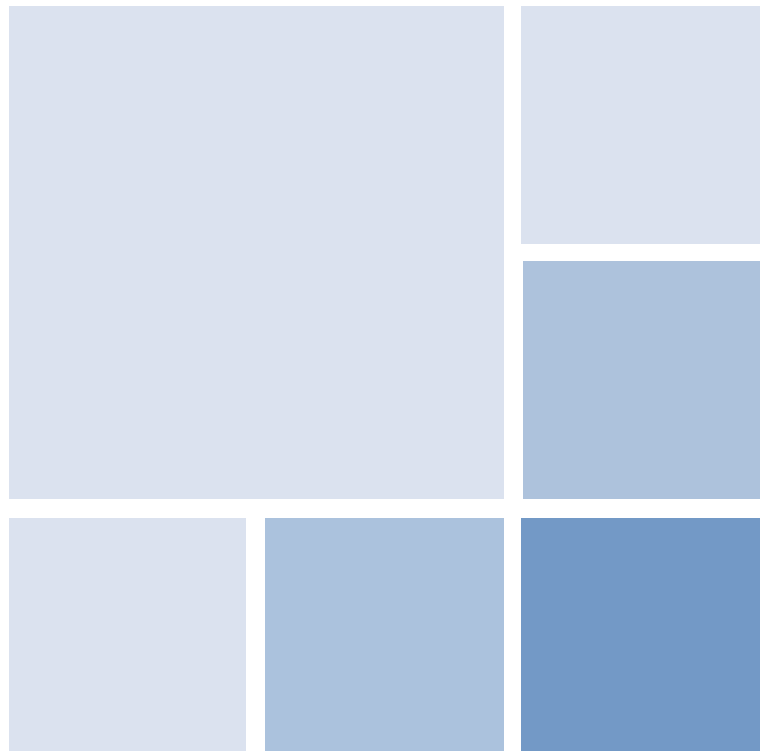


Goldman Sachs ActiveBeta[®] Equity Indexes Methodology

Last updated 24 May 2021



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I. Introduction

A. Index Overview

This document describes the methodology for the following indexes:

- Goldman Sachs ActiveBeta® Emerging Markets Equity Index
- Goldman Sachs ActiveBeta® Europe Equity Index
- Goldman Sachs ActiveBeta® International Equity Index
- Goldman Sachs ActiveBeta® Japan Equity Index
- Goldman Sachs ActiveBeta® U.S. Large Cap Equity Index
- Goldman Sachs ActiveBeta® U.S. Small Cap Equity Index

The Goldman Sachs ActiveBeta® Equity Indexes are owned by Goldman Sachs Asset Management (the Index Sponsor) and were developed to capture the performance of diversified exposure to the equity common factors: value, momentum, volatility, and quality.

Using a patented portfolio construction methodology and patent-pending turnover minimization technique, each Index aims to deliver higher returns than a market capitalization-weighted index for the same geographical region at similar or lower levels of total risk, as measured by volatility and drawdown. The Goldman Sachs ActiveBeta® Equity Indexes also seek to mitigate the magnitude and duration of potential market underperformance.

B. Index Details

The Goldman Sachs ActiveBeta® Equity Indexes are distributed under the following identifiers.

Name	Ticker
Goldman Sachs ActiveBeta® Emerging Markets Equity Index (NTR)	GEMNR
Goldman Sachs ActiveBeta® Europe Equity Index (NTR)	GSEUNR
Goldman Sachs ActiveBeta® International Equity Index (NTR)	GSIENR
Goldman Sachs ActiveBeta® Japan Equity Index (NTR)	GSJYNR
Goldman Sachs ActiveBeta® U.S. Large Cap Equity Index (TR)	GSLCTR
Goldman Sachs ActiveBeta® U.S. Small Cap Equity Index (TR)	GSSCTR

II. Index Construction Methodology

A. Eligible Securities

The eligible securities for each of the Goldman Sachs ActiveBeta® Indexes are defined as the constituents of these corresponding Index Universes.

Goldman Sachs ActiveBeta® Equity Index	Index Universe
Emerging Markets Equity	MSCI Emerging Markets Index
Europe Equity	MSCI Europe Index
International Equity	MSCI World ex USA Index
Japan Equity	MSCI Japan Index
U.S. Large Cap Equity	Solactive US Large Cap Index
U.S. Small Cap Equity	Russell 2000 Index

The Index Universes are adjusted to exclude the stock of Goldman Sachs and any stocks that are traded solely on the Shenzhen or Shanghai exchanges.

