S&P Dow Jones Indices

A Division of S&P Global

S&P GSCI Risk Weight

Methodology Supplement

December 2018

Introduction

Index Objective and Highlights

The S&P GSCI Risk Weight is designed to measure the broad commodities market while assigning weights based on the contribution of each commodity sector to the overall index risk.

The index takes into account the contribution of each commodity sector to the overall index risk in order to avoid concentration in any one sector and build the most diversified index in terms of individual sector risk contributions.

The S&P GSCI Risk Weight Methodology Supplement

This methodology supplement uses various terms from the S&P GSCI Methodology. Where not specifically noted otherwise in this document, the rules of the S&P GSCI will prevail. Where the terms in this document are also defined in the *S&P GSCI Methodology*, the definitions in this document prevail.

Supporting Documents

This methodology is meant to be read in conjunction with supporting documents providing greater detail with respect to the policies, procedures and calculations described herein. References throughout the methodology direct the reader to the relevant supporting document for further information on a specific topic. The list of the main supplemental documents for this methodology and the hyperlinks to those documents is as follows:

Supporting Document	URL
S&P Dow Jones Indices' Commodities Indices Policies & Practices Methodology	Commodities Indices Policies & Practices
S&P Dow Jones Indices' Index Mathematics Methodology	Index Mathematics Methodology

This supplement was created by S&P Dow Jones Indices to achieve the aforementioned objective of measuring the underlying interest of each index governed by this methodology supplement. Any changes to or deviations from this methodology supplement are made in the sole judgment and discretion of S&P Dow Jones Indices so that the index continues to achieve its objective.

For information on:

- *Quality Assurance*
- *Internal Reviews of Methodology*
- *Calculations and Pricing Disruptions*
- *Expert Judgment*
- *Data Hierarchy*
- *Unexpected Exchange Closures*

Please refer to S&P Dow Jones Indices' Commodities Indices Policies & Practices document.

Weighting Scheme

The aim is to determine an allocation such that the risk contribution from each constituent sector is balanced, subject to the weight of each constituent being positive and their cumulative weights totalling 100%.

The five sectors in the S&P GSCI Risk Weight are the same as the sectors in the S&P GSCI. The representative indices are as follows:

- S&P GSCI Energy ER
- S&P GSCI Industrial Metals ER

- S&P GSCI Precious Metals ER
- S&P GSCI Agriculture ER
- S&P GSCI Livestock ER

The risk contribution from each sector is calculated using its covariance, as defined by its volatility and correlation with other sectors. Volatility is defined as the standard deviation of the daily returns of the relevant sector index over a one-year period and correlation is computed using daily returns over the same period.

The Sector Weights are determined monthly on the third S&P GSCI Business Day, defined as two days prior to the S&P GSCI Roll Period. The index is rebalanced during the monthly five day S&P GSCI Roll Period.

Determination of the Risk Contribution from each Commodity Sector. The marginal risk contribution is defined as the change in volatility of the overall index induced by an infinitesimal increase in the weight of that sector.

Mathematically, it can be summarised as follows:

$$MRC_i = \frac{\partial \sigma_{PORT}}{\partial \varpi_i} = \sum_{j=1}^{N} \varpi_j \cdot \operatorname{cov}(r_i, r_j) = \operatorname{cov}(r_i, r_{PORT})$$

where:

$\frac{\partial \sigma_{PORT}}{\partial \varpi_i}$ = Change in the volatility of the index with respect to a small change in the weight of sector *i*

$\operatorname{cov}(r_{i,} r_j)$ = Covariance between sector *i* and *j*

$\operatorname{cov}(r_i, r_{PORT})$ = Covariance between sector *i* and the entire index

The risk contribution from each sector is equal to the product of its weight and its respective marginal risk contribution.

$$RC_i = \varpi_i \times MRC_i$$

Determination of Weights of Individual Sectors. The individual sector weights are solved using a numerical optimization technique, with the aim of minimizing, as far as possible, the variance of the risk contributions from all of the commodity sectors. The maximum sector weight is capped at 33%. Any excess over 33% is redistributed to the remaining sectors based on their risk contribution.

Determination of Weights of Individual Commodities. Individual commodities within a sector are weighted according to their respective Contract Production Weights (CPWs) defined in the most recent *S&P GSCI Methodology*. The CPWs are updated annually and instituted during the January roll.

Rolling Scheme

The contract rolling schedule of the index follows the roll calendar of the S&P GSCI Methodology, unless otherwise stated.

For the S&P GSCI Dynamic Roll Risk Weight Index, the contract rolling schedule of the index follows the dynamic roll contract selection of the S&P GSCI Dynamic Roll Index.

