S&P 500 Engle VT Indices
Methodology

December 2024

Table of Contents

Introduction

Index Objective

The S&P 500 Engle VT Index measures dynamic exposure to E-mini S&P 500 Futures while applying an intraday volatility control mechanism. The volatility control mechanism is based on a volatility parameter calculated using the Multiplicative Error Model (MEM) intraday forecasting model introduced by Robert Engle's research in his paper New Frontier for ARCH Models and Forecasting Intraday Volatility.

Index Family

Index	Target Volatility	Rebalance Cost	Replication Cost	Upper Intraday Weight	Max Effective Exposure with VAF
S&P 500 Engle 8% VT Index (USD) ER	8%	0%	0%	125%	150%
S&P 500 Engle 8% VT TCA Index (USD) ER	8%	0.01%	0.05%	125%	150%
S&P 500 Engle 10% VT Index (USD) ER	10%	0%	0%	125%	150%
S&P 500 Engle 10% VT TCA Index (USD) ER	10%	0.01%	0.05%	125%	150%
S&P 500 Engle 12% VT Index (USD) ER	12%	0%	0%	150%	180%
S&P 500 Engle 12% VT TCA Index (USD) ER	12%	0.01%	0.05%	150%	180%

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

Index Calculations

For each index calculation day, the index calculates as follows:

$$\left(\frac{F_t}{F_{t-1}} - 1\right) = \left(\frac{I_{t,e}}{I_{t-1,e}} - 1\right) \times \text{VAF}_{t-2}$$

where:

F_t = The index level for day t

$I_{t,e}$ = The Intermediate index level for the last execution window e and day t

VAF_t = Volatility Adjustment factor for day t

For each index calculation day t, the Variance Adjustment Factor (VAF) calculates as follows:[1]

$$VAF_t = \begin{cases} VAF_{t-1}, & \left| VAF_t^T - VAF_{t-1}\right| < 5\% \\ VAF_{t,}^T & otherwise \end{cases}$$

$$VAF_t^T = \max\left(0.95, \min\left(1.20, \sqrt{max\left(0, 2 - \frac{VarObs_t}{TV^2/252}\right)}\right)\right)$$

$$VarObs_t = \frac{1}{VaOP * 0.5} \sum_{j=1}^{VaOP *[0.5]} \left(\frac{F_{t-j+1}}{F_{t-j}} - 1\right)^2$$

where:

TV = Target Volatility

$VaOP$ = 40

For each index calculation day t and window i, the Intermediate index calculates as follows[2]:

$$I_{t,i} = I_{t,i-1} + R_{t,i}$$

$$L_{t,i} = L_{t,i-1}\left(\frac{TWAP_{t,i}}{TWAP_{t,i-1}} - \frac{Act(i,i-1)}{365} \times ReplicaCost\right)$$

If the index window i represents the execution window e, then:

$$R_{t,i} = \text{UNIT}_{t,e-1} \times \left(L_{t,e} - L_{t,o}\right) - \left|\text{UNIT}_{t,e} - \text{UNIT}_{t,e-1}\right| \times RebalCost \times L_{t,e}$$

If the index window i represents the observation window o, then:

$$R_{t,i} = \text{UNIT}_{t,e-1} \times \left(L_{t,o} - L_{t,e-1}\right)$$

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[1] On each date within 19 business days after the index initialization date, including this date, VAF is set to 1.
[2] With respect to the Intermediate index level, i indicates the respective observation (o) or execution (e) period. If i is the first Observation Period ($o = 1$) on an Index Business Day t, then $i - 1$ refers to the last Execution Period ($e = 7$) on Index Business Day $t - 1$. Likewise, if i is the last Execution Period on an Index Business Day t, then $i + 1$ refers to the first Observation Period ($o = 1$) on Index Business Day $t + 1$.

where:

$TWAP_t$ = The E-mini S&P 500 Futures TWAP for window i and day t. For calculation details, please refer to *Appendix A.*

$Act(i, i-1)$ = The time elapsed in days between the current and previous TWAP[3] period