More information about the MSCI Indexes is available from www.msциbarra.com, the Solactive Index from www.solactive.com, and the Russell 2000 Index from www.ftserussell.com.

B. Index Construction

The construction of each ActiveBeta® Equity Index involves two steps:

- construct four factor subindexes:
 - ActiveBeta® Value Factor Subindex
 - ActiveBeta® Momentum Factor Subindex
 - ActiveBeta® Quality Factor Subindex
 - ActiveBeta® Low Volatility Factor Subindex
- combine the four subindexes with equal weights to form each ActiveBeta® Equity Index.

1. Constructing the factor subindexes

The ActiveBeta® factor subindexes are constructed according to a patented portfolio construction methodology,¹ as described in steps 1.0 through 1.4.

1.0 Assigning a factor score

For each ActiveBeta® factor subindex, constituents in the Index Universe are ranked on the basis of a factor score.

The cut-off date for data used in calculating the factor scores is four US trading days prior to the effective rebalance date for the corresponding ActiveBeta® Equity index (the Selection Date).

Values are calculated for each factor for every stock in an Index Universe, as described below.

- **Value** – A composite of three valuation measures: book value-to-price, sales-to-price, and free cash flow-to-price. The earnings-to-price ratio is used instead of free cash flow-to-price for financial stocks.
- **Momentum** – Beta- and volatility-adjusted daily total returns over an 11-month period ending one month before the Rebalance Date
- **Quality** – Gross profit divided by total assets, or return on equity for financial stocks or when gross profit is not available
- **Low Volatility** – The inverse of the standard deviation of daily total stock returns over the past 12 months, up to and including the Selection Date.

The values are used to rank the stocks by each factor. Ranks are converted to fractional factor scores ranging from –1 to +1, inclusive.

1.1 Cut-off Score and Maximum Stock Underweight

Two parameters are used in the construction process for each ActiveBeta® factor subindex:

- Cut-off Score
- Maximum Stock Underweight

The Cut-off Score determines the proportion of underweights to overweights, and the Maximum Stock Underweight the magnitude of stock weight differences relative to their weights in the Index Universe. The appropriate parameter values for each factor are determined based on historical simulations and are fixed for each ActiveBeta® Index.

¹ Methods and Systems for Building and Maintaining Portfolios based on Ordinal Ranks of Securities, U.S. Patent Numbers 8,285,620 and 8,473,398.

1.2 Determining target underweights and overweights

Stocks whose factor scores are above the Cut-off Score are overweighted relative to the Index Universe. Those whose factor score is below the Cut-off Score are underweighted.

Because the index is subject to a long-only constraint, the smallest weight of any stock is zero.

For all stocks and for each factor:

- For factor scores less than the Cut-off Score, rescale the factor scores to range from -1 to 0
- For factor scores greater than or equal to the Cut-off Score, rescale the factor score to range from 0 to +1

Once the factor scores are rescaled, stocks with factor scores greater than 0 are overweighted relative to the Index Universe. Stocks with factor scores less than or equal to 0 are underweighted relative to the Index Universe.

For all stocks and factors with an $RScore_i \leq 0$,

$$TgtWgt_i = \max(IUWgt_i + RScore_i \times MaxUnderWgt, 0)$$

The total of the stock underweights is calculated.

$$TotalUnderWgt = \sum (IUWgt_i - TgtWgt_i)$$

For all stocks and factors with an $RScore_i > 0$, a $TgtWgt_i'$ is determined by proportionately reweighting all constituents such that $TotalUnderWgt = TotalOverWgt$

$$TgtWgt_i' = IUWgt_i + RScore_i / \sum RScore_i \times TotalUnderWgt$$

Any $TgtWgt_i'$ that exceeds 20 times its $IUWgt_i$ is capped at 20 times its $IUWgt_i$ except in the case of the ActiveBeta® U.S. Small Cap Equity Index for which $TgtWgt_i'$ is capped at 5 times its $IUWgt_i$.

