

Methodology book for MSCI Diversified Multiple-Factor R- Series Indexes, MSCI Diversified Multiple-Factor Low Volatility Indexes, MSCI Diversified Multiple 5-Factor Indexes, MSCI Diversified Multiple 3-Factor Indexes

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1 Introduction

The MSCI Diversified Multiple-Factor R-Series Indexes, the MSCI Diversified Multiple Factor Low Volatility Indexes, the MSCI Diversified Multiple 5-Factor Indexes and the MSCI Diversified Multiple 3-Factor Indexes (herein, the “Multiple-Factor Indexes”) are designed to represent the performance of strategies that seek higher exposure to some or all five style factors (Value, Momentum, Low Size, Quality and Low Volatility) relative to others within the relevant Barra Equity Model¹ combined with control over ex-ante total risk. In other words, the index methodologies aim to represent high combined exposure to the target factors while maintaining total risk exposure similar to or lower than a specified proportion of that of the underlying Parent Index (defined below).

The MSCI Diversified Multiple-Factor R-Series Indexes are optimization-based indexes that are designed to represent the performance of a strategy that seeks higher composite exposure to four style factors - Value, Momentum, Quality and Low Size. The index is designed to maximize combined factor exposure while controlling (predicted) total risk to be no more than 90% of the Parent Index.

The MSCI Diversified Multiple-Factor Low Volatility Indexes are optimization-based indexes that are designed to represent the performance of a strategy that seeks higher composite exposure to four style factors - Value, Momentum, Quality and Low Volatility while aiming to maintain a risk profile similar to that of the underlying Parent Index.

The MSCI Diversified Multiple 5-Factor Indexes are optimization-based indexes that are designed to represent the performance of a strategy that seeks higher composite exposure to five style factors - Value, Momentum, Quality, Low Size and Low Volatility while aiming to maintain a risk profile similar to that of the underlying Parent Index.

The MSCI Diversified Multiple 3-Factor Indexes are designed to represent the performance of a strategy that seeks higher composite exposure to three style factors - Value, Momentum and Quality. The index targets a maximized combined factor exposure while aiming to maintain a risk profile similar to that of the underlying Parent Index.

¹ Please refer to Appendix II and Appendix III

2 Index Construction Methodology

The applicable universe includes all the existing constituents of an underlying MSCI Parent Index (herein, the “Parent Index”). This approach aims to provide an opportunity set with sufficient liquidity and capacity. The relevant Parent Index could be any MSCI Regional or Country standard, small cap or Investable Market Index (IMI).

The Multiple-Factor Indexes are constructed by optimizing from an underlying Parent Index using a Barra Equity Model to maximize the index-level exposure to the targeted style factors while maintaining market risk similar to or lower than a fixed proportion of the (predicted) total risk of the Parent Index.

The steps for constructing the Multiple-Factor Indexes are described below.

2.1 APPLICABLE UNIVERSE

All the securities from the Parent Index become part of the applicable universe. 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.

2.2 CONSTITUENT IDENTIFICATION

Identification of the constituents from the applicable universe is done by the process of optimization.

2.3 WEIGHTING SCHEME

The optimization objective is to maximize the Alpha score (representative of the exposures to the set of target factors) under the “target risk” constraint where the risk target is equal to or lower than a fixed proportion of the (predicted) total risk of the Parent Index at the time of rebalancing

2.3.1 CALCULATION OF THE ALPHA SCORE

The Alpha score of each of the indexes is defined as follows:

1. **MSCI Diversified Multiple-Factor R-Series Indexes:**

$$\alpha_i = 0.25 * F_{1,i} + 0.25 * F_{2,i} + 0.25 * F_{3,i} + 0.25 * F_{4,i}$$
2. **MSCI Diversified Multiple-Factor Low Volatility Indexes:**

$$\alpha_i = 0.25 * F_{1,i} + 0.25 * F_{5,i} + 0.25 * F_{3,i} + 0.25 * F_{4,i}$$
3. **MSCI Diversified Multiple 5-Factor Indexes:**

$$\alpha_i = 0.2 * F_{1,i} + 0.2 * F_{2,i} + 0.2 * F_{3,i} + 0.2 * F_{4,i} + 0.2 * F_{5,i}$$

4. MSCI Diversified Multiple 3-Factor Indexes:

$$\alpha_i = 0.3333 * F_{1,i} + 0.3334 * F_{3,i} + 0.3333 * F_{4,i}$$

Where,

$F_{j,i}$ = Factor exposure of each security i for each of the target factors.