$ReplicaCost$ = The cost due to the replication of the index[4]

$\text{UNIT}_{t,e}$ = Number of units determined at day t and execution window e

$RebalCost$ = The trading costs associated with rebalancing the index

For each index calculation day *t* and execution window e, the number of units calculates as follows[5]:

$$\text{UNIT}_{t,e} = \begin{cases} \dfrac{W_{t,o}}{L_{t,o}} \times I_{t,o}, & |W_{t,o}^{\text{target}} - W_{t,o-1}| \geq 10\% \\ \text{UNIT}_{t,e-1}, & \text{otherwise} \end{cases}$$

where:

$W_{t,o}$ = Weight for the observation window *o* on day *t*

For each index calculation day *t* and observation window *o*, $W_{t,o}$ calculates as follows:

$$W_{t,o} = \begin{cases} \max\left(W_{t,o,\,\text{minintra}}, \min\left(W_{t,o,\,\text{maxintra}}, W_{t,o}^{\text{target}}\right)\right), & |W_{t,o}^{\text{target}} - W_{t,o-1}| \geq 10\% \\ W_{t,o-1}, & \text{otherwise} \end{cases}$$

$$W_{t,o,\,\text{minintra}} = \max\left(\underline{W}, W_{t,o-1} - \Delta\right)$$

$$W_{t,o,\,\text{maxintra}} = \min\left(\bar{W}, W_{t,o-1} + \Delta\right)$$

where:

$W_{t,o}^{\text{target}}$ = Target weight on window *o* and day *t*

$W_{t,o,minintra}$ = Minimum weight for observation window *o* and day *t*

$W_{t,o,maxintra}$ = Maximum weight for observation window *o* and day *t*

$\underline{W}$ = 0

$\bar{W}$ = Upper Intraday Weight

Δ = 30%

For each index calculation day *t* and window *o*, $W_{t,o}^{\text{target}}$ calculates as follows:

$$W_{t,o}^{\text{target}} = \max\left(\underline{W}, \min\left(\bar{W}, \dfrac{TV}{\hat{\sigma}_{t,o}} \times \text{Adj}_{t-1} \times \text{Trend}_{t,o}\right)\right)$$

where:

$\hat{\sigma}_{t,o}$ = Volatility parameter for the last observation window *o* and day *t*

Adj_t = Overnight Scale Factor[6] on day *t*

$\text{Trend}_{t,0}$ = Trend component for observation window *o* and day *t*

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[3] For more information on TWAP calculation time windows, please refer to *Index Maintenance.*
[4] Cost is calculated using an Actual/365-day count convention.
[5] For the index initialization date, $W_{t,o} = W_{t,o}^{\text{target}}$
[6] The Overnight Scale Factor is initialized to 0.84.

For each index calculation day t and window o, $\text{Trend}_{t,0}$ calculates as follows:[7]

$$\text{Trend}_{t,o} = \begin{cases} \max(0, 0.5 + 20 \times R_{t,o}), & IR_{t,o} < -1\% \\ 1.0, & \text{otherwise} \end{cases}$$

$$IR_{t,o} = \frac{L_{t,o}}{L_{t-1}} - 1$$

where:

$IR_{t,o}$ = The E-mini S&P 500 Future TWAP between the last execution window of day $t-1$ and current observation window L_o for day t

The Overnight Scale Factor for day t calculates as follows[8]:

$$\text{Adj}_t = \text{median}_{i=1}^{504} \frac{\hat{\sigma}_{t,o}}{\sigma_t^{EOD}}$$

where:

σ_t^{EOD} = 20-day exponentially weighted volatility on day t

$\hat{\sigma}_{t,o}$ = Intraday volatility in the last observation period for day t

The 20-day exponentially weighted volatility σ_t^{EOD} for day t calculates as follows:

$$\sigma_t^{EOD} = \sqrt{252} \times \sqrt{\sum_{i=0}^{19} \left(\frac{L_{t-i}}{L_{t-i-1}} - 1\right)^2 \frac{(1-\alpha)^i}{\sum_{i=0}^{19}(1-\alpha)^i}}$$

$$\alpha = 1 - exp\left(\frac{-\ln(2)}{10}\right)$$

where:

