INDEX METHODOLOGY

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-MSCI Quantitative Factor Market Neutral Indexes Methodology -MSCI Quantitative Factor Market Neutral Excess Return Indexes Methodology

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1. Introduction

The MSCI Quantitative Factor Market Neutral Indexes (herein, the "Indexes" and each as “Index”)[1] are designed to provide high systematic exposure to the specified style factors[2] by combining long and short positions. The Indexes can be exposed to individual factors or multiple factors (QVM). The Indexes deploy a 100/100 leverage structure, 100% long and 100% short, enabling to capture both the positive exposure and negative exposure ends of the target factor spectrum, while maintaining limited beta to the market. The Indexes are constructed using an optimization-based approach that seeks to maximize the target factor exposure less a penalty for total risk, subject to explicit constraints on ex-ante total risk, total specific risk, and other unintended risk exposures.

The construction process is designed to:

- Emphasize exposure to the target factor through both long and short positions while limiting unintended exposures to other systematic risk characteristics such as styles, sectors and countries
- Apply an optimization-based portfolio construction framework incorporating defined risk controls including constraints on total risk, beta, and by-side sector and country exposures
- Incorporate implementation considerations pertaining to the investability, including turnover, capacity and liquidity

The Indexes are intended to provide a transparent and systematic representation of quantitative market-neutral factor strategies within a rules-based index methodology framework.

The MSCI Quantitative Factor Market Neutral Excess Return Indexes are designed to represent the performance of an investment strategy tracking MSCI Quantitative Factor Market Neutral Indexes after deducting short-term rates. For more details, please refer to Section 2.10[3].

[1] The Indexes are governed by a set of methodology and policy documents (“Methodology Set”), including the present index methodology document. Please refer to Appendix V for more details.

[2] Please refer to Appendix I for the detailed calculation of the target factor scores.

[3] Please refer to the MSCI Excess Return Indexes methodology at www.msci.com/index-methodology.

2. Index Construction Methodology

The Indexes are constructed by combining the following components:

- MSCI Quantitative Factor Market Neutral Long Index (the "component 1", together the "components")
- MSCI Quantitative Factor Market Neutral Short Index (the "component 2", together the "components")
- Cash Index[4] (the "component 3", together the "components")

At Index Review, the components are combined based on the following weights and return variants to create the Indexes:

Component Index	Weight	Return Variant
MSCI Quantitative Factor Market Neutral Long Index	100%	Net Total Return
MSCI Quantitative Factor Market Neutral Short Index	-100%	Gross Total Return
Cash Index	100%	Total Return

The level of the Cash Index is determined using the daily Cash Index return ("Daily Cash Index Return") which is calculated on each day "t" as follows:

$$Cash\ Index_t = Cash\ Index_{t-1} \times (1 + Daily\ Cash\ Index\ Return_t)$$

Where:

$$Daily\ Cash\ Index\ Return_t = CR_{t-1} * \frac{ACT_{(t-1,t)}}{Day\ Count}$$

Where:

CR_{t-1} = Short-Term rate[4] published on the previous business day t-1

$ACT_{(t-1,t)}$ = Number of actual calendar days between business day t-1 and t

$Day\ Count$ = Day count convention used by the short-term rate

Between successive rebalancing, the weights of the component indexes will evolve based on their respective performance.

[4] For USD, LIBOR rate is used until August 31, 2021, SOFR is used effective September 1, 2021.

The MSCI Quantitative Factor Market Neutral Long Index[5] and the MSCI Quantitative Factor Market Neutral Short Index[6] are constructed from the Optimized Index[7]. Please refer to Section 2.3 for more details on the Optimized Index.

2.1 Defining MSCI Quantitative Factor Market Neutral Long Index

All the securities from the Optimized Index with positive weights are selected for inclusion in the MSCI Quantitative Factor Market Neutral Long Index in the same weightings as in the Optimized Index. The weights of the selected securities from the Optimized Index are then normalized to 100%.

2.2 Defining MSCI Quantitative Factor Market Neutral Short Index

All the securities from the Optimized Index with negative weights are selected for inclusion in the MSCI Quantitative Factor Market Neutral Short Index in the same weightings as in the Optimized Index. The weights of the selected securities from the Optimized Index are then normalized to 100%.

