MSCI

Index Methodology

MSCI Global Minimum Volatility Indices Methodology

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Table of Contents

Section 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. Moreover, new pension regulations in the US and elsewhere have led to increased aversion to asset volatility. MSCI has developed a global 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 Indices 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 http://www.mscibarra.com/products/analytics/models/.

This methodology book describes a generic methodology that can be applied to create Minimum Volatility Indices from any of the existing MSCI equity indices (herein, "Parent Indices"). 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.[2]

Section 2: Characteristics of MSCI Minimum Volatility Indices

The MSCI Minimum Volatility Indices 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

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

[2] See www.barra.com/support/library/optimizer_practical_convex_quadratic_programming.pdf for a detailed description of the Barra Mean-Variance Optimizer.

Section 3: Constructing the MSCI Minimum Volatility Indices

Constructing the MSCI Minimum Volatility Indices 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 MSCI Minimum Volatility Indices begins with selecting the Parent Index to perform total risk minimizing optimization. The Parent Indices serve as the universe of eligible securities for optimization. The optimization is performed from a base currency 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 semi-annual 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 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 Barra Volatility risk index factor. Exposure to all other Barra 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 10%.

3.3 Determining the optimized portfolio

The MSCI Minimum Volatility Index is constructed using the most recent release of 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 MSCI Minimum Volatility Index seeks to have the lowest absolute volatility based on the set of constraints.

Section 4: Maintaining the Minimum Volatility Indices

4.1 Semi-Annual Index Reviews

The changes resulting from the index review of the MSCI Minimum Volatility indices will be made as of the close of the last business day of May and November, coinciding with the May and November semi-annual index review of the Parent Indices.

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

The security co-variance matrix used to determine the MSCI Minimum Volatility Indices is maintained on a monthly basis. For the May and the November semi-annual MSCI Minimum Volatility Index reviews, the security covariance matrices as of the end of April and the end of October are used respectively.

At each rebalancing, a constraint factor is calculated for each constituent in the MSCI Minimum Volatility Index. 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

In general, the MSCI Minimum Volatility Indices follow the event maintenance of the Parent Index.

4.2.1 IPOs and other Early Inclusions

IPOs and other newly listed securities will only be considered for inclusion at the next semi-annual index review, even if they qualify for early inclusion in the Parent Indices.

4.2.2 Additions and Deletions due to Corporate Events

The general treatment of additions and deletions due to corporate events aims at minimizing turnover in the MSCI Minimum Volatility Indices.

There will be no early inclusion of new securities to the MSCI Minimum Volatility Index, except when the new security results from an event affecting an existing constituent (e.g., merger, acquisition, spin off).

In the event of a merger or an acquisition where an index constituent acquires another index constituent or merges with another index constituent, the remaining company is maintained in the index with a constraint factor calculated as the weighted average of the constraint factors before the corporate event.

If a spun off security of an index constituent is added to the Parent Index, it will be added to the MSCI Minimum Volatility Index with the same constraint factor as the Parent Security.
A constituent deleted from the Parent Index following a corporate event or during the Quarterly Index Review of the Parent Index will be simultaneously deleted from the MSCI Minimum Volatility Index.

Please refer to the MSCI Corporate Events Methodology book available at: http://www.msci.com/products/indices/size/standard/methodology.html for more details.

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). As of the November 2009 Semi-Annual Index Review, the MSCI Minimum Volatility Indices are based on the new Barra Global Equity Model (GEM2).

The transition was done without applying a turnover constraint using the GEM2 model, with a goal to achieve a similar number of securities as the existing MSCI Minimum Volatility Indices.

Appendix II: Optimization Settings for Constructing MSCI Minimum Volatility Indices

The MSCI Minimum Volatility Indices are currently constructed using the latest version of the Barra Open Optimizer in combination with the relevant Barra Equity Model. The following optimization settings are applied to construct the MSCI Minimum Volatility Indices.

1.0 Specify "Initial Portfolio" and "Trade Universe" settings on the Barra Open 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 release of factor exposure data of the relevant Barra Equity Model.
- The common factor co-variances are set using the most recent 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.

4.0 Setup 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 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 Barra Volatility risk index factor. Exposure to all other Barra 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 10%.

Appendix III: 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 3.2, the following constraints will be relaxed, until an optimal solution is found:

- Relax the turnover constraint in steps of 5%, up to a maximum of 30%
- Relax the minimum weight constraint in steps of 0.01% up to a minimum of 0.01%.

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 semi-annual index review.

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