where,

$RScore_i$ = rescaled factor score for each stock and factor

$TgtWgt_i$ = the target weight of each stock in its factor subindex prior to any capping or turnover minimization

$IUWgt_i$ = the weight of each stock in its Index Universe

$MaxUnderWgt$ = the maximum stock under-weight that applies for each factor subindex

$TotalUnderWgt$ = the sum of all the stock underweights in a factor subindex relative to its Index Universe

TgtWgt_i' = the target weight of each stock in its factor subindex prior to any capping or turnover minimization, normalized to ensure that TotalUnderWgt = TotalOverWgt

For the ActiveBeta® Low Volatility Factor subindex only, stocks in the Index Universe are reweighted using 50% equal-weight and 50% cap-weight within sectors, countries and/or regions before calculating the overweights and underweights.

1.4 Controlling for country, region, and industry group biases

Weight constraints are applied to control unwanted biases to countries, regions and industry groups, as follows:

- **Value** – Industry group weights within each geographic region are constrained to closely match those of the same region in the Index Universe. Overall weight constraints apply to the exposure of major regions.
- **Momentum** – All country weights are constrained to be within a band around the Index Universe country weights as defined by $\pm 5\% * \frac{\sqrt{\# \text{ stocks in each Country}}}{\text{Max}(\sqrt{\# \text{ stocks in a Country}})}$
- **Quality** – Country weights are constrained to closely match those of the Index Universe. In the case of the ActiveBeta® U.S. Small Cap Equity Index only, industry group weights are constrained to closely match those of the Index Universe.
- **Low Volatility** – Country weights are constrained to closely match those of the Index Universe.

Two additional constraints are applied across each ActiveBeta® Equity Index such that 1) the sum of all stock positions with a weight greater than 5% shall not exceed 25% in aggregate, and 2) the weight of each industry group will be constrained to less than 25%.

2. Combining the ActiveBeta® Factor Indexes

Each Goldman Sachs ActiveBeta® Equity Index is created by equally weighting the four ActiveBeta® factor subindexes constructed for its Index Universe. As part of this combination, offsetting security positions are calculated and netted across the ActiveBeta® factor subindexes.

For the ActiveBeta® U.S. Large Cap Equity Index, ActiveBeta® U.S. Small Cap Equity Index, ActiveBeta® International Equity Index, ActiveBeta® Europe Equity Index and ActiveBeta® Japan Equity Index, the minimum weight for new additions to each ActiveBeta® Equity Index at rebalance is 2 bps, and stocks currently held in each index below 2 bps are either removed or increased to a minimum of 2 bps. For the ActiveBeta® Emerging Markets Equity Index, the minimum weight for new additions to the index at rebalance is 4 bps, and stocks currently held in the index below 2 bps are either removed or increased to a minimum of 4 bps.

III. Index Rebalancing

A. Rebalancing Schedule

The ActiveBeta® U.S. Large Cap Equity Index is rebalanced quarterly according to the published rebalancing schedule of their Index Universes, on the close of the first Wednesday of February, May, August, and November or, if that day is a US exchange holiday, the next trading day.

The ActiveBeta® International Equity Index, ActiveBeta® Emerging Market Equity Index, ActiveBeta® Europe Equity Index and ActiveBeta® Japan Equity Index are rebalanced quarterly according to the published rebalancing schedule of their Index Universes, typically on the close of the last business day of February, May, August, and November.

The ActiveBeta® U.S. Small Cap Equity Index is rebalanced quarterly according to the published rebalancing schedule of its Index Universe.

Each ActiveBeta® Equity Index is rebalanced according to the Index Construction Methodology described in Section II, subject to the ActiveBeta® Turnover Minimization Technique², described under III B and C below.

B. Target Weight Buffers

To minimize turnover, buffers are applied to the weights which result from the Index Construction Methodology. Buffers are determined using the following process:

- Each stock is assigned its target weight, $TgtWgt_i$ according to the Index Construction Methodology in Section II.
- A buffer is assigned to a stock relative to each factor index's maximum underweight.

$$Buffer_i = \min(0.20 \times MaxUnderWgt, 0.30\%)$$

The lower and upper trading bounds on constituent i are then defined as:

$$LowerWgt_i = \min(\max(TgtWgt_i - Buffer, 0), MaxWgt_i)$$

$$UpperWgt_i = \min(\max(TgtWgt_i + Buffer, 0), MaxWgt_i)$$

where,

$TgtWgt_i$ = the target weight of each stock in its factor subindex prior to any capping or turnover minimization, normalized to ensure that $TotalUnderWgt = TotalOverWgt$

$MaxUnderWgt$ = the maximum stock under-weight that applies for each factor subindex

² Methods and Systems for Reducing Turnover in Multi-Portfolio Structures, U.S. Patent Application Number 14/208,865.

