MSCI

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MSCI Minimum Volatility Indexes Methodology

Contents

1 Introduction

Minimum-variance and managed volatility equity strategies have been around since the early 1990s but have recently gained popularity. Since minimum variance strategies do not require return forecasts, in some cases they may be more efficient than strategies that trade off expected risk and return. MSCI has developed a minimum volatility index that can serve as a transparent and relevant benchmark for managed volatility equity strategies.

The theoretical minimum variance (MV) portfolio has been widely known since Markowitz's seminal paper in 1952[1]. The MV portfolio is positioned on the very left tip of a mean-variance efficient frontier and describes an equity portfolio with the lowest return-variance for a given covariance matrix of stock returns. While all other portfolios on the efficient frontier minimize risk for a given expected return, the MV portfolio minimizes risk without an expected return input.

The MSCI Minimum Volatility Indexes[2] are calculated by optimizing a parent MSCI Index by using an estimated security co-variance matrix to produce an index that has the lowest absolute volatility for a given set of constraints. The starting universe to determine a Minimum Volatility Index is an MSCI Equity Index and the estimated security co-variance matrix is based on the relevant Barra multi-factor equity model. Details about the Barra multi-factor risk models are available at https://www.msci.com/portfolio-management.

This methodology book describes a generic methodology that can be applied to create Minimum Volatility Indexes (herein, "Indexes") from any of the existing MSCI equity indexes (herein, "Parent Indexes"). Some of the optimization constraints applied to determine the MSCI Minimum Volatility Index may vary based on the Parent Index on which the optimization is performed.

[1] See Markowitz, H. (1952), Portfolio Selection, Journal of Finance, 7

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

2 Characteristics of the Indexes

The Indexes historically demonstrate the following characteristics across markets:

- Low Beta relative to the Parent Index
- Lower Volatility than the Parent Index
- Lower cap bias
- Bias towards stocks with low idiosyncratic risk

3 Constructing the Indexes

Constructing the Indexes involves the following steps:

- Defining the Parent Index and the base currency for optimization
- Defining the optimization constraints
- Determining the optimized portfolio

Each step is described below.

3.1 Defining the Parent Index and the Base Currency for Optimization

Constructing the Indexes begins with selecting the Parent Index to perform total risk minimizing optimization. The Parent Indexes serve as the universe of eligible securities for optimization. The optimization is performed from a base currency[3] perspective and does not allow short selling of securities.

The optimization relies on the factor exposures for all the securities in the Parent Index and the factor co-variance matrix of the relevant Barra Equity Model.

3.2 Defining the Optimization Constraints

At each index review, the following optimization constraints are employed, which aim to ensure replicability and investability while achieving the lowest volatility for a given set of constraints.

- The maximum weight of an index constituent will be restricted to the lower of 1.5% or 20 times the weight of the security in the Parent Index.
- The minimum weight of an index constituent will be 0.05%.
- For countries with weight greater than 2.5% in the Parent Index, the weight in the MSCI Minimum Volatility 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 Minimum Volatility Index will be capped at 3 times their weight in the Parent Index.
- 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.
- The sector weights of the MSCI Minimum Volatility Index will not deviate more than +/- 5% from the sector weights of the Parent Index.

[3] Any currency within the relevant Barra Equity Model can be used as an optimization currency so that index forecast risk is minimized (subject to the listed constraints) from the perspective of an investor who uses that currency to denominate their investment portfolio. Additionally, a "local currency" choice can be made for which currency risk is not taken into account in the optimization process.

- No constraint will be applied on the exposure of the MSCI Minimum Volatility Index to the Beta and Residual Volatility risk index factors. Exposure to all other risk index factors will be restricted to +/-0.25 standard deviations relative to the Parent Index.
- The one way turnover of the MSCI Minimum Volatility Index is constrained to a maximum of 5%.

3.3 Determining the Optimized Portfolio

The Indexes are 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 optimal MSCI Minimum Volatility Index. The Barra Open Optimizer determines the optimal solution, i.e. the portfolio with the lowest total risk, using an estimated security co-variance matrix under the applicable investment constraints. The Indexes seeks to have the lowest absolute volatility based on the set of constraints.

4 Maintaining the Indexes

4.1 Index Reviews

The changes resulting from the index review of the MSCI Minimum Volatility indexes will be made 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 Parent Indexes. Barra Equity Model data as of the day before the rebalancing day is used.

The pro forma indexes are in general announced nine business days before the effective date.

