

MSCI Minimum Volatility EU CTB/PAB Indexes Methodology

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1 Introduction

The MSCI Minimum Volatility EU CTB Indexes and the MSCI Minimum Volatility EU PAB Indexes (the “Indexes”) are designed to represent the performance of a strategy that meets the minimum standards¹ of the EU Climate Transition Benchmark (CTB) and the EU Paris-Aligned Benchmark (PAB) respectively and aims to minimize volatility risk. The starting universe to determine a Minimum Volatility EU CTB/PAB Index is an MSCI Global Investable Market Index and the estimated security covariance matrix is based on the relevant Barra Equity Model².

This index methodology aims to incorporate climate-based constraints and to minimize ex-ante total risk in an optimization-based index construction approach.

¹ Commission Delegated Regulation (EU) 2020/1818 of 17 July 2020 supplementing Regulation (EU) 2016/1011 of the European Parliament and of the Council as regards minimum standards for EU Climate Transition Benchmarks and EU Paris-aligned Benchmarks (EU Low Carbon Benchmarks Delegated Acts): <https://eurlex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020R1818&rid=1>.

In case there are changes in the EU delegated acts and an update to the Index methodology is required, MSCI will issue an announcement prior to implementing the changes in the methodology. MSCI will not conduct a formal consultation for such an update.

² Please refer to Appendix III.

2 MSCI ESG Research

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

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

2.1 MSCI CLIMATE CHANGE METRICS

MSCI Climate Change Metrics provides climate data & tools to support investors integrating climate risk & opportunities into their investment strategy and processes. It supports investors seeking to achieve a range of objectives, including measuring and reporting on climate risk exposure, implementing low carbon and fossil fuel-free strategies, align 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>.

2.2 MSCI ESG CONTROVERSIES

MSCI ESG Controversies provides assessments of controversies concerning the 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.

3 Index Construction Methodology

The Indexes are constructed based on an optimization process from the underlying Parent Index (herein, the “Parent Index”) using a Barra Equity Model to minimize the total risk and meeting the minimum standards of the EU Climate Transition Benchmark (CTB) and the EU Paris-Aligned Benchmark (PAB) respectively .

The steps for constructing the Indexes are described below.

3.1 APPLICABLE UNIVERSE

The Applicable Universe includes all the existing constituents of the Parent Index. The relevant Parent Index could be any MSCI Global Investable Market Index.

3.2 ELIGIBLE UNIVERSE

The Eligible Universe is constructed by excluding securities from the Applicable Universe based on the exclusion criteria described below.

3.3 DEFINING THE EXCLUSION CRITERIA

3.3.1 CONTROVERSEY BASED EXCLUSION CRITERIA

Securities of companies involved in “Very Severe” business controversies as defined by the MSCI ESG Controversies Methodology are not eligible for inclusion in the Index. This is implemented by excluding securities from the Applicable Universe with ESG Controversy Score = 0 (‘Red Flag’ companies).

3.3.2 BUSINESS EXCLUSION CRITERIA

Companies that are involved in specific businesses which have high potential for negative social and/or environmental impact are ineligible for inclusion in the Index based on the exclusion criteria below and as per the implementation schedule detailed in Table 1.

- Controversial Weapons
- Environmental Harm
- Tobacco
- Thermal Coal Mining
- Oil & Gas
- Power Generation

Please refer to Appendix I for more details on these criteria.

Table 1: Implementation schedule for exclusions in the MSCI Minimum Volatility EU CTB/PAB Indexes

| | MSCI Minimum Volatility EU CTB Indexes | MSCI Minimum Volatility EU PAB Indexes |
|------------------------------|--|--|
| Controversial Weapons | Excluded | Excluded |
| ESG Controversies | Excluded | Excluded |
| Environmental Harm | Excluded | Excluded |
| Tobacco | Excluded ³ | Excluded |
| Thermal Coal Mining | Not Excluded | Excluded |
| Oil & Gas | Not Excluded | Excluded |
| Power Generation | Not Excluded | Excluded |

3.4 CONSTITUENT IDENTIFICATION

The selection of constituents from the Eligible Universe is conducted through the process of optimization.

The optimization relies on the factor exposures for all the securities in the Parent Index and the factor covariance matrix of the relevant Barra Equity Model. The optimization is performed using a base currency. The default currency is the US Dollar.