$MaxWgt = 20 \times IUWgt_i$, except in the case of the ActiveBeta® U.S. Small Cap Equity Index for which it is $5 \times IUWgt_i$.
 $IUWgt_i =$ the weight of each stock in its Index Universe

C. Turnover Minimization

The ActiveBeta® Turnover Minimization Technique reduces the turnover in the ActiveBeta® Equity Indexes by calculating offsetting pair trades in the individual factor subindexes and allowing constituent weights to float inside the upper and lower weight bounds, as defined above.

A trade weight is calculated for each stock from the difference between the stock's weight before rebalancing and the weight determined by the Index Construction Methodology described in Section II. The lower and upper trading bounds allow a stock's weight to deviate from its target weight, either positively or negatively, before a trade or rebalancing is triggered. Iterative pair-wise trades are netted until the minimum amount of trading is determined which maintains each stock within its upper and lower weight bounds. In the case of the ActiveBeta® U.S. Small Cap Equity Index only, the trade size is further constrained as a function of 60 day median trading volume and the market capitalization of the Russell 2000 Index.

IV. Index Calculation and On-going Maintenance

A. Daily Calculation

The indexes are calculated by Solactive AG (the Calculation Agent).

The Index Calculation Agent is responsible for calculating index levels based on weights and stocks as determined by the Index Sponsor on a quarterly basis using the steps described in Section II, Index Construction Methodology, and Section III, Index Rebalancing.

The Index Calculation Agent applies corporate action adjustments and calculates the indexes as described in the the Solactive Index Calculation Guideline, Version 1.1 dated July 8th, 2013 <http://www.solactive.com/wp-content/uploads/2012/06/Index-Calculation-Guideline-Solactive1.pdf>

Both price and total return indexes are calculated for each ActiveBeta[®] Equity Index in US dollars. Total return indexes assume reinvestment of cash dividends across the full index at the open on the ex-date. The total return indexes for the ActiveBeta[®] US Large Cap and US Small Cap Indexes are calculated using gross dividends. The total return indexes for the ActiveBeta[®] International, Emerging Markets, Europe and Japan are calculated using net dividends.

The compositions of the ActiveBeta[®] Equity Indexes are available on the GSAM website (www.gsamfunds.com) and Solactive website (www.solactive.com) on a daily basis. Results of the latest rebalancing are available on the Solactive website three days prior to the effective date (www.solactive.com) and are adjusted for corporate actions between the Selection date and Rebalance dates in accordance with the rules for Daily Calculation.

B. Inception Date & Value

The ActiveBeta[®] Equity Indexes have the following inception dates. Index data prior to the inception dates are based on backtests (pre-inception performance).

Name	Date
Goldman Sachs ActiveBeta [®] Emerging Markets Equity Index (NTR)	8/19/2015
Goldman Sachs ActiveBeta [®] International Equity Index (NTR)	8/19/2015
Goldman Sachs ActiveBeta [®] U.S. Large Cap Equity Index (TR)	8/19/2015
Goldman Sachs ActiveBeta [®] Europe Equity Index (TR)	3/2/2016
Goldman Sachs ActiveBeta [®] Japan Equity Index (TR)	3/2/2016
Goldman Sachs ActiveBeta [®] U.S. Small Cap Equity Index (TR)	6/28/2017

V. Amendments and Exceptions to this Methodology

The Index Committee, comprised of Goldman Sachs Asset Management employees, is responsible for approving changes to the methodology for the Goldman Sachs ActiveBeta® Equity Indexes. This document is updated to reflect any changes approved by the Index Committee.

VI. Updates to this Methodology Document

The following sections were updated with effect from:

27 May 2021

II. B. 2. The minimum weight applied to the ActiveBeta® Emerging Markets Equity Index was reduced from 10bps to 4bps and current stocks below 2bps either removed or increased to 4bps.

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