At each rebalancing, a constraint factor is calculated for each constituent in the Indexes. The constraint factor is defined as the weight in the MSCI Minimum Volatility Index at the time of the rebalancing divided by the weight in the Parent Index. The constraint factor as well as the constituents in the index remains constant between index reviews except in case of corporate events as described below.

4.2 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.

Additionally, if the frequency of Index Reviews in the Parent Index is greater than the frequency of Index Reviews in the MSCI Minimum Volatility Index, the changes made to the Parent Index during intermediate Index Reviews will be neutralized in the MSCI Minimum Volatility Index.

The following section briefly describes the treatment of common corporate events within the MSCI Minimum Volatility 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: Transition

The MSCI World Minimum Volatility Index and MSCI USA Minimum Volatility Index were based on the previous Barra Global Equity Model (GEM). Starting from the November 2009 Semi-Annual Index Review, the MSCI Minimum Volatility Indexes were based on the new Barra Global Equity Model (GEM2L).

The transition was done without applying a turnover constraint using the GEM2L model, with a goal to achieve a similar number of securities as the existing MSCI Minimum Volatility Indexes.

Starting from the November 2017 Semi-Annual Index Review, the MSCI Minimum Volatility Index construction used an optimization setup that used the Barra Global Equity Model for Long-Term Investors (GEMLTL). The change of optimization setup was completed without any change in the turnover constraint.

Appendix II: Optimization Settings for Constructing MSCI Minimum Volatility Indexes

The MSCI Minimum Volatility Indexes are constructed using the Barra Optimizer in combination with the relevant Barra Equity Model. The following optimization settings are applied to construct the MSCI Minimum Volatility Indexes.

1.0 Specify "Initial Portfolio" and "Trade Universe" settings on the Barra Optimizer

- "Initial Portfolio" is set as the current MSCI Minimum Volatility Index, using the constituent weights as of the close of the Rebalancing Date (before the rebalancing) updated for corporate actions up to the effective date of the rebalancing. When there is no current MSCI Minimum Volatility Index (for example, when no optimization has been applied to the Parent Index yet), the Initial Portfolio is set to be the Parent Index.
- "Trade Universe" is set to be the index constituents of the Parent Index.

2.0 Specify Risk Model

- The factor exposures for all the securities in the Trade universe are set using the most recent monthly release of factor exposure data of the relevant Barra Equity Model.
- The common factor co-variances are set using the most recent monthly release of factor co-variance data of the relevant Barra Equity Model.
- The specific co-variances of all securities in the Trade Universe are set using the most recent monthly release of specific co-variances data of the relevant Barra Equity Model.

3.0 Setup Utility function

- The optimization objective is to find a pro forma Minimum Volatility Index that minimizes the total risk of Parent Index, as determined by the relevant Barra Equity Model. The risk aversion parameters used in the optimization are as follows:
- Common factor risk aversion = 0.0075
- Specific risk aversion = 0.075

4.0 Setup constraints for Initial Construction*

- The maximum weight of an index constituent will be restricted to the lower of 1.5% or 20 times the weight of the security in the Parent Index.
- The minimum weight of an index constituent will be 0.05%.

- For countries with weight greater than 2.5% in the Parent Index, the weight in the MSCI Minimum Volatility 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 Minimum Volatility Index will be capped at 3 times their weight in the Parent Index.
- 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.
- The sector weights of the MSCI Minimum Volatility Index will not deviate more than +/- 5% from the sector weights of the Parent Index.
- No constraint will be applied on the exposure of the MSCI Minimum Volatility Index to the Beta and Residual Volatility risk index factors. Exposure to all other risk index factors will be restricted to +/-0.25 standard deviations relative to the Parent Index.
- The optimization process for creating MSCI Minimum Volatility Indexes based on MSCI Small Cap Indexes[4] uses different parameters for the turnover and the asset weight constraints, as explained in Appendix IV.

*For MSCI Sector/Country/Region Indexes which have relatively lower number of stocks, the standard optimization parameters may lead to an infeasible solution. In such cases, MSCI may apply relaxed constraints relative to the standard set of constraints.

5.0 Additional Setup constraints for Index Reviews

- The one way turnover of the MSCI Minimum Volatility Index is constrained to a maximum of 5%

[4] Please refer to MSCI Small Cap Indexes in the MSCI Global Investable Market Indexes methodology located at www.msci.com/index-methodology

Appendix III: Handling Infeasible Optimizations

During index review, in the event that there is no optimal solution that satisfies all the optimization constraints defined in Section 3.2, the following constraints will be relaxed, until an optimal solution is found:

- Relax the turnover constraint in steps of 2.5%, up to a maximum of 15%
- Relax the minimum weight constraint in steps of 0.01% up to a minimum of 0.01%.
- The above two constraints are alternately relaxed until a feasible solution is achieved.