2.3 Optimized Index

Constructing the Optimized Index involves the following steps:

- Defining the Parent Index
- Defining the Alpha Score
- Defining the Eligible Universe
- Defining the Optimization Setup
- Determining the Optimized Index

The steps mentioned above are defined in detail in the subsequent sections.

2.4 Defining the Parent Index

Construction of the Indexes begins with identifying the Parent Index which is a free-float adjusted market capitalization weighted MSCI Index as per the MSCI Global Investable Markets Index (GIMI) methodology[8]. The optimization is performed from a base currency[9] perspective.

[5] Refer to Section 2.1 for more details

[6] Refer to Section 2.2 for more details

[7] Refer to section 2.3 for more details

[8] For details about the methodology, please refer to: https://www.msci.com/index/methodology/latest/GIMI.

[9] Any currency within the relevant Barra Equity Model can be used as an optimization currency. The default currency is the US Dollar.

2.5 Defining the Alpha Score

Alpha score for each security is computed as winsorized (±3) z-scores[10] of the target factor exposures. The single-factor Alpha Score is used for individual target factor indexes. The Multi-Factor Alpha Score below is used for the MSCI Quantitative QVM Market Neutral Index.

Alpha Score:

$$\propto_i = F_{j,i}$$

Where $F_{j,i}$ represents the factor score of security i for the target factor j.

The factor scores for the target factors are defined in Appendix I.

For Multi-Factor:

$$\propto_i = 0.3333 * F_{1,i} + 0.3333 * F_{2,i} + 0.3334 * F_{3,i}$$

Where $F_{j,i}$ represents the factor score of security i for the target factor j.

The factor scores for the target factors are defined as follows:

- Quality ($F_{1,i}$) - The factor score definition is given in Appendix I.
- Value ($F_{2,i}$) – The factor score definition is given in Appendix I.
- Momentum ($F_{3,i}$) – The factor score definition is given in Appendix I.

If any of the factor score ($F_{j,i}$) is missing for a security (i), a value of zero is assigned for that factor score ($F_{j,i}$). A minimum of one factor score is required to calculate the Alpha score.

2.6 Defining the Eligible Universe

The Eligible Universe is constructed by excluding securities without an Alpha score (as defined in Section 2.5) for the relevant target factor from all the constituents of the Parent Index.

2.7 Defining the Optimization Setup

The optimization objective is to maximize the Alpha score (representative of the exposures to the target factor) less a penalty for total risk at the time of rebalancing.

2.8 Optimization Constraints

At each Index Review, the following optimization constraints are employed, which aim to meet the objectives of the Index while ensuring replicability and investability:

- The gross leverage will be 200% with 100% long leverage and 100% short leverage
- The maximum weight of the Index constituent at net level will be restricted to 3% and the minimum weight of an Index constituent at net level will be restricted to - 3%.

[10] For the Value and Quality factors, the alpha score is computed as winsorized (±3) sector-relative z-score of the corresponding target factor exposures.

- At each Index Review, the weight of each index constituent at net level will not change more than a predefined Trade Limit linked to the stock's Average Daily Traded Value (ADTV). Please refer to Appendix IV for more details.
- Exposure of the Index at net level to the positive target Barra style factors[11] (factors included in the calculation of Alpha score) will be constrained to be greater than 0.1 standard deviation and the negative target Barra style factors[12] (factors included in the calculation of Alpha score) will be constrained to be less than -0.1 standard deviation.
- Exposure of the Index at net level to non-target[13] Barra style factors will be restricted to be between +/-0.1 standard deviation.
- Exposure of the Index at long level to the Short Interest Barra style factor will be restricted to +/-0.1 standard deviation, and at short level both upper bound and lower bound will be kept unconstrained.
- The Common Factor Risk Aversion and Specific Risk Aversion parameters[14] in the optimization are set to 0.0015 and 0.015, respectively.
- The ex-ante total risk of the Index will be capped at 5%[15].
- The ex-ante total specific risk of the Index will be capped at 3.5%[16].
- The ex-ante beta of the Index at net level calculated with respect to the Parent Index will be constrained between -0.05 to 0.05.
- Securities from the Parent Index with shorting cost more than 250 basis points (bps) or missing are not eligible for inclusion in the short leg. If it is an existing constituent, then it will become ineligible for inclusion in the short leg if its shorting cost becomes more than 300bps.
- The absolute GICS®[17] sector weights at net level of the Index will be constrained between +/-5%.
- The GICS® sector weights of the Index on the long leg will not deviate more than +/-10% from the GICS® sector weights of the Parent Index.

