

MSCI MARKET NEUTRAL BARRA FACTOR INDEXES METHODOLOGY

March 2018

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1 INTRODUCTION

Fundamental factors have become increasingly important in various areas of the investment process, including risk management and portfolio construction. Fundamental factors represent sources of systematic risk and return.

MSCI has done extensive research to identify the common factors driving equity markets and built factor models to capture these common sources of risk and return. MSCI research shows that three types of fundamental factors account for a significant part of the commonality in equity returns across different markets and time periods: country factors, industry factors, and style factors. The main style factors include size, value, momentum, volatility and growth, to name a few.

The MSCI Market Neutral Barra Factor Indexes aim to capture systematic returns associated with a particular style factor while maintaining controlled exposure to other factors such as industry, country or other style factors. These indexes are constructed by optimizing a parent MSCI index to achieve a specified high level of exposure to a particular Barra style factor (herein, “Target Factor”), very low exposure to all other style, industry and country factors, and low tracking error to a corresponding Pure Factor portfolio¹ (herein, “Benchmark”). MSCI currently offers Market Neutral Barra Factor Indexes that target the Momentum & Volatility style factors.

This methodology book describes the generic methodology to create MSCI Market Neutral Barra Factor Indexes based on an existing MSCI Equity Index (a “Parent Index”) using the Barra Optimizer and the applicable Barra Equity Model. Further information about the Barra Optimizer and the various Barra Equity Models can be found at www.msci.com/research-archive.

¹ Pure Factor portfolios are the portfolios that have unit exposure to a Target Factor and no exposure to country, industry and non-target style factors.

2 MAIN CHARACTERISTICS OF MSCI MARKET NEUTRAL BARRA FACTOR INDEXES

The MSCI Market Neutral Barra Factor Indexes aim to track the performance of a particular Target Factor with a high exposure to the Target Factor and low exposure to the non-target factors. The MSCI Market Neutral Barra Factor Indexes aim to minimize tracking error with low turnover relative to the Benchmark. The MSCI Market Neutral Barra Factor Indexes are rebalanced at a monthly frequency.

3 CONSTRUCTING THE MSCI MARKET NEUTRAL BARRA FACTOR INDEXES

The MSCI Market Neutral Barra Factor Indexes are constructed by optimizing a Parent Index in conjunction with a Barra Equity Model to achieve a specified stable level of exposure to the Target Factor and a controlled level of exposure to all other style, industry and country factors, while minimizing the tracking error relative to the Benchmark, for a given set of investability constraints. Constructing the MSCI Market Neutral Barra Factor Indexes involves the following steps:

- Specifying the Parent Index, Benchmark and the Barra Equity Model for optimization
- Specifying the Target Factor and optimization objective
- Specifying the optimization constraints
- Calculating the optimized index

The steps for constructing the MSCI Market Neutral Barra Factor Indexes are described below.

3.1 SPECIFYING THE PARENT INDEX, BENCHMARK AND THE BARRA EQUITY MODEL FOR OPTIMIZATION

The MSCI Market Neutral Barra Factor Indexes begins with the selection of the Parent Index, the Benchmark and the relevant Barra Equity Model for the optimization. For the MSCI Market Neutral Barra Factor Indexes:

- the Parent Index is the applicable MSCI Standard Index and serves as the eligible universe of securities for the optimization process
- the Benchmark for the optimization is the applicable Pure Factor portfolio
- the applicable Barra Equity Model is the relevant global, regional or single country Barra Equity Model.

For example, to construct the MSCI Europe Market Neutral Barra Factor Indexes, the MSCI Europe Index is the applicable Parent Index. The Barra Europe Short-Term Model would be used as the underlying risk model for the optimization. The Pure Factor portfolio corresponding to the Target Factor and the applicable Barra Equity Model would be used as the Benchmark for the optimization.

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 (e.g., the Euro is the base currency for the MSCI Europe Market Neutral Barra Factor Indexes)

3.2 SPECIFYING THE TARGET FACTOR AND OPTIMIZATION OBJECTIVES

The optimization objective is to minimize the tracking error of the MSCI Market Neutral Barra Factor Index relative to the Benchmark, subject to the optimization constraints specified in Section 3.3.

The MSCI Market Neutral Barra Factor Index targets 1 or -1 standard deviation of exposure to the Target Factor. Please refer to Appendix I for the current list of MSCI Market Neutral Barra Factor Indexes and their intended Target Factor exposure.

3.3 SPECIFYING THE OPTIMIZATION CONSTRAINTS

At each monthly index rebalancing, specific optimization constraints are applied with an aim to control the level of exposures to non-target factors, and to achieve a balance between the objectives of replicability and investability, high exposure to the Target Factor, low tracking error to the Benchmark and low index turnover relative to a Barra Pure Factor portfolio.

