S&P Dow Jones Indices

A Division of S&P Global

S&P 500 VEQTOR Switch Index
Methodology

January 2021

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Introduction

Index Objective and Highlights

The S&P 500 VEQTOR Switch Index is designed to measure the large cap US market (represented by the S&P 500) with a target volatility of 10% by dynamically allocating, based on realized volatility, to the S&P 500 and to the S&P 500 VIX Futures Long/Short Switch Index.

If realized volatility of the S&P 500 exceeds 10%, the weight assignment to the S&P 500 is less than 100% and the remainder is assigned to the S&P 500 VIX Futures Long/Short Switch Index. If realized volatility of the S&P 500 is lower than 10%, the weight assignment to the S&P 500 is capped at 100%. The index adjusts its allocation to component indices only when its weight assignments on the last reference day deviates more than 10% from the target allocation.

The S&P 500 VIX Futures Long/Short Switch Index dynamically allocates between cash and one-month VIX futures with the aim of capturing VIX futures roll yield and volatility drops ("short") when volatility declines and VIX futures upside when volatility spikes ("long"). When the futures term structure is convex, the index represents a long position in the VIX one-month futures; when the futures term structure is concave, the index represents a short position in the VIX one-month futures. The index calculates curvature of the VIX futures term structure on a daily basis. If the curvature signal flips and remains constant for three continuous business days, the index switches its position accordingly. The index has a constant scale factor of 1/3 on the VIX futures position.

For more information on the S&P 500 and S&P 500 VIX Futures Long/Short Switch Index, please refer to the S&P U.S. Indices and S&P 500 VIX Futures Long/Short Switch Index methodology documents, respectively, available at www.spdji.com.

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' Equity Indices Policies & Practices Methodology	Equity Indices Policies & Practices
S&P Dow Jones Indices' Index Mathematics Methodology	Index Mathematics Methodology
S&P Dow Jones Indices' Float Adjustment Methodology	Float Adjustment Methodology

This methodology 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 document. Any changes to or deviations from this methodology are made in the sole judgment and discretion of S&P Dow Jones Indices so that the index continues to achieve its objective.

Index Construction

Approaches

The S&P 500 VEQTOR Switch Index dynamically allocates between two components:

- The S&P 500, representing equity.
- The S&P 500 VIX Futures Long/Short Switch Index, representing volatility.

The index uses an exponentially weighted risk control model to determine the target allocation to the S&P 500. The realized volatility in the S&P 500 is calculated as the maximum of two exponentially weighted moving averages, one measuring short-term volatility and one measuring long-term volatility. If realized volatility exceeds the target level, the allocation to the S&P 500 is less than 100% and the remainder is allocated to the S&P 500 VIX Futures Long/Short Switch Index. If realized volatility is lower than the target level, allocation to the S&P 500 is capped at 100%.

The target volatility level is set to 10%.

Although the target allocation is evaluated daily, the index adjusts its allocation to equity and volatility only when its allocation on the last rebalancing day deviates more than 10% from the target allocation.

Base Date and History Availability

Index history availability, base dates and base values are shown in the table below.

Index	Launch Date	First Value Date	Base Date	Base Value
S&P 500 VEQTOR Switch Index (ER)	11/17/2014	01/20/2006	01/20/2006	100
S&P 500 VEQTOR Switch Index (TR)	11/17/2014	01/20/2006	01/20/2006	100

Excess Return Index Calculations

On any business day *t*, the excess return index value is calculated as:

$$Index\ ER_t = IndexER_{rb} * (1 + ER_t) \quad (1)$$

where:

$IndexER_t$ = Excess return index level at the close of day *t*.

$IndexER_{lrb}$ = Excess return index level at the close of the last rebalancing day.

ER_t = Excess return since the last rebalancing day at the close of day *t*, calculated as:

$$ER_t = W_{E,lrb} * EqtER_t + W_{V,lrb} * VolER_t \quad (2)$$

where:

$EqtER_t$ = Excess return of the S&P 500 since the last rebalancing day on day *t*, calculated as:

$$EqtER_t = \frac{SPXE_t}{SPXE_{lrb}} - 1 \quad (2a)$$

where:

$SPXE_t$ = The S&P 500 Excess Return index value[1] at the close of day *t*.