[11] Positive target Barra style factors include Value and Earnings Yield (for Value as the target factor); Investment Quality, Earnings Quality and Profitability (for Quality); Momentum (for Momentum).

[12] Negative target Barra style factors include Earnings Variability and Leverage (for Quality as the target factor).

[13] Exposure of the Index to the Dividend Yield style factor will not be constrained in the MSCI Quantitative Value Market Neutral Index, as it is correlated with the Value target style factors. Additionally, exposure of the Index to the Seasonality, Short Term Reversal, Stock Crowding and Machine Learning factors will not be constrained in the MSCI Quantitative Momentum Market Neutral Index. Similar convention will be followed for MSCI Quantitative QVM Market Neutral Index.

[14] Common Factor Risk Aversion and Specific Risk Aversion are risk aversion parameters in the Barra Open Optimizer utility function. Common Factor Risk Aversion determines the relative weight of common factor risk compared to the alpha, and Specific Risk Aversion determines the relative weight of asset-specific risk compared to the alpha, in the optimization objective.

[15] Ex-ante total risk of MSCI Quantitative Momentum Market Neutral Index will be capped at 6%.

[16] Ex-ante specific risk of MSCI Quantitative Momentum Market Neutral Index will be capped at 4%.

[17] GICS is the Global Industry Classification Standard jointly developed by MSCI and S&P Dow Jones Indices.

- The GICS® sector weights of the Index on short side will not deviate more than +/-10% from the negative of the corresponding GICS® sector weight in the Parent Index. For example, if a sector weight in the Parent Index is 20%, the short side sector weight will be constrained between −30% and −10%.
- The absolute country weights at net level of the Index will be constrained between +/-5%.
- The country weights of the Index on the long leg will not deviate more than +/-10% from the country weights of the Parent Index.
- The country weights of the Index on short side will not deviate more than +/-10% from the negative of the corresponding country weight in the Parent Index. For example, if a country weight in the Parent Index is 15%, the short side country weight will be constrained between −25% and −5%.
- The above country weight constraints will also apply on China A Stock Connect listings as a group separately in addition to the usual country weight constraint on China on net, long and short level.
- The one-way turnover of the Index is constrained to a maximum of 10% at the time of rebalancing[18].

2.9 Determining the Optimized Index

The Indexes are constructed using the Barra Open Optimizer in combination with the relevant Barra Equity Model[19]. The optimization uses the Eligible Universe as the universe of eligible securities and the specified optimization objective (that is to maximize the Alpha score less a penalty for total risk) and optimization constraints to determine the Index. Infeasible optimizations are handled as explained in Appendix II.

2.10 Constructing the MSCI Quantitative Factor Market Neutral Excess Return Indexes

The MSCI Quantitative Factor Market Neutral Excess Return Indexes is constructed by applying the MSCI Excess Return Indexes Methodology[20] to the Index on each index calculation day[21].

[18] The one-way turnover constraint for the MSCI Quantitative Momentum Market Neutral Index and MSCI Quantitative QVM Market Neutral Index is constrained to a maximum of 15% at the time of rebalancing.

[19] Please refer to Appendix III for the detailed information on model usage.

[20] Please refer to the MSCI Excess Return Indexes methodology at www.msci.com/index-methodology.

[21] For USD, LIBOR rate is used until August 31, 2021, SOFR is used effective September 1, 2021.