Parameter	MSCI Market Neutral Barra Factor Index
Parent Index (Stock Selection Universe)	MSCI Europe
Benchmark/ Reference portfolio	Barra Pure Factor portfolio
Barra Model	EUE3SBAS
Index Type	Market Neutral Barra Factor
Optimization Objective	Minimizing active risk relative to Benchmark
Gross Leverage	2 (100% Long and 100% Short)
Target factor exposure	1 or -1 standard deviation
Non-target style factor exposure	+/- 0.1
Industry factor exposure	+/- 3%
Country factor exposure	+/- 3%
Max number of stocks	300
Maximum constituent weight	+/- 3%
One-way monthly turnover	10% (i.e. 5% on Long & Short portfolio each)

1-month ADV Trade Limit ²	10%
Shorting Cost threshold ³	250bps (buffer-50bps)

- At each monthly index rebalancing, the weight of each index constituent will not change more than a predefined Trade Limit linked to the stock’s Average Daily Traded Value.
- At each monthly index rebalancing, the weight of an index constituent will not be more than +/- 3% in absolute terms. When this constraint is in conflict with the Trade Limit constraint defined above, the Trade Limit constraint takes precedence.

3.4 CALCULATING THE MSCI MARKET NEUTRAL BARRA FACTOR INDEX

The approach for calculating the daily index levels of an MSCI Market Neutral Barra Factor Index is as follows:

- The MSCI Market Neutral Barra Factor Index is a combined index of two sub-indexes.
- The two sub-indexes are,
 - Long Index – Index of Long constituents from optimized portfolio
 - Short Index – Index of Short constituents from optimized portfolio
- The daily returns of the MSCI Market Neutral Barra Factor Index are computed as follows:

$$Index_T = (1 + W_{L,T} * R_{L,T} - W_{S,T} * R_{S,T}) * Index_{T-1}$$

Where,

$W_{L,T}$ = Long Index weight for T

$W_{S,T}$ = Short Index weight for T

$R_{L,T}$ = Daily return on Long Index from T-1 to T

$R_{S,T}$ = Daily return on Short Index from T-1 to T

The sub-index weights will be determined as follows:

² Please refer to Appendix IV for the calculation of the Trade Limit

³ Please refer to Appendix III for the details on Shorting Cost

$$W_{L,T} = W_{L,T-1} * \frac{(1 + R_{L,T-1})}{(1 + R_{P,T-1})}$$

$$W_{S,T} = W_{S,T-1} * \frac{(1 + R_{S,T-1})}{(1 + R_{P,T-1})}$$

$R_{L,T-1}$ = Daily return on Long Index from T-2 to T-1

$R_{S,T-1}$ = Daily return on Short Index from T-2 to T-1

$R_{P,T-1}$ = Daily return on MSCI Market Neutral Barra Factor Index from T-2 to T-1

At the effective date of each monthly rebalancing, the Long Index weight and Short Index weight will be reset to 100% & -100% respectively.

4 MAINTAINING THE MSCI MARKET NEUTRAL BARRA FACTOR INDEXES

4.1 MONTHLY INDEX REVIEWS

The index review of the MSCI Market Neutral Barra Factor Indexes is scheduled for the beginning of each month following the release by Barra to its clients of the monthly updates of the security exposure data and factor variances and co-variances data of the relevant Barra Equity Model. The rebalancing date for the MSCI Market Neutral Barra Factor Indexes is as specified in Appendix II (the “Rebalancing Date”). The Rebalancing Date of the MSCI Market Neutral Barra Factor Indexes may vary depending on the release date of the monthly update of the corresponding Barra Equity Model. The release date of the monthly update of the relevant Barra Equity Model will be announced to all MSCI Market Neutral Barra Factor Index clients on or before the release.

The rebalancing of the MSCI Market Neutral Barra Factor Indexes is conducted as of the close of the Rebalancing Date. The changes resulting from the index rebalancing will be announced on the Rebalancing Date and will be effective from the third business day following the Rebalancing Date.

Please refer to Appendix II for further information about the monthly rebalancing timeline.

4.2 ONGOING EVENT RELATED CHANGES

The general treatment of corporate events in the MSCI Market Neutral Barra 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 Market Neutral Barra Factor Index, the changes made to the Parent Index during intermediate Index Reviews will be neutralized in the MSCI Market Neutral Barra Factor Index.

