S&P Dow Jones Indices
A Division of S&P Global

S&P Edge Volatility Indices
Methodology

October 2024

Table of Contents

Introduction

Index Objective and Highlights

The S&P Edge Volatility Indices measure the performance of leveraged strategies applied to an underlying index based on a forward-looking volatility estimate.

The indices comprise five subindices, with each subindex rebalancing respectively on one day of the week using PM-settled SPXW options. Each subindex floors at 25% of the prior week's rebalancing level and applies a leverage cap. The overall index level targets equal weight exposure by rebalancing each subindex on its corresponding rebalancing day.

For information on the historical data used for calculating the indices, please refer to Appendix B.

Index Family

The index family includes the following:

Index	Underlying Index	Target Volatility	Leverage Cap	Decrement Factor
S&P 500 Futures 35% Edge Volatility Index (USD) ER	S&P 500 Futures ER	35%	5	0%
S&P 500 Futures 35% Edge Volatility 6% Decrement Index (USD) ER	S&P 500 Futures ER	35%	5	6%
S&P 500 Futures 40% Edge Volatility Index (USD) ER	S&P 500 Futures ER	40%	5	0%
S&P 500 Futures 40% Edge Volatility 6% Decrement Index (USD) ER	S&P 500 Futures ER	40%	5	6%
S&P 500 35% Edge Volatility Index (USD) ER	S&P 500 TR	35%	5	0%
S&P 500 35% Edge Volatility 1% Decrement Index (USD) ER	S&P 500 TR	35%	5	1%

Note that the target volatilities used to determine index leverage are based on the one-week implied volatilities. The actual index realized volatility may deviate from the target volatilities.

For information on the underlying indices, please refer to their respective methodologies, available at www.spglobal.com/spdji.

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' Options Indices Policies and Practices Methodology	Options Indices Policies & Practices Methodology
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

S&P 500 Futures Edge Volatility Indices

Subindex Calculation

Unless otherwise specified, the time-weighted average prices (TWAPs) below calculate between 12:50 - 13:00 ET.

For more information on TWAPs, please refer to the Pricing Types section in S&P Dow Jones Indices' Options Indices Policies & Practices Methodology.

On each day *t*, the new TWAP level calculates based on the change from the prior rebalancing day's TWAP level.

$$SubIndex_t^{i,twap} = \max \begin{cases} 0.25 \times SubIndex_{rb-1}^{i,twap}, \\ SubIndex_{rb-1}^{i,twap} + n_{rb-1}^i \times \left[Underlying_t^{twap} - Underlying_{rb-1}^{i,twap} \right] - SubIndex_{rb-1}^{i,twap} \times DF \frac{Days_{rb-1,t}^i}{360} \end{cases}$$

If the day *t* is a subindex *i* rebalancing day, then the leverage level for the next week calculates and applies to the subindex as follows:

$$Leverage_t^i = \min \left(maxL, \frac{TV}{IV_t} \right)$$

$$n_t^i = Leverage_t^i \times \frac{SubIndex_t^{i,fixing}}{Underlying_t^{fixing}}$$

For more information on the implied volatility calculation, please refer to Appendix A.

The subindex level calculates as the change from the new TWAP level to the end of day level, utilizing the newly applied leverage.

$$SubIndex_t^i = \max \begin{cases} 0.25 \times SubIndex_t^{i,twap}, \\ SubIndex_t^{i,twap} + n_t^i \times \left[Underlying_t - Underlying_t^{twap} \right] \end{cases}$$

where:

$SubIndex_t^i$	= Closing level of the subindex *i* on day *t*
$SubIndex_t^{i,twap}$	= TWAP of subindex *i* on day *t*
$SubIndex_{rb-1}^{i,twap}$	= TWAP of subindex *i* on its prior rebalancing day
$Underlying_t$	= Closing level of the underlying index for day *t*
$Underlying_t^{twap}$	= TWAP of the underlying index for day *t*
$Underlying_{rb-1}^{i,twap}$	= TWAP of the underlying index on the prior subindex *i* rebalancing day

$Days^i_{rb-1,t}$ = Number of calendar days between the previous rebalancing day of subindex i and day t, including the previous rebalancing day of subindex i and excluding day t

DF = Decrement factor

TV = Target volatility

IV_t = Weekly implied volatility, as calculated on day t

$maxL$ = Leverage cap

If day t is not a subindex i rebalancing day, then the subindex level calculates as the leveraged change from the subindex's prior rebalancing day's TWAP level.

$$SubIndex^i_t = \max\left\{ \begin{array}{l} 0.25 \times SubIndex^{i,twap}_{rb-1}, \\ SubIndex^{i,twap}_{rb-1} + n^i_{rb-1} \times \left[Underlying_t - Underlying^{i,twap}_{rb-1}\right] - SubIndex^{i,twap}_{rb-1} \times DF \frac{Days^i_{rb-1,t}}{360} \end{array} \right\}$$

On the first rebalancing day for each subindex, the initial fixing and TWAP values are the underlying futures index's TWAP level on that day.