The factor exposures for the target factors are sourced as follows:

- Momentum (F1)– The winsorized z-score of factor exposure for each security taken from the Momentum factor exposure in the relevant Barra Equity Model. The factor definition is given in Appendix III.
- Low Size (F2)- The winsorized z-score of factor exposure for each security taken from the relevant Barra Equity Model. The factor definition is given in Appendix III.
- Value (F3) – Sector-relative score calculated using the security-level exposures to earnings-based, asset-based and whole-firm based valuation metrics from the relevant Barra Equity Model. The factor definition is given in Appendix III.
- Quality (F4) – Sector-relative score calculated using the security-level exposures to all quality factors from the relevant Barra Equity Model. The factor definition is given in Appendix III.
- Low Volatility (F5)- The winsorized z-score of negative of the factor exposure for each security taken from the relevant Barra Equity Model. The factor definition is given in Appendix III.

2.4 OPTIMIZATION CONSTRAINTS

At each Quarterly Index Review (QIR), the following optimization constraints are employed, which aim to ensure investability while achieving total risk in line with that of the Parent Index.

- The total risk of the MSCI Diversified Multiple-Factor R-Series Index is constrained to be less than 90% of the total risk of the Parent Index, while the total risk of the MSCI Diversified Multiple-Factor Low Volatility Index, the MSCI Diversified Multiple 5 Factor Index and the MSCI Diversified Multiple 3-Factor Index are constrained to have a risk profile similar to that of the Parent Index.
- If the Parent Index is an MSCI Standard index or an MSCI Investable Market Index (IMI), then the maximum weight of index constituents that belong to the Large Cap size segment will be restricted to the lower of the weight of the security in the Parent Index + 2% or 10 times the weight of the security in the Parent Index. The minimum weight of an index constituent will be restricted to the higher of the weight of the security in the Parent Index - 2% or 0. The maximum weight of index constituents that belong to the Mid Cap or Small Cap size segments will be

restricted to the lower of (the weight of the security in the Parent Index + 1%) or 5 times the weight of the security in the Parent Index. The minimum weight of an index constituent will be restricted to the higher of the (weight of the security in the Parent Index - 1%) or 0.

- If the Parent Index is an MSCI Small Cap Index the maximum weight of an index constituent will be restricted to the lower of the weight of the security in the Parent Index + 1% or 5 times the weight of the security in the Parent Index. The minimum weight of an index constituent will be restricted to the higher of the weight of the security in the Parent Index - 1% or 0.
- Exposure of the Multiple-Factor Indexes to non-target Barra style factors will be restricted to ± 0.1 standard deviations relative to the Parent Index. In addition, the exposure to volatility factor (Beta, Residual Volatility) in the MSCI Diversified Multiple-Factor R-Series Indexes, MSCI Diversified Multiple-Factor Low Volatility Indexes and MSCI Diversified Multiple 5-Factor Indexes, would be constrained to be greater than -0.5 standard deviations relative to the Parent Index.
- Active exposure of the Multiple-Factor Indexes to the target Barra style factors (factors included in the calculation of Alpha score; except Beta, Residual Volatility for MSCI Diversified Multiple-Factor Low Volatility Indexes and MSCI Diversified Multiple 5-Factor Indexes) will be constrained to be greater than 0.1 and less than 0.6. Factors, namely, Earnings Variability, Leverage, Size, if included in the calculation of Alpha score, will be constrained to be greater than -0.6 and less than -0.1 relative to the Parent Index.
- The sector weights of the Multiple-Factor Indexes will not deviate more than $\pm 5\%$ from the sector weights of the Parent Index.
- For countries with weight greater than 2.5% in the Parent Index, the weight in the Multiple-Factor Indexes will not deviate more than $\pm 5\%$ from the country weight in the Parent Index.
- For countries with weight less than 2.5% in the Parent Index, the weight in the Multiple-Factor Indexes will be capped at 3 times their weight in the Parent Index.
- The one-way turnover of the Multiple-Factor Indexes is constrained to a maximum of 10% at each index review.

2.5 DETERMINING THE OPTIMIZED INDEX

The Multiple-Factor Indexes are constructed using the Barra Open Optimizer in combination with the relevant Barra Equity Model². The optimization uses the Parent Index as the universe of eligible securities and the specified optimization objective and constraints to determine the Multiple-Factor Indexes. The Barra Open Optimizer determines the optimal solution, i.e. the set of securities with the highest possible

² Please refer to Appendix II and Appendix III

Alpha score with “target risk” equal to or less than a fixed proportion of the ex-ante risk of the Parent Index at the time of rebalancing, using an estimated security covariance matrix under the applicable investment constraints.