3.5 WEIGHTING SCHEME

The optimization objective is to minimize the total risk of the Index at the time of rebalancing.

³ Tobacco based business involvement exclusion screen is applicable for the MSCI Minimum Volatility EU CTB Indexes starting from November 2022 Semi-Annual Index Review (SAIR).

3.6 OPTIMIZATION CONSTRAINTS

At each Semi-Annual Index Review (SAIR), the following optimization constraints are employed, which aim to ensure investability while achieving the lowest volatility for a given set of constraints:

- The maximum weight of an Index constituent will be restricted to the lower of 1.5% or 20 times the weight of the security in the Parent Index.
- The minimum weight of an Index constituent will be 0.05%.
- No constraint will be applied on the exposure of the Index to the Beta and Residual Volatility risk index factors. Exposure to all other risk index factors will be restricted to +/-0.25 standard deviations relative to the Parent Index.
- The Global Industry Classification Standard (GICS®)⁴ sector weights of the Index will not deviate more than +/- 5% from the sector weights of the Parent Index (the Energy GICS Sector is not constrained).
- For countries with weight greater than 2.5% in the Parent Index, the weight in the Index will not deviate more than +/-5% from the country weight in the Parent Index.
- For countries with weight less than 2.5% in the Parent Index, the weight in the 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.
- The one-way turnover of the Index is constrained to a maximum of 10% at each SAIR.
- In addition to the above-mentioned constraints, the climate objective constraints are applied as detailed in Table 1 below:

⁴ Please refer to MSCI GICS Methodology for details. The GICS methodology is available at: <https://www.msci.com/gics>.

Table 2: Constraints imposed to meet climate objectives

| No. | Climate Objectives | MSCI Minimum Volatility EU CTB Indexes | MSCI Minimum Volatility EU PAB Indexes |
|-----|--|--|--|
| 1. | Minimum reduction in Greenhouse Gas (GHG) Intensity relative to EVIC (Scope 1+2+3 ⁵) relative to the Parent Index | 30% | 50% |
| 2. | Minimum average reduction (per annum) in GHG Intensity (relative to EVIC) relative to GHG Intensity of the Index at the Base Date ⁶ | 7% | 7% |
| 3. | Minimum active weight in High Climate Impact Sector relative to Parent Index as defined in Appendix II | 0% | 0% |

3.7 DETERMINING THE OPTIMIZED INDEX

The Indexes are constructed using the Barra Open Optimizer in combination with the relevant Barra Equity Model⁷. The optimization uses the Eligible Universe and the Applicable Universe and the specified optimization objective and constraints to determine the constituents and the weights of the Index. The Eligible Universe is used to determine the securities eligible in the Index and the Applicable Universe is used to define other constraints like the maximum weight of an Index constituent. The Indexes seek to have the lowest absolute volatility based on the set of constraints. Infeasible optimizations are handled as explained in Appendix IV.

⁵ Prior to the May 2020 Semi-Annual Index Review (SAIR) of the Indexes, the Weighted Average Carbon Emissions Intensity relative to EVIC has been calculated based on Scope 1+2 Emissions.

⁶ Prior to the May 2020 Semi-Annual Index Review (SAIR) of the Indexes, the average reduction in Weighted Average Carbon Emissions Intensity relative to EVIC has been calculated using Scope 1+2 Emissions since Inception.

⁷ Please refer to Appendix III for the detailed information on model usage.

4 Maintaining the Indexes

4.1 SEMI-ANNUAL INDEX REVIEWS

The 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 regular Index Reviews (SAIRs) of the MSCI Global Investable Market Indexes. The Barra Equity Model data as of the end of April and the end of October are used respectively. This approach aims to capture timely updates to the risk characteristics of the companies and coincide with the rebalancing frequency of the relevant Parent Index.

In general, MSCI uses MSCI ESG Research data (including MSCI Climate Change Metrics, MSCI ESG Controversies and MSCI Business Involvement Screening Research) as of the end of the month preceding the Index Reviews for the rebalancing of the Indexes.

The pro forma 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 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.

Additionally, if the frequency of Index Reviews in the Parent Index is greater than the frequency of Index Reviews in the Index, the changes made to the Parent Index during intermediate Index Reviews will be neutralized in the Index.

The following section briefly describes the treatment of common corporate events within the Index.

