MSCI Diversified Multiple-Factor Indexes Methodology

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1   Introduction

The MSCI Diversified Multiple-Factor Indexes are designed to represent the performance of a strategy that seeks higher exposure to four style factors - Value, Momentum, Low Size and Quality - relative to other factors from the relevant Barra Equity Model[1] with controlled ex-ante risk. In other words, the index methodology aims to represent high exposure to the above-mentioned four factors while maintaining market risk exposure similar to the underlying parent index.

MSCI categorizes the MSCI Diversified Multiple-Factor Indexes as part of the family of MSCI Factor Indexes, which are designed to reflect 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.

Single factor indexes are designed to represent the performance of systematic exposures to certain stock characteristics. Building on academic research, the MSCI Factor Index family is built around six such factors: Value, Momentum, Low Size, Quality, Low Volatility and Yield. These factors have historically demonstrated long-term risk-adjusted outperformance but have also experienced significant multi-year periods of underperformance of capitalization-weighted indexes. The historical performance and the definition of the factors is reviewed in detail in a number of MSCI research papers, for example, "Foundations of Factor Investing" and "Factor Indexes in Perspective: Insights from 40 Years of Data (Part 1 and Part II)". Multi-factor indexes are designed to represent the performance of a diversified exposure to a range of factors. The MSCI Diversified Multiple-Factor Indexes are constructed from the stock-level upwards using individual stock exposures to four of the six factors identified above as having historically demonstrated long-term risk-adjusted outperformance - Value, Momentum, Quality and Low Size - rather than by combining the aggregate exposures of separate single factor indexes.

The MSCI Diversified Multiple-Factor Indexes are optimization-based indexes that aim to maximize exposure to the four style factors while maintaining a total risk profile for the index similar to that of the underlying parent index at the time of rebalancing.

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[1] Please refer to Appendix II and Appendix VI

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, mid cap, small cap or Investable Market Index (IMI).

The MSCI Diversified 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 the Parent Index.

The steps for constructing the MSCI Diversified 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 UNIVERSE

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 the ex-ante risk of the Parent Index at the time of rebalancing.

2.3.1   CALCULATION OF THE ALPHA SCORE

$$\propto_i = 0.25 * F_{1,i} + 0.25 * F_{2,i} + 0.25 * F_{3,i} + 0.25 * F_{4,i}$$

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 – 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 - 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 – 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 – 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.

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.

- 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 Mid Cap index or 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.

- Active exposure of the MSCI Diversified Multi-Factor Index to the target Barra style factors, namely, Book-to-Price, Earnings Yield, Earnings Quality, Investment Quality, Profitability and Momentum will be constrained to be greater than 0.1 and less than 0.6 relative to the Parent Index and the target Barra style factors, namely, Earnings Variability, Leverage and Size will be constrained to be greater than -0.6 and less than -0.1 relative to the Parent Index.

- Exposure of the MSCI Diversified Multiple-Factor Index to non-target Barra style factors, namely, Beta, Residual Volatility, Growth and Liquidity will be restricted to +/-0.1 standard deviations relative to the Parent Index.

- The sector weights of the MSCI Diversified Multiple-Factor Index 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 MSCI Diversified Multiple-Factor 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 MSCI Diversified Multiple-Factor 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 MSCI Diversified Multiple-Factor Index is constrained to a maximum of 10% at each index review.

2.5 DETERMINING THE OPTIMIZED INDEX

The MSCI Diversified Multiple-Factor Index is 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 MSCI Diversified Multiple-Factor Index. 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 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 MSCI Diversified 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 MSCI Diversified 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 MSCI Diversified Multiple-Factor 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 MSCI Diversified Multiple-Factor Index, the changes made to the Parent Index during intermediate Index Reviews will be neutralized in the MSCI Diversified Multiple-Factor Index.

The following section briefly describes the treatment of common corporate events within the MSCI Diversified 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

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

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

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

Where wm_i = Maximum Active 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

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

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

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

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 MSCI Diversified Multiple-Factor Index will not be rebalanced for that Quarterly Index Review.

Appendix II: 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 III: Target Factor Definition Summary

The style factors targeted in the MSCI Diversified Multiple-Factor Index are the four style factor groups and their combinations: Momentum, Low Size, Value and Quality. These factor groups are described using individual factor scores from the current release of the MSCI Barra Global Equity Model for Long-Term Investors (GEMLTL). The choice of factors used within each 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 GEMLTL, 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 GEMLTL).

Low 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 GEMLTL).

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 GEMLTL). 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 GEMLTL). A sector-relative score is derived from the combined score by standardizing (z-score) the latter within each sector and winsorizing at +/- 3.

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

Appendix IV: Methodology for MSCI Canada IMI Select Diversified Multiple-Factor (CAD) index

MSCI Canada IMI Select Diversified Multiple-Factor (CAD) Index uses the Canadian Dollar as the optimization currency. Reflecting the narrower opportunity set offered by a single country with particularly strong sector tilts versus MSCI World (for example), the methodology for constructing this index differs from the standard MSCI Diversified Multiple-Factor Index methodology in the following optimization constraints:

- The maximum weight of an index constituent will be restricted to the lower of (the weight of the security in the Parent Index + 3%) or 15 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 - 3%) or 0.

- The maximum weight multiple will be relaxed in steps of 3 instead of 2 in case of an infeasible optimization. Other relaxation parameters remain same as the Large Cap segment relaxations in standard methodology (Ref. Appendix I).