3 Maintaining the Indexes

3.1 QUARTERLY INDEX REVIEWS

The Multiple-Factor Indexes are rebalanced on a quarterly basis, usually as of the close of the last business day of February, May, August and November, coinciding with the regular Index Reviews (Semi-Annual Index Reviews in May and November and Quarterly Index Reviews in February and August) of the MSCI Global Investable Market Indexes. Barra Equity Model data as of the day before the rebalancing day is used. 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. The pro forma Multiple-Factor Indexes are in general announced nine business days before the effective date.

3.2 ONGOING EVENT RELATED CHANGES

The general treatment of corporate events in the Multiple-Factor Indexes aim 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 Multiple-Factor Indexes, the changes made to the Parent Index during intermediate Index Reviews will be neutralized in the Multiple-Factor Indexes.

The following section briefly describes the treatment of common corporate events within the Multiple-Factor Indexes.

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: Handling Infeasible Optimizations

During the Quarterly Index Review, in the event that there is no optimal solution that satisfies all the optimization constraints defined in Section 2.4, the following constraints will be relaxed, until an optimal solution is found:

- Relax the maximum active weight constraint of the Large Cap size segment (2%) in multiples of 1.25 up to a maximum of 4 iterations based upon the following formula

$$w_{i+1} = 1.25 * w_i \text{ for } i = 0 - 3$$

Where w_i = Maximum Active weight constraint

- Relax the maximum weight multiple of the Large Cap size segment (10x) in steps of 2 up to a maximum of 5 iterations based upon the following formula

$$wm_{i+1} = 2 + wm_i \text{ for } i = 0 - 4$$

Where wm_i = Maximum weight multiple

- Relax the maximum weight multiple of the Mid Cap and Small Cap size segments (5x) in steps of 1 up to a maximum of 5 iterations based upon the following formula

$$wm_{i+1} = 1 + wm_i \text{ for } i = 0 - 4$$

Where wm_i = Maximum Active weight multiple

- Relax the maximum active weight constraint of the Mid Cap and Small Cap size segments (1%) in multiples of 1.25 up to a maximum of 4 iterations based upon the following formula

$$w_{i+1} = 1.25 * w_i \text{ for } i = 0 - 3$$

Where w_i = Maximum Active weight constraint

- The above four constraints are alternately relaxed until a feasible solution is achieved.

In the event that no optimal solution is found after the above constraints have been relaxed over all the iterations, the relevant Multiple-Factor Indexes will not be rebalanced for that Quarterly Index Review.

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

A new release of the relevant Barra Equity Model or Barra Optimizer may replace the former version within a suitable timeframe. At launch, the Multiple-Factor indexes made use of the MSCI Barra Global Equity Model – Long Horizon (GEM2L) for the optimization. Starting from the May 2018 Semi-Annual Index Review, the methodology transitioned to use the MSCI Barra Global Equity Model for Long-Term Investors (GEMTL) for optimization while the Value and Quality factor exposures were also taken from the Barra GEMTL model, aligned with a similar transition in the MSCI Diversified Multiple-Factor Indexes.

Appendix III: Target Factor Definition Summary

The style factor groups targeted in the Multiple-Factor Indexes are Momentum, Low Size, Value, Quality and Low Volatility. These factor groups are described using individual factor scores from the current release of the MSCI Barra Global Equity Model for Long-Term Investors (GEMTL). The precise choice of component factors used to represent each broad factor group is governed by the current model used for the optimization, which may change with a new release of the Barra Equity Model (as specified in Appendix II). The model data will be used from a day prior to the rebalancing date. All factor exposures are re-normalized at the Parent Index level prior to the calculation of the Alpha score. Following are the definitions of factor groups currently used in the Index. For more detailed information on individual factors in GEMTL, please refer to <https://www.msci.com/portfolio-management/>.

Momentum:

The Momentum score for each security is the winsorized (at +/- 3) z-score of the Momentum factor score taken from the relevant Barra Equity Model (currently GEMTL).

Size:

The Size score for each security is the winsorized (at +/- 3) z-score of negative of the Size factor score taken from the relevant Barra Equity Model (currently GEMTL).