Index Calculation

The fixing level (intraday level) for each subindex calculates as follows:

$$SubIndex^{i,fixing}_t =$$
$$\max\left\{ \begin{array}{l} 0.25 \times SubIndex^{i,twap}_{rb-1}, \\ SubIndex^{i,twap}_{rb-1} + n^i_{rb-1} \times \left[Underlying^{fixing}_t - Underlying^{i,twap}_{rb-1}\right] - SubIndex^{i,twap}_{rb-1} \times DF \frac{Days^i_{rb-1,t}}{360} \end{array} \right\}$$

The overall index level targets equal weight exposure to each subindex i that corresponds to a day of the week (Mon, Tue, Wed, Thu, Fri).

$$Index^{fixing}_t = Index_{t-1} + \sum_{i=1}^{5} N^i_{t-1}\left(SubIndex^{i,fixing}_t - SubIndex^i_{t-1}\right)$$

The target quantity of each subindex calculates at the fixing time as follows:

If $SubIndex^i_t$ rebalances on day t:

$$N^i_t = \frac{0.2 \times Index^{fixing}_t}{SubIndex^{i,fixing}_t}$$

Otherwise:

$$N^i_t = N^i_{t-1}$$

Finally, the index level calculates as follows:

$$Index^{twap}_t = Index_{t-1} + \sum_{i=1}^{5} N^i_{t-1}\left(SubIndex^{i,twap}_t - SubIndex^i_{t-1}\right)$$

$$Index_t = Index^{twap}_t + \sum_{i=1}^{5} N^i_t\left(SubIndex^i_t - SubIndex^{i,twap}_t\right)$$

where:

$SubIndex^{i,fixing}_t$ = Fixing level of the subindex i on day t

$Underlying_t^{fixing}$ = Fixing of the underlying index for day t, taken as a snapshot at 11:35 ET

$Index_t^{fixing}$ = Fixing of the index on day t

$Index_t^{twap}$ = TWAP level of the index on day t

$Index_t$ = Closing level of the index on day t

On the base date of the index, the target quantity of each subindex is 20% of the base level divided by the closing level of the corresponding subindex.

S&P 500 Edge Volatility Indices

Underlying Calculation

On every business day t, the closing level and fixing of the underlying calculate as follows:

$$Underlying_t = Underlying_{t-1} \times \left(\frac{SPTR_t}{SPTR_{t-1}} - (r_{t-1} + Spread) \times \frac{Days_{t-1,t}}{360} \right)$$

$$Underlying_t^{fixing} = Underlying_{t-1} \times \left(\frac{SPTR_t^{fixing}}{SPTR_{t-1}} - (r_{t-1} + Spread) \times \frac{Days_{t-1,t}}{360} \right)$$

where:

$SPTR_t$ = Closing level of the S&P 500 TR on day t

$Underlying_t^{fixing}$ = Fixing of the underlying index for day t, taken as a snapshot at 14:35 ET (If the market closes early at 1:00 PM ET, the snapshot is at 11:35 ET)

$Days_{t-1,t}$ = Number of calendar days between the previous day t-1 and day t, including the previous day t-1 and excluding day t

$Spread$ = 0.5%

r_{t-1} = Fed Funds rate as of t-1

Subindex Calculation

If the day t is a subindex i rebalancing day, then the leverage level for the next week calculates and applies to the subindex as follows:

$$Leverage_t^i = \min \left(maxL, \frac{TV}{IV_t} \right)$$

$$n_t^i = Leverage_t^i \times \frac{SubIndex_t^{i,fixing}}{Underlying_t^{fixing}}$$

For more information on the implied volatility calculation, please refer to Appendix A.