- Exposure of the MSCI Canada IMI Select Diversified Multiple-Factor (CAD) Index to the Barra style factor "Size" will be constrained to be greater than or equal to - 1 standard deviation relative to the Parent Index. Other target Barra style factors are left unconstrained.

- Exposure of the MSCI Canada IMI Select Diversified Multiple-Factor (CAD) Index to non-target Barra style factors, namely, Beta, Residual Volatility, Growth and Liquidity will be restricted to +/-0.25 standard deviations relative to the Parent Index.

- The sector weights of the MSCI Canada IMI Select Diversified Multiple-Factor (CAD) Index will be constrained not to deviate more than +/-10% from the sector weights of the Parent Index.

- The momentum and low size factors score for Alpha are directly from the factor exposure in the relevant Barra Equity Model.

- Barra Equity Model data as of the end of month prior to rebalancing date are used.

- The MSCI Canada IMI Select Diversified Multiple-Factor (CAD) Index is rebalanced on semi-annual frequency, coinciding with the May and November Semi-annual Index Reviews of the MSCI Global Investable Market Indexes. The one-way turnover of the Index is constrained to a maximum of 20% at each index review.

Appendix V: Methodology for MSCI USA Sector Diversified Multiple-Factor Capped indexes

The methodology for constructing the MSCI USA Sector Diversified Multiple-Factor Capped Indexes[2] differs from the standard MSCI Diversified Multiple-Factor Index methodology in the following optimization constraint:

- Exposure of the MSCI USA Sector Diversified Multiple-Factor Capped Indexes to non-target Barra style factors, namely, Beta, Residual Volatility, Growth and Liquidity will be restricted to +/-0.25 standard deviations relative to the Parent Index.

MSCI USA Sector Diversified Multiple-Factor Capped Indexes are constructed by applying the methodology of the MSCI USA Sector Index as the Parent Index. Subsequently, the issuer-level weights of the constituents of this derived index are capped at 25% (with the buffer of 1%), in accordance with the MSCI Capped Indexes methodology. The MSCI Capped Indexes methodology is available at:

https://www.msci.com/index-methodology

The following is the list of Parent Indexes:

- MSCI USA Energy
- MSCI USA Materials
- MSCI USA Industrials
- MSCI USA Consumer Discretionary
- MSCI USA Consumer Staples
- MSCI USA Health Care
- MSCI USA Financials
- MSCI USA Information Technology
- MSCI USA Utilities

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[2] Please refer to Appendix VII for the transition parameters during May 2022 Index Review

Appendix VI: MSCI Barra Equity Model Used In The Optimization

The MSCI Diversified Multiple-Factor Indexes, since inception, made use of the MSCI Barra Global Equity Model – Long Horizon (GEM2L) within the optimization setup. However, starting from the May 2018 Semi-Annual Index Review, the index construction currently uses an optimization setup using the MSCI Barra Global Equity Model for Long-Term Investors (GEMLTL).

Appendix VII: 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 times[3] the weight of the security in the Parent Index.

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.

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[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

THE FOLLOWING SECTIONS HAVE BEEN MODIFIED SINCE FEBRUARY 2015

Section 1 - Introduction

- Added a description of factor indexing at MSCI and an overview of how the construction of the Diversified Multiple-Factor Indexes fits into that framework.

Section 2 – Index Construction Methodology and Appendix III – Target Factor Definition

- Added links in section 2 to the relevant Barra documents and index methodologies where the target factors are defined in detail
- Added Appendix III which contains a short summary of target factor definition

THE FOLLOWING SECTIONS HAVE BEEN MODIFIED SINCE APRIL 2015

Appendix IV – Corporate Event Treatment

- Corrected a typo in the treatment of Acquisitions

Appendix IV

- Added Appendix IV which details the index construction parameters for the MSCI Canada IMI Select Diversified Multiple-Factor (CAD) Index

THE FOLLOWING SECTIONS HAVE BEEN MODIFIED SINCE SEPTEMBER 2015

Appendix V

- Added Appendix V which details the index construction parameters for the MSCI USA Sector Diversified Multiple-Factor Capped Indexes

THE FOLLOWING SECTIONS HAVE BEEN MODIFIED SINCE OCTOBER 2015

Appendix III

- Added a description for calculation of value score for "Real Estate" sector

THE FOLLOWING SECTIONS HAVE BEEN MODIFIED SINCE AUGUST 2016

Section 2.4

- Added optimization parameters when the Parent Index is an MSCI IMI Index

THE FOLLOWING SECTIONS HAVE BEEN MODIFIED SINCE SEPTEMBER 2016:

- Appendix IV in the previous version of the methodology book describing the Corporate Events treatment has been deleted. The details on the Corporate Events treatment are now included in Section 3.2.

THE FOLLOWING SECTIONS HAVE BEEN MODIFIED SINCE JUNE 2017:

- Section 2.4 has been updated to reflect the additional constraint on China A Stock Connect listings

- Section 1 and Section 2.5 have been updated 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 VI has been added to update the information on transition of MSCI Diversified Multiple-Factor Indexes to GEMLTL

THE FOLLOWING SECTIONS HAVE BEEN MODIFIED SINCE MAY 2018:

- Section 2.4 has been updated to reflect the optimization constraints when the parent Index is an MSCI Mid Cap Index.

- Appendix I has been updated to handle optimization infeasibility on MSCI Mid Cap 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 updated to reflect the treatment of MSCI Canada IMI Select Diversified Multiple-Factor (CAD) Index methodology.

- Appendix V has been updated to reflect the treatment of MSCI USA Sector Diversified Multiple-Factor Capped Indexes methodology.

- Appendix VII has been added to describe transition parameters during May 2022 Index Review.

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