

**METHODOLOGY BOOK FOR:**  
**- MSCI DIVERSIFIED MULTIPLE-FACTOR R-SERIES INDEXES**  
**- MSCI DIVERSIFIED MULTIPLE-FACTOR LOW VOLATILITY INDEXES**  
**- MSCI DIVERSIFIED MULTIPLE 5-FACTOR INDEXES**

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## 1 INTRODUCTION

The MSCI Diversified Multiple-Factor R-Series Indexes, the MSCI Diversified Multiple-Factor Low Volatility Indexes and the MSCI Diversified Multiple 5-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 Model combined with control over ex-ante total risk. In other words, the index methodologies aim to represent high 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).

MSCI categorizes the MSCI Diversified Multiple-Factor R-Series Indexes, the MSCI Diversified Multiple-Factor Low Volatility Indexes and the MSCI Diversified Multiple 5-Factor Indexes as part of the MSCI Factor Indexes, which are designed to represent the performance of the systematic elements of particular investment styles or strategies. While capitalization weighted indexes aim to represent the broad market beta, additional sources of systematic return associated with particular investment styles and strategies, such as value, momentum, volatility, etc. or their combination could be represented through alternatively weighted indexes.

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 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 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 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.

All three Multiple-Factor Indexes are rebalanced on a semi-annual basis.

## 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 accomplished by using the optimization process described below.

### 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:

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

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:

1. Momentum (F1) – Factor exposure for each security taken from the relevant Barra Equity Model. The factor definition is given in Appendix III.
2. Low Size (F2) - Negative of the factor exposure for each security taken from the relevant Barra Equity Model. The factor definition is given in Appendix III.
3. Value (F3) – Sector-relative Value z-score calculated using the same steps as in section 2.2 (up to section 2.2.2) of the MSCI Enhanced Value Indexes Methodology. The scores range between +/- 3 after winsorization.
4. Quality (F4) – Sector-relative Quality score calculated using the same steps as in Appendix VI of the MSCI Quality Indexes Methodology. The scores range between +/- 3 after winsorization.
5. Low Volatility (F5) - 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 Semi-Annual Index Review (SAIR), 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 and the MSCI Diversified Multiple 5-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 then the maximum weight of an index constituent 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.
- 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.

- If the Parent Index is an MSCI Investable Market Index (IMI), the maximum and minimum constituent weight constraints will be same as that where the Parent Index is an MSCI Standard Index. In the optimization, exposure of the Multiple-Factor Indexes to one of the target Barra style factors, namely, Size will be constrained to be greater than or equal to -1.0 standard deviations relative to the Parent Index.
- Exposure of the Multiple-Factor Indexes to non-target Barra style factors such as growth and liquidity will be restricted to +/-0.25 standard deviations relative to the Parent Index. In addition, the exposure to volatility factor in all the 3 indexes would be constrained to be greater than -0.5 standard deviations relative to the Parent Index.
- The sector weights of the Multiple-Factor Indexes will not deviate more than +/-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 +/-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 20% 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 Model. 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 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 SEMI-ANNUAL INDEX REVIEWS

The Multiple-Factor 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. 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 Semi-Annual 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 (2% in the case of standard indexes and 1% in the case of small cap indexes) in multiples of 1.25 up to a maximum of 5 iterations based upon the following formula

$$w_{i+1} = 1.25 * w_i \text{ for } i = 0 - 4$$

Where  $w_i$  = Maximum Active weight constraint

- Relax the maximum weight multiple 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

- The maximum active weight constraint and the maximum weight multiple 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 5 iterations, the relevant Multiple-Factor Indexes will not be rebalanced for that Semi-Annual Index Review.

## **APPENDIX II: NEW RELEASE OF BARRA<sup>®</sup> EQUITY MODEL OR BARRA<sup>®</sup> 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 would use the Barra GEM2 Equity model for the optimization. In May 2018, the methodology would transition to use the Barra GEMLT Equity model for optimization while the Value and Quality factor exposures would also be taken from the Barra GEMLT model, aligned with a similar transition in the MSCI Diversified Multiple-Factor Indexes.

## APPENDIX III: TARGET FACTOR DEFINITION SUMMARY

The factors targeted in the 3 Multiple-Factor Indexes are Momentum, Low Size, Value, Quality and Low Volatility. The precise choice of component factors used to represent each broad factor is governed by the current model used for the optimization, which may change with a new release of the Barra Equity Model.

### *Momentum:*

The momentum factor score for a security is taken from the relevant Barra Equity Model (presently GEM2) and is consistent with the momentum factor used in the current optimization model (as defined in Appendix II). It is currently calculated as the weighted average of security-level z-scores for 12-month relative strength, 6-month relative strength and historical alpha (refer [MSCI GEM2 Research Notes for more details](#)).

### *Size:*

The size factor score for a security is taken from the relevant Barra Equity Model (presently GEM2) and is consistent with the size factor used in the current optimization model (as defined in Appendix II). It is currently calculated using the logarithm of the market-capitalization of the relevant firm and is standardized on a country-relative basis (refer [MSCI GEM2 Research Notes for more details](#)).

### *Value:*

The value score for each security is currently based on earnings-based, asset-based and whole firm based valuations and is calculated using the same steps as in section 2.2 (up to section 2.2.2) of the MSCI Enhanced Value Indexes Methodology. The value score currently uses three valuation descriptors, Forward Price to Earnings, Price to Book Value and Enterprise Value/Operating Cash Flows (EV/CFO), calculated within sectors.

### *Quality:*

The quality score for each security is currently based on profitability, leverage and stability of earnings based measures, currently using the same steps as in Appendix VI of the MSCI

Quality Indexes Methodology. The quality score currently uses three descriptors, Return on Equity, Debt to Equity and Earnings Variability, calculated within sectors.

*Volatility:*

The volatility factor score for a security is taken from the relevant Barra Equity Model (presently GEM2) and is consistent with the volatility factor used in the current optimization model (as defined in Appendix II). It is currently based on the following four descriptors, historical sigma, historical beta, daily standard deviation and cumulative range (refer [MSCI GEM2 Research Notes for more details](#)).

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