α = exponentially weighted factor

The estimated volatility $\hat{\sigma}_{t,\bar{o}}$ for observation window o and day t calculates as follows:

$$\hat{\sigma}_{t,o} = \sqrt{252 \times N_{obs} \times h_{t-1,o}} \times \sqrt{\frac{\sum_{j=1}^{VOP} \left(\lambda^j \times r_{t,o-j+1}^2 \times q_{o-j+1}\right)}{\sum_{j=1}^{VOP} \lambda^j \times q_{o-j+1}}}$$

$$r_{t,o-j+1} = \left(\frac{L_{t,o-j+1}/L_{t,o-j} - 1}{\sqrt{h_{t,o-j+1}}}\right)$$

where:

λ = 0.99

q_o = Intraday Period Equalizing Factor for observation window o and day t. For more information, see *Appendix C*

$h_{t,o}$ = Conditional Variance for observation period o and day t. For more information, see *Appendix D*

N_{obs} = 7

VOP = 140

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[7] For the last observation window o on day t, the $\text{Trend}_{t,o}$ is set to 1.
[8] Starting 20 Scheduled Trading Days (inclusive) after the Index Initialization Date and continuing until 504 Scheduled Trading Days have passed, the Intraday-End-of-Day Adjustment Factor remains equal to the Initial Intraday-End-of-Day Adjustment Factor.

Index Maintenance

Rebalancing

The index rebalances seven times daily, using two TWAP periods: one for signal calculation and one for rebalancing execution. The following are the periods for the calculations and rebalance:

Window	TWAP Execution Period
1	9:38 to 9:53 ET
2	10:30 to 10:45 ET
3	11:30 to 11:45 ET
4	12:30 to 12:45 ET
5	13:30 to 13:45 ET
6	14:30 to 14:45 ET
7	15:45 to 16:00 ET

Window	TWAP Observation Period
1	9:31 to 9:33 ET
2	10:10 to 10:15 ET
3	11:10 to 11:15 ET
4	12:10 to 12:15 ET
5	13:10 to 13:15 ET
6	14:10 to 14:15 ET
7	15:25 to 15:30 ET

Due to certain market events, rebalancing timing can change in the following ways:

- For any regularly scheduled early market closure, the index uses the first four regular-day observation periods. For execution windows, the index rebalances using the first three regular-day execution windows and a final execution window from 12:45 to 13:00 ET.

- For any unscheduled full-day market closure, the index does not rebalance.

- For any date where a market disruption event occurs during an observation window, if one-third of the E-mini S&P 500 TWAP Levels are not available for an observation window, $\text{UNIT}_{t,e} = \text{UNIT}_{t,e-1}$. Otherwise, the observation TWAP calculates using all available ticks.

- For any date where a market disruption event occurs during an execution window and $\text{UNIT}_{t,e} \neq \text{UNIT}_{t,e-1}$, the $UNIT$ value used for the disrupted execution period e is $\widehat{\text{UNIT}}_{t,e}$ which calculates as follows:

$$\widehat{\text{UNIT}}_{t,e} = \frac{NS}{TS} \times (\text{UNIT}_{t,e} - \text{UNIT}_{t,e-1}) + \text{UNIT}_{t,e-1}$$

where:

NS = The number of seconds for which an Underlying TWAP Level is available with respect to Execution Period e

TS = The number of seconds during that Execution Period e

- For any day with an execution period *e* that is immediately preceded by a disrupted execution and disrupted observation period and $UNIT_{t,e-1} \neq UNIT_{t,e-2}$, the $UNIT$ value used for the execution period $e-1$ is $\widehat{UNIT}_{t,e-1} = UNIT_{t,e-1}$. If this execution period is the last execution period, then the $UNIT$ value used for the execution period $e-1$ is $\widehat{UNIT}_{t,e-1} = UNIT^*_{t,e-1}$.

where:

$UNIT^*_{t,e-1}$ = The number of units $UNIT_{t,e-1}$ recalculated setting $Trend_{t,o} = 1$

Currency of Calculation and Additional Index Return Series

The indices calculate in U.S. dollars.