Value:

The Value score for each security is currently based on earnings-based, asset-based and whole firm-based valuation metrics - currently captured by the following two factors, Book-to-Price and Earnings Yield, from the relevant Barra Equity Model (currently GEMTL). A sector-relative score is derived from the combined score by standardizing (z-score) the latter within each sector and winsorizing at +/- 3.

$$\text{Value}_i = (0.33) * \text{BtoP}_i + (0.67) * \text{EarningsYield}_i$$

Quality:

The Quality score for each security is currently based on all quality factors, Profitability, Investment Quality, Earnings Quality, Leverage and Earnings Variability, from the relevant Barra Equity Model (currently GEMTL). A sector-relative score is derived from the combined score by standardizing (z-score) the latter within each sector and winsorizing at +/- 3.

$$\begin{aligned} \text{Quality}_i = & (0.2) * \text{Profitability}_i + (0.2) * \text{Investment Quality}_i + (0.2) \\ & * \text{Earnings Quality}_i + (-1) * (0.2) * \text{Earnings Variability}_i + (-1) \\ & * (0.2) * \text{Leverage}_i \end{aligned}$$

Volatility:

The Volatility score for each security is calculated by combining in equal proportion the security-level exposures to two factors - Beta and Residual Volatility - scores. The Beta and Residual Volatility score for each security is the winsorized (at +/- 3) z-score of Beta and Residual Volatility factor scores, respectively taken from the relevant Barra Equity Model (currently GEMLTL).

$$\text{Volatility}_i = -(1) * (0.5)\text{Beta}_i + (-1) * (0.5)\text{Residual Volatility}_i$$

Appendix IV: Transition Parameters during May 2022 Index Review

At the transition, during May 2022 Index Review, the one-way turnover cap will be maintained at 20% for the May 2022 Index Review and the maximum weight of an index constituents in the Mid Cap and Small Cap segments will be restricted to the lower of (the weight of the security in the Parent Index + 1%) and 7 times³ the weight of the security in the Parent Index for the MSCI Diversified Multiple-Factor R-Series Indexes⁴, the MSCI Diversified Multiple Factor Low Volatility Indexes, the MSCI Diversified Multiple 5-Factor Indexes and the MSCI Diversified Multiple 3-Factor Indexes.

Starting from August 2022 Quarterly Index Review, the one-way turnover cap will be set to 10% at each index review and the maximum weight of an index constituent in the Mid Cap and Small Cap segments will be restricted to the lower of (the weight of the security in the Parent Index + 1%) and 5 times the weight of the security in the Parent Index.

³ For the methodology transition in May 2022 Index Review, the maximum weight multiple of the Mid Cap and Small Cap size segments is relaxed from 7 times in steps of 1 up to a maximum of 5 iterations (12 times) along with other constraints as defined in Appendix I

⁴ The total risk of the MSCI United Kingdom Diversified Multiple-Factor R-Series Index will be constrained to be less than 95% of the total risk of the Parent Index from May 2022 Index Review

THE FOLLOWING SECTIONS HAVE BEEN MODIFIED SINCE FEBRUARY 2018:

- Section 2.4 has been updated to reflect the additional constraint on China A Stock Connect listings
- Footnotes added in Section 1 and Section 2.5 to reflect the current release of the relevant Barra Equity Model
- Section 2.3.1 and Appendix III have been updated to reflect the choice of factors used within each target factor group used in the Index
- Appendix II has been updated to reflect the information on transition of the Indexes to GEMTL

THE FOLLOWING SECTIONS HAVE BEEN MODIFIED SINCE MAY 2018:

- Sections 1 has been updated to include the definition of the MSCI Diversified Multiple 3-Factor Indexes
- Section 2 has been updated to explain the index construction methodology
- Section 2.3.1 and section 2.4 have been updated to include the Alpha score definition and optimization constraints of the MSCI Diversified Multiple 3-Factor Indexes

THE FOLLOWING SECTIONS HAVE BEEN MODIFIED EFFECTIVE MAY 2022:

- Section 2.3.1 has been updated to reflect the change in calculation of the Alpha score
- Section 2.4 has been updated to reflect the change in optimization constraints
- Section 3.1 has been updated to reflect the change in rebalancing frequency
- Appendix I has been updated to reflect the change in handling of optimization infeasibility
- Appendix III has been updated to reflect the parent-level normalization of target factors
- Appendix IV has been added to describe transition parameters during May 2022 Index Review

THE FOLLOWING SECTIONS HAVE BEEN MODIFIED EFFECTIVE AUGUST 2022:

- Appendix IV has been updated to reflect the change in parameter of MSCI United Kingdom Diversified Multiple-Factor R-Series Index during August 2022 Index Review.



THE FOLLOWING SECTIONS HAVE BEEN MODIFIED EFFECTIVE NOVEMBER 2022:

- Appendix IV has been updated to reflect the change in parameter of MSCI United Kingdom Diversified Multiple-Factor R-Series Index.

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