For MSCI Sector/Country/Region Indexes which have relatively lower number of stocks, the standard optimization parameters may lead to an infeasible solution. In such cases, MSCI may apply relaxed constraints relative to the standard set of constraints. These parameter changes would be announced before implementation.

In the event that no optimal solution is found after the above constraints have been relaxed, the relevant MSCI Minimum Volatility Index will not be rebalanced for that index review.

Appendix IV: Optimization Parameters for Minimum Volatility Indexes Based on MSCI Small Cap Indexes

The following table contains an illustrative list of parameters which are used for some of the Minimum Volatility Indexes based on MSCI Small Cap Indexes:

Region/Country	Weight Multiplier	Turnover Constraint*
ACWI	10X	10%
AC Asia ex Japan	10X	15%
Australia	10X	10%
EM	10X	15%
Europe	10X	10%
Japan	10X	10%
UK	10X	10%
USA	10X	10%
World ex Japan	10X	10%
World	10X	10%

*Quarterly One Way Index Turnover

Appendix V: Methodology for MSCI Australia IMI Select Minimum Volatility (AUD) Index

The MSCI Australia IMI Select Minimum Volatility (AUD) Index is constructed from the MSCI Australia IMI (the "Parent Index"). MSCI Australia IMI Select Minimum Volatility (AUD) Index uses the Australian Dollar as the optimization currency. The methodology for constructing this index differs from the standard MSCI Minimum Volatility Indexes methodology in the following optimization constraints:

- The maximum weight of an index constituent will be restricted to the lower of 10% or 20 times the weight of the security in the Parent Index.

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: 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 Industry Classification Standard (GICS) Methodology – https://www.msci.com/index/methodology/latest/GICS
- MSCI Global Investable Market Indexes Methodology – https://www.msci.com/index/methodology/latest/GIMI

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'.

Appendix VIII: Changes to this Document

The following sections have been modified since December 2013:

- Added Appendix IV containing different asset weight multiplier and turnover constraints that are used for creating Minimum Volatility Indexes based on MSCI Small Cap Indexes
- Included a reference to Appendix IV in Appendix II

The following sections have been modified since June 2016:

- Added Appendix V containing index specific parameters for the MSCI Australia IMI Select Minimum Volatility (AUD) Index

The following sections have been modified since September 2016:

- The details on the Corporate Events treatment are now included in Section 4.2.

The following sections have been modified since June 2017:

Section 1: Introduction

- Updates to description
- Updated link to the description of Barra Optimizer

Section 3.3: Determining the Optimized Portfolio

- Updated link to the description of Barra Optimizer

Appendix II: Optimization Settings

- Included information about the current Barra Equity Model used by the methodology
- Bifurcated the section on setup constraints to separate out the initial and ongoing index review constraints. Added section for handling concentrated markets

Appendix III: Handling Infeasible Optimizations

- Modified text for clarity

The following sections have been modified since September 2017:

Section 3.2: Defining the optimization constraints

- Updated the information on constraints on risk index factors

Appendix I: Transition

- Updated the information on transition of MSCI Minimum Volatility Indexes to GEMLTL

Appendix II: Optimization Settings

- Updated the information on constraints on risk index factors

The following sections have been modified since NOVEMBER 2017:

Section 3.2: Defining the optimization constraints

- Updated to reflect the additional constraint on China A Stock Connect listings

Appendix II: Optimization Settings

- Updated to reflect the additional constraint on China A Stock Connect listings

The following sections have been modified since August 2025:

Section 3.2: Defining the optimization constraints:

- Updated to reflect the change in optimization constraints to change the one way turnover of the MSCI Minimum Volatility Index constraint to a maximum of 5%.

Section 4.1: Index Reviews:

- Updated to reflect the change in rebalancing frequency from semi-annually to quarterly.

Appendix III: Handling Infeasible Optimizations

- Updated to reflect the change in handling of optimization infeasibility.

Appendix IV: Optimization Parameters for Minimum Volatility Indexes Based on MSCI Small Cap Indexes

- Updated to reflect the change in region/country turnover constraints.

Appendix VII: Methodology Set

- Added Appendix VII to clarify details on the Methodology Set for the Indexes.

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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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EUROPE, MIDDLE EAST & AFRICA

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