer to Appendix II for details on these criteria.

Values based Exclusions:

- Controversial Weapons
- Tobacco
- Civilian Firearms

Climate Change based Exclusions:

- Thermal Coal
- Oil Sands

3.2.2 ESG Controversies Score Eligibility

The Indexes use MSCI ESG Controversies Scores to identify those companies that are involved in very serious controversies involving the environmental, social, or governance impact of their operations and/or products and services. Constituents of the Parent Index with ESG Controversy Score = 0 ('Red Flag' companies) are excluded from the Eligible Universe.

3.2.3 Other Exclusion Criteria

- Missing Controversy Score – Companies not assessed by MSCI ESG Research LLC on ESG Controversies are not eligible for inclusion in the MSCI Minimum Volatility Extended ESG Reduced Carbon Target Indexes
- Missing ESG Rating or ESG Score – Companies not assessed by MSCI ESG Research LLC on ESG Rating or ESG Score are not eligible for inclusion in the MSCI Minimum Volatility Extended ESG Reduced Carbon Target Indexes

3.3 Defining the Security Level Carbon Exposure

The carbon exposure of a security is measured in terms of its greenhouse gas emissions and its potential carbon emissions from fossil fuel reserves. The MSCI Minimum Volatility Extended ESG Reduced Carbon Target Indexes use MSCI Climate Change Metrics data from MSCI ESG Research to determine carbon exposure.

3.3.1 Greenhouse Gas Emissions

MSCI ESG Research collects company-specific direct (Scope 1) and indirect (Scope 2) greenhouse gas (GHG) emissions data from company public documents and/or the Carbon Disclosure Project. If a company does not report GHG emissions, then MSCI ESG Research uses its proprietary methodology to estimate Scope 1 and Scope 2 GHG emissions.

For newly added companies to the Index which do not report emission data and where MSCI ESG Research has not estimated the greenhouse gas emissions yet, MSCI estimates emissions for the company by using the Average Emissions per dollar of issuer market capitalization for the companies in the same industry group, multiplied by the market capitalization of the company.

3.3.2 Potential Carbon Emissions from Fossil Fuels

MSCI ESG Research collects fossil fuel reserves data where relevant for companies which have reserves, typically in the Oil & Gas, Coal Mining and Electric Utilities industries. Fossil fuel reserves can be used for several applications including energy or industrial (e.g. coking coal used for steel production). For the development of the MSCI Minimum Volatility Extended ESG Reduced Carbon Target Indexes, only fossil fuel reserves used for energy are taken into account. The data is updated on an annual basis and based on information disclosed by companies. Sources include company publications, other public records and third party data providers. For newly added companies to the Index where data is not available yet, MSCI uses zero fossil fuel reserves. The size of reserves of a company typically influences its market valuation, and hence MSCI normalizes for size by dividing the potential carbon emissions of the company by its market capitalization.

To convert reserves data to potential carbon emissions, MSCI ESG Research applies a formula from the Potsdam Institute for Climate Impact Research[1].

3.4 Defining the Optimization Constraints

At each Semi-Annual Index Review (SAIR), the following optimization constraints are employed, which aim to ensure replicability and investability.

- The maximum weight of an index constituent will be restricted to the lower of 1.5% and 20 times the weight of the security in the Parent Index
- The minimum weight of an index constituent will be 0.05%
- For countries with weight greater than 2.5% in a composite Parent Index, the weight in the MSCI Minimum Volatility Extended ESG Reduced Carbon Target
- Index will not deviate more than +/-5% from the country weight in the Parent Index
- For countries with weight less than 2.5% in a composite Parent Index, the weight in the MSCI Minimum Volatility Extended ESG Reduced Carbon Target Index will be capped at 3 times their weight in the Parent Index
- The above country weight constraint will also apply on China A Stock Connect listings as a group separately, in addition to the usual country weight constraint on China

[1] Malte Meinshausen, Nicolai Meinshausen, William Hare, Sarah C. B. Raper, Katja Frieler, Reto Knutti, David J. Frame & Myles R. Allen. Greenhouse-gas emission Target for limiting global warming to 2 °C. Nature 458, 11581162 (30 April 2009) | doi: 10.1038/nature08017; Received 25 September 2008; Accepted 25 March 2009. Supplementary Information, p. 7.

- The sector weights of the MSCI Minimum Volatility Extended ESG Reduced Carbon Target Index will not deviate more than +/-5% from the sector weights of the Parent Index
- No constraint will be applied on the exposure of the MSCI Minimum Volatility Extended ESG Reduced Carbon Target Index to the Barra Volatility risk factors (BETA and RESVOL). Exposure to all other Barra risk factors will be restricted to +/-0.25 standard deviations relative to the Parent Index
- The weighted-average industry-adjusted ESG Score of the Index will be at least 20% more than the weighted-average industry-adjusted ESG Score of the Parent Index at the time of rebalancing
- The minimum reduction in the Carbon Emission Intensity relative to the Parent Index will be 30%
- The minimum reduction in the Potential Emissions per dollar of market capitalization relative to the Parent Index will be 30%
- The one-way turnover of the MSCI Minimum Volatility Extended ESG Reduced Carbon Target Index is constrained to a maximum of 10% at each SAIR

The Carbon Emission Intensity and the Potential Emissions per dollar of market capitalization of the Index are calculated using the formulae defined in Appendix V.