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

For information on the calculation of different 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.spglobal.com/spdji/.

Base Dates 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 Engle 8% VT Index (USD) ER	12/18/2024	01/02/2004	01/02/2004	100
S&P 500 Engle 8% VT TCA Index (USD) ER	12/18/2024	01/02/2004	01/02/2004	100
S&P 500 Engle 10% VT Index (USD) ER	12/18/2024	01/02/2004	01/02/2004	100
S&P 500 Engle 10% VT TCA Index (USD) ER	12/18/2024	01/02/2004	01/02/2004	100
S&P 500 Engle 12% VT Index (USD) ER	12/18/2024	01/02/2004	01/02/2004	100
S&P 500 Engle 12% VT TCA Index (USD) ER	12/18/2024	01/02/2004	01/02/2004	100

Index Data

Calculation Return Types

S&P Dow Jones Indices calculates multiple return types which vary based on the treatment of regular cash dividends. The classification of regular cash dividends is determined by S&P Dow Jones Indices.

- Price Return (PR) versions are calculated without adjustments for regular cash dividends.

- Gross Total Return (TR) versions reinvest regular cash dividends at the close on the ex-date without consideration for withholding taxes.

- Net Total Return (NTR) versions, if available, reinvest regular cash dividends at the close on the ex-date after the deduction of applicable withholding taxes.

In the event there are no regular cash dividends on the ex-date, the daily performance of all three indices will be identical.

For a complete list of indices available, please refer to the daily index levels file ("SDL").

For more information on the classification of regular versus special cash dividends as well as the tax rates used in the calculation of net return, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices Methodology.

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

Index Governance

Index Committee

An Index Committee maintains the indices. The Index Committee meets regularly. All committee members are full-time professional members of S&P Dow Jones Indices' staff. At each meeting, the Index Committee reviews pending corporate actions that may affect index constituents, statistics comparing the composition of the indices to the market, companies that are being considered as candidates for addition to an 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 Methodology.

Index Policy

Announcements

All index constituents are evaluated daily for data needed to calculate index levels and returns and are communicated to clients in end-of-day files. Any unusual treatment or short notice of an event may be communicated to clients via email.

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

Holiday Schedule

The indices calculate when the U.S. equity markets are open.

A complete holiday schedule for the year is available on the S&P Dow Jones Indices' Web site at www.spglobal.com/spdji/.

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 Methodology.

Recalculation Policy

For information on the recalculation policy please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices Methodology.

Real-Time Calculation

Real-time indices are not restated.

For information on Calculations and Pricing Disruptions, Expert Judgment and Data Hierarchy, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices Methodology.

Contact Information

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

Index Dissemination

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	BBG	RIC
S&P 500 Engle 8% VT Index (USD) ER	SPEVT8E	.SPEVT8E
S&P 500 Engle 8% VT TCA Index (USD) ER	SPETC8E	.SPETC8E
S&P 500 Engle 10% VT Index (USD) ER	SPEVT10E	.SPEVT10E
S&P 500 Engle 10% VT TCA Index (USD) ER	SPETC10E	.SPETC10E
S&P 500 Engle 12% VT Index (USD) ER	SPEVT12E	.SPEVT12E
S&P 500 Engle 12% VT TCA Index (USD) ER	SPETC12E	.SPETC12E

Index Data

Daily constituent and index level data are available via subscription.

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

Web site

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

Appendix A: Calculation of Time Weighted Average Price (TWAP)

Given an intraday time window defined by a window start time and a window end time, to calculate the TWAP, the E-mini S&P 500 Futures trade level is grouped as follows:

- The observation and execution time windows are defined as beginning at (and including) the start time and ending at (and including) the end time.