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

| 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: Business Exclusion Criteria

Companies whose activities meet the following values and climate change-based criteria, as evaluated by MSCI ESG Research, are excluded from the Indexes.

- **ESG Controversy Score (“Red Flags”)**
 - Securities of companies having faced very severe controversies pertaining to ESG issues are not eligible for inclusion in the Index. This is implemented by excluding constituents of Parent Index with MSCI ESG Controversy Score = 0 (“Red Flag” companies). For more details on MSCI ESG Controversies Score, please refer to <https://www.msci.com/esg-integration>.

- **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 Ex-Controversial Weapons Indexes available at <https://www.msci.com/index-methodology>.

- **Environmental Harm**
 - All companies having faced very severe and severe controversies pertaining to Environmental issues – Defined as companies with an Environment Controversy Score of 0 or 1.

- **Tobacco**
 - All companies that are involved in the manufacturing of Tobacco products.

- **Thermal Coal Mining**
 - All companies deriving 1% 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 excludes revenue from metallurgical coal, coal mined for internal power generation (e.g., in the case of vertically integrated power producers), intracompany sales of mined thermal coal, and revenue from coal trading (either reported or estimated).

- **Oil & Gas**
 - All companies deriving 10% or more revenue from oil and gas related activities, including distribution / retail, equipment and services, extraction and production, pipelines and transportation and refining but excluding biofuel production and sales and trading activities.

- **Power Generation**
 - All companies deriving 50% or more revenue from thermal coal-based power generation, liquid fuel-based power generation and natural gas-based power generation⁸.

⁸ As per https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_chapter7.pdf, thermal coal based power generation, liquid fuel based power generation and natural gas based power generation have median lifecycle emissions exceeding 100gCO₂/kWh.

Appendix II: Calculation of Target Metrics

Calculation of GHG Intensity relative to EVIC

For Parent Index constituents where the Scope 1+2+3 Emissions Intensity is not available, the average Scope 1+2+3 Emissions Intensity of all the constituents of the MSCI ACWI in the same GICS Industry Group in which the constituent belongs is used.

Security Level GHG Intensity =

$$\frac{\text{Scope 1 + 2 + 3 Carbon Emissions} * (1 + EVIAF)}{\text{Enterprise Value} + \text{Cash(in M\$\text{)}}}$$

Enterprise Value Inflation Adjustment Factor (EVIAF) =

$$EVIAF = \left(\frac{\text{Average(Enterprise Value} + \text{Cash)}}{\text{Previous (Average(Enterprise Value} + \text{Cash))}} \right) - 1$$

Weighted Average GHG Intensity of Parent Index =

$$\sum (\text{Weight in Parent Index} * \text{Security Level GHG Intensity})$$

Weighted Average GHG Intensity of Derived Index =

$$\sum (\text{Index Weight} * \text{Security Level GHG Intensity})$$

Calculation of Average Decarbonization

On average, the Indexes follow a 7% decarbonization trajectory since the Base Date. The Weighted Average GHG Intensity relative to EVIC at the Base Date (W_1) is used to compute the target Weighted Average GHG Intensity relative to EVIC at any given Semi-Annual Index Review (W_t) as per the below formula.

$$W_t = W_1 * 0.93^{\frac{(t-1)}{2}}$$

Where 't' is the number of Semi-Annual Index Reviews since the Base Date.

Thus, for the 3rd Semi-Annual Index Review since the Base Date (t=3), the target Weighted Average GHG Intensity relative to EVIC will be $W_1 * 0.93$.

Calculation of GHG Intensity relative to Sales

For Parent Index constituents where the Scope 1+2+3 Emissions Intensity is not available, the average Scope 1+2+3 Emissions Intensity of all the constituents of the MSCI ACWI in the same GICS Industry Group in which the constituent belongs is used.