3.5 Determining the Optimized Index

The MSCI Minimum Volatility Extended ESG Reduced Carbon Target Index is constructed using the Barra Open Optimizer in combination with the relevant Barra Equity Model[2]. The optimization uses the Eligible Universe as the universe of eligible securities and the specified optimization objective and constraints to determine the MSCI Minimum Volatility Extended ESG Reduced Carbon Target Index. Infeasible optimizations are handled as explained in Appendix III.

[2] Please refer to Appendix IV for the detailed information on model usage

4 Maintaining the Index

4.1 Semi-Annual Index Reviews

The MSCI Minimum Volatility Extended ESG Reduced Carbon Target Indexes are rebalanced on a semi-annual basis, usually as of the close of the last business day of May and November, coinciding with the May and November Semi-Annual Index Reviews (SAIRs) of the MSCI Global Investable Market Indexes. Barra Equity Model data as of the end of April and October are used respectively.

Similarly, the MSCI ESG Research data (including MSCI ESG Ratings, MSCI ESG

Controversies Scores, MSCI Business Involvement Screening Research, and MSCI Climate Change Metrics) used for the Semi-annual Index Reviews will be taken as of the end of the month preceding the Index Review i.e., April and October. For some securities, such data may not be published by MSCI ESG Research by the end of the month preceding the Index Review. For such securities, MSCI will use ESG data published after the end of month, when available.

The pro forma MSCI Minimum Volatility Extended ESG Reduced Carbon Target

Indexes are in general announced nine business days before the effective date.

4.2 Ongoing Event-Related Changes

The general treatment of corporate events in the MSCI Minimum Volatility Extended ESG Reduced Carbon Target Indexes aims to minimize turnover outside of Index Reviews. The methodology aims to appropriately represent an investor's participation in an event based on relevant deal terms and pre-event weighting of the Index constituents that are involved. Further, changes in index market capitalization that occur as a result of corporate event implementation will be offset by a corresponding change in the Variable Weighting Factor (VWF) of the constituent.

The following section briefly describes the treatment of common corporate events within the MSCI Minimum Volatility Extended ESG Reduced Carbon Target Indexes.

No new securities will be added (except where noted below) to the Index between Index Reviews. Parent Index deletions will be reflected simultaneously in the Index.

EVENT TYPE	EVENT DETAILS
New additions to the Parent Index	A new security added to the Parent Index (such as IPO and other early inclusions) will not be added to the Index.
Spin-Offs	All securities created as a result of the spin-off of an existing Index constituent will be added to the Index at the time of event implementation. Reevaluation for continued inclusion in the Index will occur at the subsequent Index Review.
Merger/Acquisition	For Mergers and Acquisitions, the acquirer's post event weight will account for the proportionate amount of shares involved in deal consideration, while cash proceeds will be invested across the Index. If an existing Index constituent is acquired by a non-Index constituent, the existing constituent will be deleted from the Index and the acquiring non-constituent will not be added to the Index.
Changes in Security Characteristics	A security will continue to be an Index constituent if there are changes in characteristics (country, sector, size segment, etc.) Reevaluation for continued inclusion in the Index will occur at the subsequent Index Review.

Further detail and illustration regarding specific treatment of corporate events relevant to this Index can be found in the MSCI Corporate Events Methodology book under the sections detailing the treatment of events in Capped Weighted and Non-Market Capitalization Weighted indexes.

The MSCI Corporate Events methodology book is available at: https://www.msci.com/index-methodology.

Appendix I: The Parent Index and the Base Currency for Optimization

Minimum Volatility Extended ESG Reduced Carbon Target Index	Parent Index	Base Currency for Optimization
MSCI USA Minimum Volatility Extended ESG Reduced Carbon Target Index	MSCI USA Index	USD