- The conditional variance window is defined as beginning at (and including) the start time and ending at (and excluding) the end time.

- For all TWAP calculations, the last traded price at every 1-second interval is kept.

- For each observation and execution window, the TWAP for each window is calculated as the average of recorded last traded prices within that window. For example, if the window starts at 9:31:00 and ends at 9:33:00 ET, the TWAP is computed by averaging all recorded last traded prices, including those at 9:31:00 and 9:33:00 ET.

- The conditional variance window is split into 1-minute intervals. The 1-minute TWAP is calculated by taking the average of the available recorded last traded prices. For example, if the 1-minute window starts at 9:30:00 and ends at 9:31:00 ET, the 1-minute TWAP is calculated by averaging all recorded last traded prices in the window, including those at 9:30:00 and excluding those at 9:31:00 ET.

- The conditional variance of 5-minute TWAPs is calculated as the average of five consecutive 1-minute TWAPs. For example, the window from 9:30:00 to 9:35:00 ET averages available 1-minute TWAPs from 9:30:00 to 9:34:00 ET. Similarly, the final window, from 15:55:00 to 16:00:00 ET, uses available 1-minute TWAPs from 15:55:00 to 15:59:00 ET.

Appendix B: Daily Realized Variance Calculation

On an index business day t, the Daily Realized Variance is calculated using the sum of 78 5-minute squared log-returns and calculates as follows[9]:

$$RVar_t = \sum_{i=2}^{79} ln\left(\frac{TWAP_{t,i}^{5-min}}{TWAP_{t,i-1}^{5-min}}\right)^2$$

On an index business day t that is a half-day, or a market disruption event has occurred, the prior business day's Realized Variance is used:

$$RVar_t = RVar_{t-1}$$

where:

$TWAP_{t,i}^{5-min}$ = The 5-minute TWAP on the E-mini S&P 500 Futures with the first TWAP window starting 9:30:00 EST[10]. For further details on the TWAP calculation, see *Appendix A*.

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[9] From January 5, 1996, to December 31, 2003, UBS was the source of the Daily Realized Variances, which calculate using S&P 500 Index TWAPs. UBS is a user of the S&P 500 Engle VT Indices.
[10] On partial trading days, the last 5-minute TWAP window is from 12:55 to 13:00 ET.

Appendix C: Intraday Period Equalizing Factor

The q_{o-j+1} parameter for regular trading dates is determined according to the following table:

Observation Time	q_{o-j+1}
9:33	0.2
10:15	1.2
11:15	1.2
12:15	1.2
13:15	1.2
14:15	1.2
15:30	0.9

For any regular scheduled early market closure, the q_{o-j+1} parameter is determined according to the following table:

Observation Time	q_{o-j+1}
9:33	0.2
10:15	1.25
11:15	1.25
12:15	1.25

Appendix D: Conditional Variance

The conditional variance calculates as follows[11]:

$$h_{t+1} = \omega + \alpha \times RVar_t + \beta \times h_t$$

where:

$RVar$ = Daily Realized Volatility Calculation described in *Appendix A*

h_t = The Conditional Variance for Day *t*

The parameters $\omega, \alpha \ and \ \beta$ are estimated using Maximum Likelihood Estimation optimization with a Rolling Window consisting of 5,040 days of Realized Variance.

From the Index Initialization Date and the Parameter Estimation Start Date (excluded), the parameters ω, α, β are fixed to levels 0.033, 0.482, and 0.505 respectively[12].

From and including the Parameter Estimation Start Date, the parameters $\omega, \alpha, \beta \ and \ h_t$ calculate as follows:

$$\max_{\omega,\alpha,\beta} \text{LogL}_t$$
$$s.t.$$
$$\alpha + \beta \leq 1; \quad \omega > 0, \alpha > 0, \beta > 0$$

where:

$$\text{LogL}_t = -\frac{1}{2}\sum_{i=0}^{T}\left(\log(h_{t-i}) + \frac{RVar_{t-i}}{h_{t-i}}\right) \quad \begin{array}{l} h_{t-i} = \omega + \alpha \times RVar_{t-i-1} + \beta \times h_{t-i-1}; \ for \ i > 0 \\ h_t = \omega/(1-\alpha-\beta); \ for \ i = 0 \end{array}$$

$$T = 5040$$

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[11] For "Flash Crash" dates May 6, 2010, and August 24, 2015, the conditional forecasted variance is equal to the conditional variance on the corresponding previous Index Business Day.