Security Level GHG Intensity =

$$\frac{\text{Scope 1 + 2 + 3 Carbon Emissions} * (1 + EVIAF)}{\text{Sales (in M\$)}}$$

Climate Impact Sectors

NACE⁹ is the European Union’s classification of economic activities. As per the draft DA, stocks in the NACE Section codes A, B, C, D, E, F, G, H, L are classified as “High Climate Impact” sector and other stocks are classified ‘Low Climate Impact’ sector. The GICS¹⁰ Sub-Industry code for each security is mapped to the corresponding “Climate Impact Sector” using a mapping. This mapping is constructed in the following steps:

1. MSCI has published a mapping¹¹ between the NACE classes and GICS Sub-Industry.
2. For each GICS Sub-Industry, the number of NACE classes which fall under the High Climate Impact Sector (say the number of classes is N_H) and Low Climate Impact Sector (say the number of classes is N_L) is identified.
3. If all the NACE classes for a given GICS Sub-Industry are identified in the High Climate Impact Sector ($N_L = 0$), then the GICS Sub-Industry is mapped to the High Climate Impact Sector. Conversely, if all the NACE classes for a given GICS Sub-Industry are identified in the Low Climate Impact Sector ($N_H = 0$) then the GICS Sub-Industry is mapped to the Low Climate Impact Sector.
4. In case a GICS Sub-Industry is mapped to some NACE classes in the High Climate Impact Sector and the others in the Low Climate Impact Sector, the GICS Industry is mapped to the Climate Impact Sector in the following manner:

⁹ For further details regarding NACE, please refer to https://ec.europa.eu/eurostat/statistics-explained/index.php?title=NACE_background

¹⁰ For further information regarding GICS, please refer to <https://www.msci.com/gics>

¹¹ This mapping is available in the [Handbook of Climate Transition Benchmarks, Paris-Aligned Benchmark and Benchmarks’ ESG Disclosures](#)

- a. **$N_H \geq N_L$** : If the number of NACE classes in the High Climate Impact Sector is at least equivalent to the number of NACE classes in the Low Climate Impact Sector, the GICS Sub-Industry is mapped to the High Climate Impact Sector.
 - b. **$N_H < N_L$** : If the number of NACE classes in the High Climate Impact Sector is less than the number of NACE classes in the Low Climate Impact Sector, the GICS Sub-Industry is mapped to the Low Climate Impact Sector.
5. Using the GICS Sub-Industry to Climate Impact Sector mapping created in Step 4, and the security-level GICS Sub-Industry, each security in the Parent Index is classified in either High Climate Impact Sector or Low Climate Impact Sector.

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

The methodology presently uses MSCI Barra Global Equity Model for Long-Term Investors (“GEMTL”) 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 IV: 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 3.6, the following constraints will be 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 | Turnover Limit |
|---------------------|----------------|----------------|
| 1 | 0.05% | 15% |
| 2 | 0.04% | 15% |
| 3 | 0.04% | 20% |
| 4 | 0.03% | 20% |

For MSCI Sector/Country/Region Indexes which have relatively lower number of stocks, the standard optimization parameters may lead to an infeasible solution. In such cases, MSCI may apply relaxed constraints relative to the standard set of constraints. These parameter changes would be announced before implementation.

In the event that no optimal solution is found after the above constraints have been relaxed over all the iterations, the relevant MSCI Minimum Volatility EU CTB/PAB Index will not be rebalanced for that Semi-Annual Index Review.

THE FOLLOWING SECTIONS HAVE BEEN MODIFIED EFFECTIVE NOVEMBER 2022:

- Introduction has been updated to describe the MSCI Minimum Volatility EU CTB Indexes.
- Section 3.3.2: Business Exclusion Criteria
Updated to include the business exclusions of the MSCI Minimum Volatility EU CTB Indexes.
- Section 3.6: Optimization Constraints
Updated to include the climate constraints of MSCI Minimum Volatility EU CTB Indexes.

Contact us

clientservice@msci.com

AMERICAS

| | |
|---------------|-------------------|
| Americas | 1 888 588 4567 * |
| Atlanta | + 1 404 551 3212 |
| Boston | + 1 617 532 0920 |
| Chicago | + 1 312 675 0545 |
| Monterrey | + 52 81 1253 4020 |
| New York | + 1 212 804 3901 |
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EUROPE, MIDDLE EAST & AFRICA

| | |
|-----------|--------------------|
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| Frankfurt | + 49 69 133 859 00 |
| Geneva | + 41 22 817 9777 |
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ASIA PACIFIC

| | |
|-------------|-----------------------|
| China North | 10800 852 1032 * |
| China South | 10800 152 1032 * |
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| Mumbai | + 91 22 6784 9160 |
| Seoul | 00798 8521 3392 * |
| Singapore | 800 852 3749 * |
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