MSCI GLOBAL MINIMUM VOLATILITY INDEXES METHODOLOGY

June 2016

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. 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 Indexes 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 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.[2]

[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.

2 CHARACTERISTICS OF MSCI MINIMUM VOLATILITY INDEXES

The MSCI Minimum Volatility 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 MSCI MINIMUM VOLATILITY INDEXES

Constructing the MSCI Minimum Volatility 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 MSCI Minimum Volatility 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 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.

4 MAINTAINING THE MINIMUM VOLATILITY INDEXES

4.1 SEMI-ANNUAL 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 May and November, coinciding with the May and November semi-annual index review of the Parent Indexes.

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

The security co-variance matrix used to determine the MSCI Minimum Volatility Indexes 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 Indexes 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 Indexes.

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 Indexes.

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/indexes/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 Indexes 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 Indexes.

APPENDIX II: OPTIMIZATION SETTINGS FOR CONSTRUCTING MSCI MINIMUM VOLATILITY INDEXES

The MSCI Minimum Volatility Indexes 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 Indexes.

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. 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

- 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%.
- The optimization process for creating MSCI Minimum Volatility Indexes based on MSCI Small Cap Indexes[3] uses different parameters for the turnover and the asset weight constraints, as explained in Appendix IV.

[3] 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 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%.

For MSCI Regional/Country Indexes which have relatively lower number of stocks, the standard optimization parameters may lead to an infeasible solution. MSCI may apply relaxed constraints relative to the standard set of constraints based on the following guidelines:

Order of Relaxation	Maximum Asset Weight	Sector Weight
1.	Lower of **3%** or 20 times the weight of the security in the Parent Index.	+/-5% from the sector weights of the Parent Index
2.	Lower of **3%** or 20 times the weight of the security in the Parent Index.	**+/-7.5%** from the sector weights of the Parent Index
3.	Lower of **5%** or 20 times the weight of the security in the Parent Index.	+/-5% from the sector weights of the Parent Index
4.	Lower of **5%** or 20 times the weight of the security in the Parent Index.	**+/-7.5%** from the sector weights of the Parent Index

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.

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	20%
AC Asia ex Japan	10X	30%
Australia	10X	20%
EM	10X	30%
Europe	10X	20%
Japan	10X	20%
UK	10X	20%
USA	10X	20%
World ex Japan	10X	20%
World	10X	20%

*Semi Annual One Way Index Turnover

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

CONTACT US

clientservice@msci.com

AMERICAS

Americas	1 888 588 4567 *
Atlanta	+ 1 404 551 3212
Boston	+ 1 617 532 0920
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	+ 1 416 628 1007

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	0800 91 59 17 *

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 *
Singapore	800 852 3749 *
Sydney	+ 61 2 9033 9333
Taipei	008 0112 7513 *
Tokyo	+ 81 3 5290 1555

* = toll free

ABOUT MSCI

For more than 40 years, MSCI's research-based indexes and analytics have helped the world's leading investors build and manage better portfolios. Clients rely on our offerings for deeper insights into the drivers of performance and risk in their portfolios, broad asset class coverage and innovative research.

Our line of products and services includes indexes, analytical models, data, real estate benchmarks and ESG research.

MSCI serves 98 of the top 100 largest money managers, according to the most recent P&I ranking.

For more information, visit us at www.msci.com.

NOTICE AND DISCLAIMER

This document and all of the information contained in it, including without limitation all text, data, graphs, charts (collectively, the "Information") is the property of MSCI Inc. or its subsidiaries (collectively, "MSCI"), or MSCI's licensors, direct or indirect suppliers or any third party involved in making or compiling any Information (collectively, with MSCI, the "Information Providers") and is provided for informational purposes only. The Information may not be modified, reverse-engineered, reproduced or redisseminated in whole or in part without prior written permission from MSCI.

The Information may not be used to create derivative works or to verify or correct other data or information. For example (but without limitation), the Information may not be used to create indexes, databases, risk models, analytics, software, or in connection with the issuing, offering, sponsoring, managing or marketing of any securities, portfolios, financial products or other investment vehicles utilizing or based on, linked to, tracking or otherwise derived from the Information or any other MSCI data, information, products or services.

The user of the Information assumes the entire risk of any use it may make or permit to be made of the Information. NONE OF THE INFORMATION PROVIDERS MAKES ANY EXPRESS OR IMPLIED WARRANTIES OR REPRESENTATIONS WITH RESPECT TO THE INFORMATION (OR THE RESULTS TO BE OBTAINED BY THE USE THEREOF), AND TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, EACH INFORMATION PROVIDER EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES (INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF ORIGINALITY, ACCURACY, TIMELINESS, NON-INFRINGEMENT, COMPLETENESS, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE) WITH RESPECT TO ANY OF THE INFORMATION.