[12] If the parameters (ω, α, β) cannot be estimated, the starting values of (ω, α, β) are set to $(0.01,0.2,0.7)$ and the optimization is re-run.

Disclaimer

Performance Disclosure/Back-Tested Data

Where applicable, S&P Dow Jones Indices and its index-related affiliates ("S&P DJI") defines various dates to assist our clients by providing transparency. The First Value Date is the first day for which there is a calculated value (either live or back-tested) for a given index. The Base Date is the date at which the index is set to a fixed value for calculation purposes. The Launch Date designates the date when the values of an index are first considered live: index values provided for any date or time period prior to the index's Launch Date are considered back-tested. S&P DJI defines the Launch Date as the date by which the values of an index are known to have been released to the public, for example via the company's public website or its data feed to external parties. For Dow Jones-branded indices introduced prior to May 31, 2013, the Launch Date (which prior to May 31, 2013, was termed "Date of introduction") is set at a date upon which no further changes were permitted to be made to the index methodology, but that may have been prior to the Index's public release date.

Please refer to the methodology for the Index for more details about the index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations.

Information presented prior to an index's launch date is hypothetical back-tested performance, not actual performance, and is based on the index methodology in effect on the launch date. However, when creating back-tested history for periods of market anomalies or other periods that do not reflect the general current market environment, index methodology rules may be relaxed to capture a large enough universe of securities to simulate the target market the index is designed to measure or strategy the index is designed to capture. For example, market capitalization and liquidity thresholds may be reduced. In addition, forks have not been factored into the back-test data with respect to the S&P Cryptocurrency Indices. For the S&P Cryptocurrency Top 5 & 10 Equal Weight Indices, the custody element of the methodology was not considered; the back-test history is based on the index constituents that meet the custody element as of the Launch Date. Also, the treatment of corporate actions in back-tested performance may differ from treatment for live indices due to limitations in replicating index management decisions. Back-tested performance reflects application of an index methodology and selection of index constituents with the benefit of hindsight and knowledge of factors that may have positively affected its performance, cannot account for all financial risk that may affect results and may be considered to reflect survivor/look ahead bias. Actual returns may differ significantly from, and be lower than, back-tested returns. Past performance is not an indication or guarantee of future results.

Typically, when S&P DJI creates back-tested index data, S&P DJI uses actual historical constituent-level data (e.g., historical price, market capitalization, and corporate action data) in its calculations. As ESG investing is still in early stages of development, certain datapoints used to calculate certain ESG indices may not be available for the entire desired period of back-tested history. The same data availability issue could be true for other indices as well. In cases when actual data is not available for all relevant historical periods, S&P DJI may employ a process of using "Backward Data Assumption" (or pulling back) of ESG data for the calculation of back-tested historical performance. "Backward Data Assumption" is a process that applies the earliest actual live data point available for an index constituent company to all prior historical instances in the index performance. For example, Backward Data Assumption inherently assumes that companies currently not involved in a specific business activity (also known as "product involvement") were never involved historically and similarly also assumes that companies currently involved in a specific business activity were involved historically too. The Backward Data Assumption allows the hypothetical back-test to be extended over more historical years than would be feasible using only actual data. For more information on "Backward Data Assumption" please refer to the FAQ. The methodology and factsheets of any index that employs backward assumption in the back-tested history

will explicitly state so. The methodology will include an Appendix with a table setting forth the specific data points and relevant time period for which backward projected data was used. Index returns shown do not represent the results of actual trading of investable assets/securities. S&P DJI maintains the index and calculates the index levels and performance shown or discussed but does not manage any assets.

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