Appendix II: Values and Climate Change Based Exclusion Criteria

- **Tobacco Involvement**
  - Companies which meet the following Tobacco involvement criteria are excluded from the Indexes
  - All companies classified as "Producer" or "Licensor".
  - All companies classified as "Distributor", "Retailer", or "Supplier" that earn 15% or more of revenues from tobacco products.
  - All companies classified as "Ownership by a Tobacco Company" or "Ownership of a Tobacco Company"
- **Controversial Weapons Involvement**
  - All companies with any tie to Controversial Weapons (cluster munitions, landmines, depleted uranium weapons, biological/chemical weapons, blinding lasers, non-detectable fragments and incendiary weapons), as defined by the methodology of the MSCI Global Ex-Controversial Weapons Indexes available at https://www.msci.com/index-methodology.
- **Civilian Firearms**
  - All companies classified as a "Producer".
  - All companies classified as a "Retailer" that earn 5% or more in revenue or more than $ 20 million in revenue, from civilian firearms-related products.
- **Thermal Coal**
  - All companies deriving 5% or more revenue (either reported or estimated) from the mining of thermal coal (including lignite, bituminous, anthracite and steam coal) and its sale to external parties. It does not cover: revenue from metallurgical coal; coal mined for internal power generation (e.g. in the case of vertically integrated power producers); intra-company sales of mined thermal coal; and revenue from coal trading.
  - All companies deriving 5% or more revenue (either reported or estimated) from the thermal coal based power generation.
- **Oil Sands**
  - This factor identifies the maximum percentage of revenue (either reported or estimated) greater than 5% that a company derives from oil sands extraction for a set of companies that own oil sands reserves and disclose evidence of deriving revenue from oil sands extraction. This factor does not include

revenue from non-extraction activities (e.g. exploration, surveying, processing, refining); ownership of oil sands reserves with no associated extraction revenues; revenue from intra-company sales

Appendix III: Handling Infeasible Optimizations

During the Semi-Annual Index Review, in the event that there is no optimal solution that satisfies all the optimization constraints defined in Section 3.4, the following constraints are relaxed, until an optimal solution is found:

- Relax the turnover constraint in steps of 5%, up to a maximum of 30%
- Relax the minimum weight constraint in steps of 0.01% up to a minimum of 0.01%
- The maximum turnover constraint and the minimum weight constraint are alternately relaxed until a feasible solution is achieved. For example, constraints relaxation is executed in the sequence as illustrated below:

Order of Relaxation	Minimum Weight Constraint	Turnover Limit
1	0.05%	15%
2	0.04%	15%
3	0.04%	20%
4	0.03%	20%

- In the event that no optimal solution is found after the above constraints have been relaxed, the ESG Score[3] is relaxed in steps of 3%, up to a maximum of 5 iterations (up to a minimum of 5% more than that of the Parent Index)

In the event that no optimal solution is found after all the above constraints have been relaxed, the MSCI Minimum Volatility Extended ESG Reduced Carbon Target Index will not be rebalanced for that semi-annual index review.

[3] Weighted-average industry-adjusted ESG Score of the portfolio

Appendix IV: New release of Barra® Equity Model or Barra® Optimizer

The methodology presently uses MSCI Barra Global Equity Model for Long-Term Investors (“GEMLTL”) for the optimization. A new release of the relevant Barra Equity Model or Barra Optimizer may replace the former version within a suitable timeframe.

Appendix V: Calculation of Carbon Exposure Metrics

Index Carbon Emissions

- Parent Index Carbon Emissions –

$$\text{Parent Index Carbon Emissions} = \sum_{\text{i}} \left(\frac{\text{Float Market Capitalization} * \text{Absolute Emissions}}{\text{Issuer Market Capitalization}} \right)$$

- Derived Index Carbon Emissions –

$$\text{Derived Index Carbon Emissions} = \sum_{\text{i}} \left(\frac{\text{Derived Index Market Capitalization} * \text{Absolute Emissions}}{\text{Issuer Market Capitalization}} \right)$$

- Parent Index Carbon Emission Intensity is defined as Parent Index Carbon Emissions, as defined above, divided by Parent Index Sales –

$$\sum\nolimits_{\text{i}} \left(\frac{\text{Float Market Capitalization} * \text{Absolute Emissions}}{\text{Issuer Market Capitalization}} \right) \Bigg/ \sum\nolimits_{\text{i}} \left(\frac{\text{Float Market Capitalization} * \text{Sales}}{\text{Issuer Market Capitalization}} \right)$$

- Derived Index Carbon Emissions Intensity is defined as Derived Index Carbon Emissions, as defined above, divided by Derived Index Sales –

$$\sum\nolimits_{\text{i}} \left(\frac{\text{Derived Index Market Capitalization} * \text{Absolute Emissions}}{\text{Issuer Market Capitalization}} \right) \Bigg/ \sum\nolimits_{\text{i}} \left(\frac{\text{Derived Index Market Capitalization} * \text{Sales}}{\text{Issuer Market Capitalization}} \right)$$

Index Potential Carbon Emissions from Fossil Fuels

- Parent Index Potential Carbon Emissions from Fossil Fuels –

$$\sum_{\text{i}} \left(\frac{\text{Float Market Capitalization} * \text{Absolute Potential Emissions}}{\text{Issuer Market Capitalization}} \right)$$

- Derived Index Potential Carbon Emissions from Fossil Fuels –

$$\sum_{i}\left(\frac{\text{Derived Index Market Capitalization} \;*\; \text{Absolute Potential Emissions}}{\text{Issuer Market Capitalization}}\right)$$

The following sections have been modified effective December 2022:

- Section 3.4 Defining the Optimization Constraints: Update to reference Appendix V
- Appendix V: Added to reference formulae used for Carbon Emission Intensity and Potential Emissions per dollar of market capitalization calculation

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