$SPXE_{lrb}$ = The S&P 500 Excess Return index value at the close of the last rebalancing day.

$VolER_t$ = Excess return of the S&P 500 VIX Futures Long/Short Switch Index since the last rebalancing day on day *t*, calculated as:

$$VolER_t = \frac{VIXE_t}{VIXE_{lrb}} - 1 \quad (2b)$$

where:

$VIXE_t$ = The S&P 500 VIX Futures Long/Short Switch Index Excess Return index value at the close of day *t*.

$VIXE_{lrb}$ = The S&P 500 VIX Futures Long/Short Switch Index Excess Return index value at the close of the last rebalancing day.

$W_{E,lrb}$ = Weight of the S&P 500 on the last rebalancing day.

$W_{V,lrb}$ = Weight of the S&P 500 VIX Futures Long/Short Switch Index on the last rebalancing day.

Total Return Index Calculations

On any business day *t*, the total return index value is calculated as:

$$IndexTR_t = IndexTR_{lrb} * (1 + TR_t) \quad (3)$$

where:

$IndexTR_t$ = Total return index level at the close of day *t*.

$IndexTR_{lrb}$ = Total return index level at the close of the last rebalancing day.

TR_t = Total return since the last rebalancing day at the close of day *t*, calculated as:

$$TR_t = W_{E,lrb} * EqtTR_t + W_{V,lrb} * VolTR_t \quad (4)$$

where:

$EqtTR_t$ = Total return of the S&P 500 since the last rebalancing day on day *t*, calculated as:

$$EqtTR_t = \frac{SPTR_t}{SPTR_{lrb}} - 1 \quad (4a)$$

where:

$SPTR_t$ = The S&P 500 Total Return index value at the close of day *t*.

$SPTR_{lrb}$ = The S&P 500 Total Return index value at the close of the last rebalancing day.

$VolTR_t$ = Total return of the S&P 500 VIX Futures Long/Short Switch Index since the last rebalancing day on day *t*, calculated as:

$$VolTR_t = \frac{VIXT_t}{VIXT_{lrb}} - 1 \quad (4b)$$

[1] The returns of this index are the returns of the S&P 500 Total Return minus the overnight LIBOR. For more details, please refer to the *Excess Return Indices* section in S&P Dow Jones Indices' *Index Mathematics Methodology* available at www.spdji.com.

where:

$VIXT_t$ = The S&P 500 VIX Futures Long/Short Switch Index Total Return index value at the close of day *t*.

$VIXT_{lrb}$ = The S&P 500 VIX Futures Long/Short Switch Index Total Return index value at the close of the last rebalancing day.

$W_{E,lrb}$ = Weight of the S&P 500 on the last rebalancing day.

$W_{V,lrb}$ = Weight of the S&P 500 VIX Futures Long/Short Switch Index on the last rebalancing day.

Allocations

Exponentially Weighted Volatility. On any business day *t*, the index calculates the realized volatility as the maximum of two exponentially weighted moving averages, one measuring short-term and one measuring long-term volatility.

$$RV_t = Max\left(RV_{S,t}, RV_{L,t}\right) \tag{5}$$

where:

$RV_{S,t}$ = The short-term volatility measure at the close of day *t*, calculated as:

$$RV_{S,t} = \sqrt{\frac{252}{n} * Variance_{S,t}}$$

$$Variance_{S,t} = \begin{cases} \lambda_S * Variance_{S,t-1} + (1-\lambda_S) * \left[\ln\left(\frac{SPX_t}{SPX_{t-n}}\right)\right]^2 \ldots if \ldots t > T_0 \\ \sum_{i=m+1}^{T_0} \frac{\alpha_{S,i,m}}{WF_S} * \left[\ln\left(\frac{SPX_i}{SPX_{i-n}}\right)\right]^2 \ldots if \ldots t = T_0 \end{cases} \tag{6a}$$

$RV_{L,t}$ = The long-term volatility measure at the close of day *t*, calculated as:

$$RV_{L,t} = \sqrt{\frac{252}{n} * Variance_{L,t}}$$

$$Variance_{L,t} = \begin{cases} \lambda_L * Variance_{L,t-1} + (1-\lambda_L) * \left[\ln\left(\frac{SPX_t}{SPX_{t-n}}\right)\right]^2 \ldots if \ldots t > T_0 \\ \sum_{i=m+1}^{T_0} \frac{\alpha_{L,i,m}}{WF_L} * \left[\ln\left(\frac{SPX_i}{SPX_{i-n}}\right)\right]^2 \ldots if \ldots t = T_0 \end{cases} \tag{6b}$$

where:

SPX_t = The S&P 500 Price Return index level at the close of day *t*.