3. Maintaining the Index

3.1 Index Reviews

The Indexes are reviewed on a monthly basis, effective day is usually the first business day of each month[22] and rebalancing day is five business days before the effective date. Barra Equity Model data as of the day before the rebalancing day is used. ADTV and Shorting-Cost data as of the previous end of month of rebalancing day is used.

The pro forma Indexes are in general announced five business days before the effective date.

3.2 Ongoing Event Related Changes

The general treatment of corporate events in the 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.

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

No new securities will be added (except where noted below) to the Indexes between Index Reviews. Parent Index deletions will be reflected simultaneously in the Index.

EVENT TYPE	EVENT DETAILS
New additions to the Parent Index	A new security added to the Parent Index (such as IPO and other early inclusion) 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 Indexes. If an existing Index constituent is acquired by a non-Index constituent, the existing constituent will be

[22] For quarterly rebalancing days, the Indexes are reviewed as of the close of the last business day of February, May, August and November, coinciding with the February, May, August and November Index Reviews of the MSCI Global Investable Market Indexes.

	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: Target Factor Definition Summary

The style factors targeted in the Indexes are the three style factor groups: Momentum, Value, and Quality.

The following are the definitions of factor groups currently used in the Indexes.

Momentum:

The Momentum score for each security is calculated by combining the security-level exposures to three factors, Momentum, Industry Momentum and Analyst Sentiment, from the relevant Equity Factor Trading Model[23]. A score is derived from the combined score by standardizing (z-score) the combined score and winsorizing at +/-3.

$$\text{Momentum score}_i = (0.5)*\text{Momentum}_i + (0.25)*\text{IndustryMomentum}_i + (0.25)*\text{AnalystSentiment}_i$$

Value:

The Value score for each security is calculated by combining the security-level exposures to two factors, Value and Earnings Yield, from the relevant Equity Factor Model[23]. A sector-relative score is derived from the combined score by standardizing (z-score) the combined score within each sector and winsorizing at +/- 3.

$$\text{Value score}_i = (0.3333) * \text{Value}_i + (0.6667) * \text{EarningsYield}_i$$

Quality:

The Quality score for each security is calculated by combining the security-level exposures to five factors - Profitability, Investment Quality, Earnings Quality, Leverage and Earnings Variability, from the relevant Equity Factor Model[23]. A sector-relative score is derived from the combined score by standardizing (z-score) the combined score within each sector and winsorizing at +/- 3.

$$\text{Quality score}_i = (0.25) * \text{Profitability}_i + (0.25) * \text{Investment Quality}_i + (0.25) * \text{Earnings Quality}_i + (-1) * (0.125) * \text{Earnings Variability}_i + (-1) * (0.125) * \text{Leverage}_i$$

[23] Please refer to Appendix III for the detailed information on relevant Equity Factor Models and Equity Factor Trading Models.

Appendix II: Handling Infeasible Optimizations

During the monthly Index Review, in the event that there is no optimal solution that satisfies all the optimization constraints defined in Section 2.8, the following constraints are relaxed, until an optimal solution is found:

- Relax the turnover constraint in steps of 4%, up to a maximum of 30%[24]
- Relax the total risk constraint in steps of 1%, up to a maximum of 10% and total specific risk constraint in steps of 0.5%, up to a maximum of 6%[25]

The total risk constraint and total specific risk constraint are relaxed simultaneously. The turnover constraint and risk constraints (total risk constraint and total specific risk constraint) are alternately relaxed until a feasible solution is achieved. For example, constraints relaxation is executed in the sequence as illustrated below:

Order of Relaxation	Turnover Limit	Total Risk Limit	Total specific risk limit
Default	10%	5%	3.5%
1	**14%**	5%	3.5%
2	14%	**6%**	**4%**
3	**18%**	6%	4%
4	18%	**7%**	**4.5%**

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

[24] For the MSCI Quantitative Momentum Market Neutral Index and MSCI Quantitative QVM Market Neutral Index, turnover constraint will be relaxed from 15% to 40% in steps of 5%.

[25] For the MSCI Quantitative Momentum Market Neutral Index, total-risk constraint will be relaxed from 6% to 11% in steps of 1% and specific-risk constraint will be relaxed from 4% to 6.5% in steps of 0.5%.