The following section briefly describes the treatment of common corporate events within the MSCI Market Neutral Barra 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: CURRENT LIST OF MSCI MARKET NEUTRAL BARRA FACTOR INDEXES AS OF MAY 2013

MSCI Market Neutral Barra Factor Index	Target Factor	Target Factor Exposure
MSCI Europe Market Neutral Barra Momentum Index (EUR)	Momentum	1
MSCI Europe Market Neutral Barra Momentum Index (USD)	Momentum	1
MSCI Europe Market Neutral Barra Volatility Index (EUR)	Volatility	1
MSCI Europe Market Neutral Barra Volatility Index (USD)	Volatility	1

The above indexes will be available with Price, Gross & Net variants

APPENDIX II: MONTHLY REBALANCING TIMELINE

The Rebalancing of the MSCI Market Neutral Barra Factor Indexes occurs after the monthly update of the corresponding Barra Equity Model.

The target release date of the Barra European Equity Model is the first calendar day after the last business day of the previous month. The Rebalancing Date for the MSCI Market Neutral Barra Factor Indexes is the close of the second business day of the rebalancing month. The changes resulting from the index rebalancing will be announced at the close of Rebalancing Date and will be effective from the fifth business day of the rebalancing month.

APPENDIX III: DEFINING SHORTING COST CUTOFF

For a current constituent, if a security's Shorting Cost at the monthly index review exceeds a Shorting Cost Cutoff of 300 basis points, the security will be excluded from the MSCI Market Neutral Barra Factor Index. For a new security, the Shorting Cost cut off is 250 basis points. If a security is not covered by the Shorting Cost data, it will also be excluded from the MSCI Market Neutral Barra Factor Index.

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 10% of its Average Daily Traded Value, assuming a portfolio value of 1 billion USD:

$$\text{Trade Limit} = (10\% * \text{Average Daily Traded Value}) / 1 \text{ billion}$$

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.

APPENDIX V: 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 3.3, the constraints will be relaxed sequentially as follows, until an optimal solution is found:

- 1) Relax the turnover constraint and factor exposure constraints on style, industry and country factors. This is achieved automatically using the Soft Constraint feature of the Barra Optimizer, by setting both turnover constraint and factor exposure constraints as Soft Constraint.
- 2) Relax the trade limit constraint by allowing two times the original Trade Limit for each security.
- 3) Relax the constraint on index constituent weight by constraining the weight of an index constituent to be no more than +/- 3.75% , instead of no more than +/- 3.0%
- 4) Relax the maximum number of index constituents to 1.25 times the original maximum number of stocks.

The above constraint relaxation sequence is followed mechanically. In the event that no optimal solution is found after all the above constraints have been relaxed, the relevant Market Neutral Barra Factor Index will not be rebalanced for that month.

APPENDIX VI: NEW RELEASE OF BARRA EQUITY MODEL OR BARRA OPTIMIZER

A new release of the relevant Barra Equity Model or Barra Optimizer may replace the former version within a suitable timeframe.

APPENDIX VII: BARRA MODEL DATA DELAYS OR CORRECTIONS

If there is a delay in the monthly release of security exposure data and factor variance and covariance data of the relevant Barra Equity Model, all MSCI Market Neutral Barra Factor Index clients will be notified, and the monthly index review of the relevant MSCI Market Neutral Barra Factor Indexes will be delayed until the relevant Barra model data is available. In the event that the relevant Barra model data is delayed for more than 5 business days after the target release date, the index review of the relevant MSCI Market Neutral Barra Factor Indexes will not be conducted for that month.

If there is a correction of the relevant Barra model data within 5 business days following the Rebalancing Date, and the impact of the correction is determined to be significant, a new index review will be conducted for the relevant MSCI Market Neutral Barra Factor Indexes. The impact of the correction will be considered significant when either the impact on the Target Factor exposure of the relevant MSCI Market Neutral Barra Factor Indexes is above a threshold of 0.1, or the impact on the Active Risk of the relevant MSCI Market Neutral Barra Factor Indexes is above a threshold of 0.5% in absolute terms.

All MSCI Market Neutral Barra Factor Index clients will be notified at the time of a relevant Barra model data correction. The new index review will be conducted on the close of the second business day and announced on the close of the third business day following the Barra data correction. The changes resulting from the new index review will be implemented as of the close of the fourth business day following the Barra data correction (effective on the fifth business day following the Barra data correction). The index levels of the relevant MSCI Market Neutral Barra Factor Indexes prior to the new index review will not be restated.

The following sections have been modified since November 2013:

- Appendix VIII 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 4.2.

The following sections have been modified since June 2017:

Appendix III: Defining Shorting Cost Cutoff

- Update to the description.

Appendix VI: New Release of Barra Equity Model or Barra Optimizer

- Updates to the description.

The following sections have been modified since September 2017:

Section 3.3: Specifying the optimization constraints

- Update of the Shorting Cost threshold parameter

Appendix III: Defining Shorting Cost Cutoff

- Updates to the description.

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