T_0 = The first value date of the S&P 500 VEQTOR Switch Index.

n = The number of days in the return calculation. *n* = 5 as S&P Dow Jones Indices uses weekly returns to calculate realized volatility.

m = The m^{th} trading date prior to T_0.

N = The number of trading days observed for calculating the initial variance as of the first value date of the index. *N* = 100.

λ_S = The short-term decay factor used for exponential weighting. The decay factor is a number greater than zero and less than one that determines the weight of each daily return in the calculation of historical variance. λ_S = 0.90.

λ_L = The long-term decay factor used for exponential weighting. The decay factor is a number greater than zero and less than one that determines the weight of each daily return in the calculation of historical variance. λ_L = 0.97.

$\alpha_{S,i,m}$ = Weight of date *i* in the short-term volatility calculation, as calculated based on the following formula:

$$\alpha_{S,i,m} = (1-\lambda_S) * \lambda_S^{N+m-i} \quad (7a)$$

$$WF_S = \sum_{i=m+1}^{T_0} \alpha_{S,i,m} \quad (7b)$$

$\alpha_{L,i,m}$ = Weight of date *i* in the long-term volatility calculation, as calculated based on the following formula:

$$\alpha_{L,i,m} = (1-\lambda_L) * \lambda_L^{N+m-i} \quad (7c)$$

$$WF_L = \sum_{i=m+1}^{T_0} \alpha_{L,i,m} \quad (7d)$$

Index Weight and Rebalancing. On any business day *t*, the index calculates the target weights as follows:

$$TW_{E,t} = Min\left(100\%, \frac{TV}{RV_t}\right)$$
$$TW_{V,t} = 100\% - TW_{E,t} \quad (8)$$

where:

$TW_{E,t}$ = The target weight of equity at the close of day *t*.

$TW_{V,t}$ = The target weight of volatility at the close of day *t*.

TV = The target volatility level. TV = 10%.

RV_t = The realized volatility level at time *t*, as calculated in formula (5).

On any business day *t*, the index calculates the deviation from target weights as follows:

$$\Delta_t = \begin{cases} |W_{E,lrb} - TW_{E,t}| \ldots if \ldots t \text{ is not a rebalancing day} \\ |TW_{E,t-1} - TW_{E,t}| \ldots if \ldots t \text{ is a rebalancing day} \end{cases} \quad (9)$$

If Δ_t is greater than 10%, the index rebalances on the next business day (*t+1*). On the index rebalancing day (*t+1*), the end-of-day index weights are set to the day *t* target weights.

Currency of Calculation and Additional Index Return Series

In addition to the indices detailed in this methodology, additional return series versions of the indices may be available, including, but not limited to: currency, currency hedged, decrement, fair value, inverse, leveraged, and risk control versions. For a list of available indices, please refer to *S&P DJI's All Indices by Methodology Report*.

For more information on these types of indices, please refer to S&P Dow Jones Indices' Index Mathematics Methodology.

For the inputs necessary to calculate certain types of indices, including decrement, dynamic hedged, fair value, and risk control indices, please refer to the Parameters documents available at www.spdji.com.

Index Governance

Index Committee

The S&P Dow Jones Indices' Multi Asset Index Committee maintains the S&P 500 VEQTOR Switch Index. All Committee members are full-time professional members of S&P Dow Jones Indices' staff. The Committee meets regularly. At each meeting, the Index Committee may review pending corporate actions that may affect index constituents, statistics comparing the composition of the index to the market, companies that are being considered as candidates for addition to the index, and any significant market events. In addition, the Index Committee may revise index policy covering rules for selecting companies, treatment of dividends, share counts or other matters.

S&P Dow Jones Indices considers information about changes to its indices and related matters to be potentially market moving and material Therefore, all Index Committee discussions are confidential.

S&P Dow Jones Indices' Index Committees reserve the right to make exceptions when applying the methodology if the need arises. In any scenario where the treatment differs from the general rules stated in this document or supplemental documents, clients will receive sufficient notice, whenever possible.

