

# 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)<sup>1</sup> with controlled ex-anterisk. 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.

 $<sup>^1</sup>$  GEM2 is a global multi-factor model. For more details on GEM2 model, please refer to  $\underline{\text{https://support.msci.com/docs/DOC-3605}}$ 



# 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-anterisk 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,

 $F_{i,i}$  = 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 VI 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 ParentIndex. The minimum weight of an index constituent will be restricted to the higher of the (weight of the security in the ParentIndex 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 MSCI Diversified Multi-Factor Index 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 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-FactorIndex 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 (<u>GEM2L</u>). 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

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: <a href="https://www.msci.com/index-methodology">https://www.msci.com/index-methodology</a>



# **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

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

Where w<sub>i</sub> = 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

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

Where wm<sub>i</sub> = 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 <u>GEM2 Barra Equity Model</u> 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 <u>GEM2</u> 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, based on the security's GICS Sector. 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. Forward Price to Earnings, Enterprise Value/ Operating Cash Flows and Price to Book are the variables used for all securities except for those classified in the Financials or Real Estate Sector. For securities classified in the Financials Sector, Forward Price to Earnings and Price to Book are used. For securities classified in the Real Estate Sector, Enterprise Value/ Operating Cash Flow is used. 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: 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.



# APPENDIX V: METHODOLOGY FOR MSCI USA SECTOR DIVERSIFIED MULTIPLE-FACTOR CAPPED INDEXES

MSCI USA Sector Diversified Multiple-Factor Capped Indexes are constructed by applying the *standard* methodology of the MSCI Diversified Multiple-Factor Indexes to an 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



#### 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.



# **CONTACT US**

#### **AMERICAS**

clientservice@msci.com

Americas	1 888 588 4567 *
Atlanta	+ 1 404 551 3212
Boston	+ 16175320920
Chicago	+ 1 312 675 0545
Monterrey	+ 52 81 1253 4020
New York	+ 1 212 804 3901
San Francisco	+ 1 415 836 8800
Sao Paulo	+ 55 11 3706 1360
Toronto	+ 14166281007

# **EUROPE, MIDDLE EAST & AFRICA**

Cape Town	+ 27 21 673 0100
Frankfurt	+ 49 69 133 859 00
Geneva	+ 41 22 817 9777
London	+ 44 20 7618 2222
Milan	+ 39 02 5849 0415
Paris	0800915917*

#### **ASIA PACIFIC**

China North	10800 852 1032 *
China South	10800 152 1032 *
Hong Kong	+ 852 2844 9333
Mumbai	+ 91 22 6784 9160
Seoul	00798 8521 3392 *
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