Appendix III: New Release of Barra® Equity Model or Barra® Optimizer

The methodology uses the relevant MSCI Equity Factor Model for the optimization, as determined by the region of the Parent Index. For all target factors other than Momentum and QVM (Multi-factor), the relevant Equity Factor Model is used, and for the Momentum factor and QVM (Multi-factor), the relevant Equity Factor Trading Model is used. For example, ACWI-based factor indexes use the MSCI Global Equity Factor Model (EFMGEMLT) and the MSCI Global Equity Factor Trading Model (EFMGEMTR). The table below provides the mapping of Parent Indexes to their corresponding Barra Equity Models. A new release of the relevant Barra Equity Model or Barra Optimizer may replace the former version within a suitable timeframe.

Sr No	Parent Index	Equity Factor Model	Equity Trading Factor Model
1.	MSCI ACWI Index	MSCI Global Equity Factor Model (EFMGEMLT)	MSCI Global Equity Factor Trading Model (EFMGEMTR)
2.	MSCI World Index	MSCI Global Equity Factor Model (EFMGEMLT)	MSCI Global Equity Factor Trading Model (EFMGEMTR)
3.	MSCI EAFE Index	MSCI Global Equity Factor Model (EFMGEMLT)	MSCI Global Equity Factor Trading Model (EFMGEMTR)

Appendix IV: Defining Trade Limits

In the monthly Index Review, the Trade Limit for each security (i.e., the maximum-security weight change) is calculated as 20% of its Average Daily Traded Value, assuming a portfolio value of 1 billion USD:

Trade Limit = (20% * Average Daily Traded Value) / 1 billion

The Average Daily Traded Value of a security is calculated as the average of the daily traded values in the one month prior to the Rebalancing Date. The daily traded value of a security is equal to the number of shares traded during the day, multiplied by the closing price of that security.

At each monthly Index Review, each security is subject to both absolute bounds of asset linear bounds and Trade Limit based bounds. The upper bound is defined as the minimum of the absolute linear and Trade Limit upper bounds, and the lower bound is defined as the maximum of the absolute linear and Trade Limit lower bounds. When these bounds conflict (i.e., the upper bound is lower than the lower bound), the Trade Limit asset bound constraint takes precedence, and both the final upper and lower bounds are set to the Trade Limit based bound. As a result, temporary deviations beyond asset linear bounds can still happen, while allowing the bounds to converge back toward the asset linear bounds range over subsequent rebalances.

For example, if a security has a current weight of 6% and a Trade Limit of ±2%, the Trade Limit implies a lower bound of 4%. Its asset linear upper bound will be 3%. Since the trade limit lower bound of 4% exceeds the absolute linear upper bound of 3%, both the final lower and upper bounds are set to 4%. Similarly, if a security has a current weight of −5.5% with the same Trade Limit, the Trade Limit implies an upper bound of −3.5% which lies below the absolute linear lower bound of −3%, so both the final lower and upper bounds will be set to -3.5%.

Appendix V: Methodology Set

The Indexes are governed by a set of methodology and policy documents ("Methodology Set"), including the present index methodology document as mentioned below:

- Description of methodology set – https://www.msci.com/index/methodology/latest/ReadMe
- MSCI Corporate Events Methodology – https://www.msci.com/index/methodology/latest/CE
- MSCI Fundamental Data Methodology – https://www.msci.com/index/methodology/latest/FundData
- MSCI Index Calculation Methodology – https://www.msci.com/index/methodology/latest/IndexCalc
- MSCI Index Glossary of Terms – https://www.msci.com/index/methodology/latest/IndexGlossary
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- MSCI Global Investable Market Indexes Methodology – https://www.msci.com/index/methodology/latest/GIMI
- MSCI Excess Return Indexes Methodology – https://www.msci.com/index/methodology/latest/ExcessReturn

The Methodology Set for the Indexes can also be accessed from MSCI's webpage https://www.msci.com/index-methodology in the section 'Search Methodology by Index Name or Index Code'.

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Canada	+ 1 416 687 6270
Brazil	+ 55 11 4040 7830
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South Africa	+ 27 21 673 0103
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