In addition to the daily governance of indices and maintenance of index methodologies, at least once within any 12-month period, the Index Committee reviews the methodology to ensure the indices continue to achieve the stated objectives, and that the data and methodology remain effective. In certain instances, S&P Dow Jones Indices may publish a consultation inviting comments from external parties.

For information on Quality Assurance and Internal Reviews of Methodology, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices document and/or Commodities Indices Policies & Practices document.

Index Policy

Announcements

Rebalancing announcements, if needed, are made two days prior to the rebalancing date. All methodology changes are posted to S&P Dow Jones Indices' Web site and announced via email to all clients. The latest available methodology is posted on the Web site at *www.spdji.com*.

For more information, please refer to the Announcements section of S&P Dow Jones Indices' Equity Indices Policies & Practices document.

Holiday Schedule

The index is calculated daily throughout the calendar year when both the S&P 500 and the S&P 500 VIX Futures Long/Short Switch Index are calculated.

A complete holiday schedule for the year is available at www.spdji.com.

Rebalancing

The Index Committee may change the date of a given rebalancing for reasons including market holidays occurring on or around the scheduled rebalancing date. Any such change will be announced with proper advance notice where possible.

Unexpected Exchange Closures

For information on Unexpected Exchange Closures, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices document and/or Commodities Indices Policies & Practices document.

Recalculation Policy

For information on the recalculation policy, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices and Commodities Indices Policies & Practices documents for the equity asset and volatility asset classes, respectively.

For information on Calculations and Pricing Disruptions, Market Disruption Events and Holidays During Roll Period, Expert Judgment and Data Hierarchy, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices and Commodities Indices Policies & Practices Methodology documents for the equity asset and volatility asset classes, respectively.

Contact Information

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

Index Dissemination

Index levels are available through S&P Dow Jones Indices' Web site at *www.spdji.com*, major quote vendors (see codes below), numerous investment-oriented Web sites, and various print and electronic media.

Tickers

The table below lists headline indices covered by this document. All versions of the below indices that may exist are also covered by this document. Please refer to the *S&P DJI Methodology & Regulatory Status Database* for a complete list of indices covered by this document.

Index	Return Type	Bloomberg	RIC
S&P 500 VEQTOR Switch Index	Excess Return Total Return	SPVQSER SPVQSTR	.SPVQSER .SPVQSTR

Index Data

Daily index levels and data are available via subscription.

For product information, please contact S&P Dow Jones Indices, www.spdji.com/contact-us.

Web site

For further information, please refer to S&P Dow Jones Indices' Web site at www.spdji.com.

Appendix

EU Required ESG Disclosures

EXPLANATION OF HOW ENVIRONMENTAL, SOCIAL & GOVERNANCE (ESG) FACTORS ARE REFLECTED IN THE KEY ELEMENTS OF THE BENCHMARK METHODOLOGY[2]		
1.	**Name of the benchmark administrator.**	S&P Dow Jones Indices LLC.
2.	**Underlying asset class of the ESG benchmark.[3]**	N/A
3.	**Name of the S&P Dow Jones Indices benchmark or family of benchmarks.**	S&P DJI Multi-Asset Indices Benchmark Statement
4.	**Do any of the indices maintained by this methodology take into account ESG factors?**	No
Appendix latest update:		January 2021
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[2] The information contained in this Appendix is intended to meet the requirements of the European Union Commission Delegated Regulation (EU) 2020/1817 supplementing Regulation (EU) 2016/1011 of the European Parliament and of the Council as regards the minimum content of the explanation of how environmental, social and governance factors are reflected in the benchmark methodology.

[3] The 'underlying assets' are defined in European Union Commission Delegated Regulation (EU) 2020/1816 supplementing Regulation (EU) 2016/1011 of the European Parliament and of the Council as regards the explanation in the benchmark statement of how environmental, social and governance factors are reflected in each benchmark provided and published.

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In addition, S&P Dow Jones Indices provides a wide range of services to, or relating to, many organizations, including issuers of securities, investment advisers, broker-dealers, investment banks, other financial institutions and financial intermediaries, and accordingly may receive fees or other economic benefits from those organizations, including organizations whose securities or services they may recommend, rate, include in model portfolios, evaluate or otherwise address.