Without limiting any of the foregoing and to the maximum extent permitted by applicable law, in no event shall any Information Provider have any liability regarding any of the Information for any direct, indirect, special, punitive, consequential (including lost profits) or any other damages even if notified of the possibility of such damages. The foregoing shall not exclude or limit any liability that may not by applicable law be excluded or limited, including without limitation (as applicable), any liability for death or personal injury to the extent that such injury results from the negligence or willful default of itself, its servants, agents or sub-contractors.

Information containing any historical information, data or analysis should not be taken as an indication or guarantee of any future performance, analysis, forecast or prediction. Past performance does not guarantee future results.

The Information should not be relied on and is not a substitute for the skill, judgment and experience of the user, its management, employees, advisors and/or clients when making investment and other business decisions. All Information is impersonal and not tailored to the needs of any person, entity or group of persons.

None of the Information constitutes an offer to sell (or a solicitation of an offer to buy), any security, financial product or other investment vehicle or any trading strategy.

It is not possible to invest directly in an index. Exposure to an asset class or trading strategy or other category represented by an index is only available through third party investable instruments (if any) based on that index. MSCI does not issue, sponsor, endorse, market, offer, review or otherwise express any opinion regarding any fund, ETF, derivative or other security, investment, financial product or trading strategy that is based on, linked to or seeks to provide an investment return related to the performance of any MSCI index (collectively, "Index Linked Investments"). MSCI makes no assurance that any Index Linked Investments will accurately track index performance or provide positive investment returns. MSCI Inc. is not an investment adviser or fiduciary and MSCI makes no representation regarding the advisability of investing in any Index Linked Investments.

Index returns do not represent the results of actual trading of investible assets/securities. MSCI maintains and calculates indexes, but does not manage actual assets. Index returns do not reflect payment of any sales charges or fees an investor may pay to purchase the securities underlying the index or Index Linked Investments. The imposition of these fees and charges would cause the performance of an Index Linked Investment to be different than the MSCI index performance.

The Information may contain back tested data. Back-tested performance is not actual performance, but is hypothetical. There are frequently material differences between back tested performance results and actual results subsequently achieved by any investment strategy.

Constituents of MSCI equity indexes are listed companies, which are included in or excluded from the indexes according to the application of the relevant index methodologies. Accordingly, constituents in MSCI equity indexes may include MSCI Inc., clients of MSCI or suppliers to MSCI. Inclusion of a security within an MSCI index is not a recommendation by MSCI to buy, sell, or hold such security, nor is it considered to be investment advice.

Data and information produced by various affiliates of MSCI Inc., including MSCI ESG Research Inc. and Barra LLC, may be used in calculating certain MSCI indexes. More information can be found in the relevant index methodologies on www.msci.com.

MSCI receives compensation in connection with licensing its indexes to third parties. MSCI Inc.'s revenue includes fees based on assets in Index Linked Investments. Information can be found in MSCI Inc.'s company filings on the Investor Relations section of www.msci.com.

MSCI ESG Research Inc. is a Registered Investment Adviser under the Investment Advisers Act of 1940 and a subsidiary of MSCI Inc. Except with respect to any applicable products or services from MSCI ESG Research, neither MSCI nor any of its products or services recommends, endorses, approves or otherwise expresses any opinion regarding any issuer, securities, financial products or instruments or trading strategies and MSCI's products or services are not intended to constitute investment advice or a recommendation to make (or refrain from making) any kind of investment decision and may not be relied on as such. Issuers mentioned or included in any MSCI ESG Research materials may include MSCI Inc., clients of MSCI or suppliers to MSCI, and may also purchase research or other products or services from MSCI ESG Research. MSCI ESG Research materials, including materials utilized in any MSCI ESG Indexes or other products, have not been submitted to, nor received approval from, the United States Securities and Exchange Commission or any other regulatory body.

Any use of or access to products, services or information of MSCI requires a license from MSCI. MSCI, Barra, RiskMetrics, IPD, FEA, InvestorForce, and other MSCI brands and product names are the trademarks, service marks, or registered trademarks of MSCI or its subsidiaries in the United States and other jurisdictions. The Global Industry Classification Standard (GICS) was developed by and is the exclusive property of MSCI and Standard & Poor's. "Global Industry Classification Standard (GICS)" is a service mark of MSCI and Standard & Poor's.