

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 Barra Equity Model, Global Equity Model – Long Horizon, (GEM2L)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. The MSCI Diversified Multiple-Factor Indexes are rebalanced on a semi-annual basis.

¹ GEM2 is a global multi-factor model. For more details on GEM2 model, please refer to <https://support.msci.com/docs/DOC-3605>

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

2.3.1 CALCULATION OF THE ALPHA SCORE

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

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:

1. Momentum – Factor exposure for each security taken from the Barra Equity Model (GEM2L). The factor definition is given in Appendix III, with full details available in the [MSCI GEM2 Research Notes](#) report.

2. Low Size - Negative of the factor exposure for each security taken from the Barra Equity Model (GEM2L). The factor definition is given in Appendix III, with full details available in the [MSCI GEM2 Research Notes](#) report.
3. Value – Sector-relative Value z-score computed as mentioned in the MSCI Enhanced Value Index methodology. (Please refer to the Section 2.2 of the [MSCI Enhanced Value Index methodology](#) for full details – a summary is contained in Appendix III.)
4. Quality – Sector-relative Quality score computed as mentioned in the MSCI Sector Neutral Quality Index methodology. (Please refer to the Appendix VII of the [MSCI Sector Neutral Quality Index methodology](#) for details – a summary is contained 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.

- 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.
- Exposure of the MSCI Diversified Multiple-Factor Index to non-target Barra style factors such as volatility, growth and liquidity will be restricted to +/-0.25 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 one-way turnover of the MSCI Diversified Multiple-Factor Index is constrained to a maximum of 20% 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 ([GEM2L](#)). 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 SEMI-ANNUAL INDEX REVIEWS

The MSCI Diversified 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 MSCI Diversified Multiple-Factor Indexes are in general announced nine business days before the effective date.

3.2 ONGOING EVENT RELATED CHANGES

In general, the MSCI Diversified Multiple-Factor Indexes follow the event maintenance of the Parent Index.

3.2.1 IPOS AND OTHER EARLY INCLUSIONS

IPOs and other newly listed securities will only be considered for inclusion at the next MSCI Diversified Multiple-Factor Index SAIR, even if they qualify for early inclusion in the Parent Index.

3.2.2 ADDITIONS AND DELETIONS DUE TO CORPORATE EVENTS

A constituent deleted from Parent Index following a corporate event will be simultaneously deleted from the MSCI Diversified Multiple-Factor Index.

Please refer to Appendix IV for the details of corporate event treatments.

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 2.3.2, 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 Active 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 MSCI Diversified Multiple-Factor Index will not be rebalanced for that Semi-Annual Index Review.

APPENDIX II: NEW RELEASE OF BARRA[®] EQUITY MODEL OR BARRA[®] OPTIMIZER

A major 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 four factors targeted in the MSCI Diversified Multiple-Factor Index are Momentum, Low Size, Value and Quality.

Momentum:

The momentum factor score in the [GEM2 Barra Equity Model](#) is a z-score calculated as the weighted sum of security-level z-scores for 12-month relative strength (25% weight), 6-month relative strength (37.5% weight) and historical alpha (37.5% weight). The historical alpha is calculated from a time-series return regression of local excess stock returns against the cap-weighted local excess returns of the [GEM2](#) model estimation universe using 104 weeks of trailing returns. The descriptor is standardized on a global-relative basis.

Low Size:

The size factor score for a security is a z-score based on the logarithm of the market-capitalization of the relevant firm (i.e. calculated at the issuer level). The descriptor is standardized on a country-relative basis as part of the [GEM2 Barra Equity Model](#).

Value:

The value score for each security is calculated by combining the z-scores of three valuation descriptors, Forward Price to Earnings, Enterprise Value/Operating Cash Flows (EV/CFO) and Price to Book Value. A given variable z-score for a security is calculated using the mean and standard deviation of the inverse of the corresponding variable computed within the MSCI Parent Index. EV/CFO is used for all securities outside “Financials” (Sector “40” of the GICS® classification). After calculating component variable z-scores, a composite z-score for each security is computed by taking an equal-weighted average of the component z-scores. A sector-relative score is then derived from the composite value z-score by standardizing the latter within each sector and winsorizing at +/- 3.

Quality:

The quality score for each security is calculated by combining the z-scores of three fundamental descriptors, Return on Equity, Debt to Equity and Earnings Variability. A given variable z-score for a security is calculated using the mean and standard deviation of the corresponding variable computed within the MSCI Parent Index. After calculating

component variable z-scores, a composite z-score for each security is computed by taking an equal-weighted average of the component z-scores. A sector-relative score is then derived from the composite value z-score by standardizing the latter within each sector and winsorizing at ± 3 .

APPENDIX IV: CORPORATE EVENT TREATMENT

This appendix describes the treatment of the most common corporate events in the MSCI Indexes. Details regarding the treatment of all other corporate events not covered in this appendix can be found in the MSCI Corporate Events Methodology book, available at <http://www.msci.com/products/indices/size/standard/methodology.html>

Event Type	Event details	Action
Acquisition	Diversified Multiple-Factor Index constituent acquires another Diversified Multiple-Factor Index constituent	Maintain acquiring company and remove acquired company, new constraint factor (CF) is computed as a weighted average of the CFs prior to the event, with weights set to weights in the Parent Index
	Diversified Multiple-Factor Index constituent acquires non- Diversified Multiple-Factor Index constituent which is a Parent Index constituent	Maintain acquiring company, new CF is computed as a weighted average of the CFs prior to the event, with weights set to weights in the Parent Index, and the CF of the acquired security is set to 0
	Diversified Multiple-Factor Index constituent acquires non- Diversified Multiple-Factor Index constituent which is not a Parent Index constituent	No change in CF
	Non-Diversified Multiple-Factor Index constituent acquires Diversified Multiple-Factor Index constituent	Remove acquired company without adding acquiring company
Merger	Diversified Multiple-Factor Index constituent merges with Diversified Multiple-Factor Index constituent	Add a new company with a new CF which is computed as a weighted average of the CFs prior to the event, with weights set to weights in the Parent Index
	Diversified Multiple-Factor Index constituent merges with non- Diversified Multiple-Factor Index constituent	Add new company if MSCI links its price history to the Diversified Multiple-Factor Index constituent. New company not added if price history is linked to the non-Diversified Multiple-Factor Index constituent

Event Type	Event details	Action
IPO	IPO added to Parent Index	Security will be considered for inclusion in the Diversified Multiple-Factor Index at the next semi-annual index review
Spin-off	Diversified Multiple-Factor Index constituent spins off security	Add spun-off security to the Diversified Multiple-Factor Index with the constraint factor of the spinning security, if it is included in the Parent Index
Conversion	Security A converted to B, A deleted from Parent Index, B added	B inherits constraint factors from A
Country Reclassification	Domicile of company reviewed: Security A deleted from country A, security B added to country B	B inherits constraint factors from A if it is added to the Parent Index
Stock exchange reclassification	Stock exchange (price source) of company reviewed: Security A deleted, security B added	B inherits constraint factors from A if it is added to the Parent Index
Other Events Resulting in Changes in Number of Shares and FIFs	Changes in number of shares and subsequent FIF resulting from other events such as share placements and offerings, and debt-to-equity-swaps	No change in Constraint Factor

APPENDIX V: 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 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.
- 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 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 V

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

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