Capping

The capping procedure follows two rules, in succession:

Rule 1: Only one component can reach a maximum weight of 35%. Any excess weight is distributed proportionately among the remaining components.

Once Rule 1 is implemented,

Rule 2: No remaining component's weight can exceed 20%. Any excess weight is distributed proportionately among the remaining components.

Capping Excess Distribution: Distributed proportionately among the remaining components

Implementation

Any excess weight from a rule #1 violation is distributed proportionally among the remaining index components.

After rule #1 is implemented, if there are rule #2 violations then the violating components are adjusted and the balance is distributed proportionately among the remaining index components.

In order to properly implement, CPWs are adjusted to arrive at the assigned weights for each commodity. This adjustment process takes place at the beginning of each quarter and every time the main S&P GSCI index is rebalanced, adjusted, and/or new commodities are added to or deleted from the index, in order to remain proportional with the S&P GSCI components.

The adjustment process takes place at the beginning of each quarter.

1. On the S&P GSCI business day before each quarterly first roll date, the latest S&P GSCI commodity CPWs are multiplied by the commodity prices to determine the S&P GSCI commodity weights.
2. The commodities are separated into components and the components are sorted in descending order by their sector weights.
3. If there is any component above 35% (historically the case for petroleum), it is capped at 35% and the excess weight distributed among the remaining index components.
4. If any additional component is above 20%, it is capped at 20% and the excess weight is distributed among the remaining index components. This process is repeated iteratively until all the capping rules are met.
5. The percentage weights of all commodities are converted to CPW-equivalents, based on the prices from the business day one day prior to the first roll date, using the initial S&P GSCI weights implied by those prices and the latest S&P GSCI CPWs. For example, the S&P GSCI CPWs are multiplied by the commodity prices from the last business day before the roll.
6. This capping adjustment process takes place every quarter and utilizes any CPW component changes to the base index, additions, subtractions, substitutions, etc. in order to maintain continuity and proportion with the base S&P GSCI.

Capping Formulas

At each rebalancing, CPWs are calculated as follows:

$$CPW_{capped,\, i} = CPW_{GSCI,\, i} * TargetWeight_j \,/\, GSCIWeight_j$$

where:

$CPW_{capped,\,i}$ = CPW for commodity i in the S&P GSCI Capped Component as of the upcoming rebalancing

$CPW_{GSCI,\,i}$ = CPW for commodity i in the S&P GSCI as of the upcoming rebalancing

$GSCIWeight_j$ = Weight of component j, of which commodity i is a part, in the S&P GSCI as of the upcoming rebalancing.

$TargetWeight_j$ = Weight of component j, of which commodity i is a part, in the S&P GSCI Capped Component as of the upcoming rebalancing.

At each rebalancing target weights are calculated as follows:

If $GSCIWeight_j > 35\%$, then $TargetWeight_j = 35\%$

For all remaining components:

$TargetWeight_j = 65\% * GSCIWeight_j / (100\% - GSCIWeight)$

where:

$GSCIWeight$ = Total weight of the capped components in the S&P GSCI as of the upcoming rebalancing.

For any subsequent commodities:

If $GSCIWeight_j > 20\%$ then $TargetWeight_j = 20\%$

For all remaining uncapped components:

$TargetWeight_j = (100\% - CappedWeight) * GSCIWeight_j / (100\% - GSCIWeight)$

This process is repeated iteratively until no more than one component has a weight greater than 20% in the index.

Currency, Currency Hedged, Inverse, Leveraged, and Risk Control Indices

Additional currency, currency hedged, inverse, leveraged, and risk control versions of the indices may be available. For a list of available indices, please contact Client Services at index_services@spglobal.com.

For more information on currency, currency hedged, inverse, leveraged, and risk control indices, please refer to S&P Dow Jones Indices' Index Mathematics Methodology.

Tickers

The table below lists headline indices covered by this document. All currency, currency hedged, risk control, and return type versions of the below indices that may exist are also covered by this document. Please contact index_services@spglobal.com for a complete list of indices covered by this document.

Index	Bloomberg	Reuters
S&P GSCI Risk Weight	SPGSRW	.SPGSRW
S&P GSCI Risk Weight ER	SPGSRWP	.SPGSRWP
S&P GSCI Risk Weight TR	SPGSRWTR	.SPGSRWTR
S&P GSCI Dynamic Roll Risk Weight	SPGSDRW	.SPGSDRW
S&P GSCI Dynamic Roll Risk Weight ER	SPGSDRWP	.SPGSDRWP
S&P GSCI Dynamic Roll Risk Weight TR	SPGSDRWT	.SPGSDRWT

S&P Dow Jones Indices' Contact Information

Contact Information

For any questions regarding an index, please contact: index_services@spglobal.com.

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