The subindex calculates as the leveraged change from the prior rebalancing day as follows:

$$SubIndex_t^i = \max \left\{ \begin{array}{l} 0.25 \times SubIndex_{rb-1}^i, \\ SubIndex_{rb-1}^i + n_{rb-1}^i \times [Underlying_t - Underlying_{rb-1}^i] - SubIndex_{rb-1}^i \times DF \frac{Days_{rb-1,t}^i}{360} \end{array} \right\}$$

where:

$SubIndex_t^i$ = Closing level of the subindex i on day t

$SubIndex_{rb-1}^i$ = Closing level of subindex i on the prior rebalancing day

$Underlying_t$ = Closing level of the underlying index for day t

$Underlying_{rb-1}^{i}$ = Closing level of the underlying index on the prior subindex i rebalancing day

$Days_{rb-1,t}^{i}$ = Number of calendar days between the previous rebalancing day of subindex i and day t, including the previous rebalancing day of subindex i and excluding day t

DF = Decrement factor

TV = Target volatility

IV_t = Weekly implied volatility, as calculated on day t

$maxL$ = Leverage cap

Index Calculation

The fixing level (intraday level) for each subindex calculates as follows:

$$SubIndex_t^{i,fixing} =$$
$$\max \left\{ \begin{array}{l} 0.25 \times SubIndex_{rb-1}^{i}, \\ SubIndex_{rb-1}^{i} + n_{rb-1}^{i} \times \left[Underlying_t^{fixing} - Underlying_{rb-1}^{i} \right] - SubIndex_{rb-1}^{i} \times DF \frac{Days_{rb-1,t}^{i}}{360} \end{array} \right\}$$

The overall index level targets equal weight exposure to each subindex i that corresponds to a day of the week (Mon, Tue, Wed, Thu, Fri).

$$Index_t^{fixing} = Index_{t-1} + \sum_{i=1}^{5} N_{t-1}^{i} \left(SubIndex_t^{i,fixing} - SubIndex_{t-1}^{i} \right)$$

The target quantity of each subindex calculates at the fixing time as follows:

$$N_t^{i} = \begin{cases} \dfrac{0.2 \times Index_t^{fixing}}{SubIndex_t^{i,fixing}} & if\ SubIndex_t^{i}\ is\ rebalanced\ on\ date\ t \\ N_{t-1}^{i} & otherwise \end{cases}$$

Finally, the index level calculates as follows:

$$Index_t = Index_{t-1} + \sum_{i=1}^{5} N_{t-1}^{i} \left(SubIndex_t^{i} - SubIndex_{t-1}^{i} \right)$$

where:

$SubIndex_t^{i,fixing}$ = Fixing level of the subindex i on day t

$Index_t^{fixing}$ = Fixing of the index on day t

$Index_t$ = Closing level of the index on day t

On the base date of the index, the target quantity of each subindex is 20% of the base level divided by the closing level of the corresponding subindex.

Index Maintenance

Rebalancing

The five subindices that comprise the Edge Volatility Indices each rebalance respectively based on the weekday that the PM-settled SPXW options expire.

Rebalancing and Implied Volatility Calculation Time

The TWAP and Implied Volatility calculation windows are:

Index	Rebalancing Timing	Implied Volatility Calculation	Implied Volatility: Early Market Closure
S&P 500 Futures Edge Volatility Indices[1]	12:50 – 13:00 PM ET TWAP	11:30 - 11:35 ET	11:30 - 11:35 ET
S&P 500 Edge Volatility Indices[2]	End-of-Day	14:30 - 14:35 ET	11:30 - 11:35 ET

For scheduled or unscheduled full-day market closures or intraday closures, the corresponding subindex rebalances on the next business day when all necessary data is available. In such cases, the index level calculates using each subindex's target quantity from the previous rebalance date.

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 index calculation, 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 Date and History Availability

The 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 Futures 35% Edge Volatility Index (USD) ER	05/10/2024	01/04/2007	07/05/2013	100
S&P 500 Futures 35% Edge Volatility 6% Decrement Index (USD) ER	05/10/2024	01/04/2007	07/05/2013	100
S&P 500 Futures 40% Edge Volatility Index (USD) ER	05/10/2024	01/04/2007	07/05/2013	100
S&P 500 Futures 40% Edge Volatility 6% Decrement Index (USD) ER	05/10/2024	01/04/2007	07/05/2013	100
S&P 500 35% Edge Volatility Index (USD) ER	10/18/2024	07/05/2013	07/05/2013	100

---

[1] For more information on historical calculations for back-test extensions, please see *Appendix C*.
[2] On 09/30/2016, due to data availability, the 12:50-13:00 PM ET TWAP calculated using the EOD level of the S&P 500 Futures Index ER.

Index	Launch Date	First Value Date	Base Date	Base Value
S&P 500 35% Edge Volatility 1% Decrement Index (USD) ER	10/18/2024	07/05/2013	07/05/2013	100

Index Governance

Index Committee

An Index Committee maintains the index. All committee members are full-time professional members of S&P Dow Jones Indices' staff. The Index Committee meets regularly. At each meeting, the 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 the indices, 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

Announcements of the daily index values are made after the market close each day.

Holiday Schedule

The index calculates daily, throughout the calendar year, when the U.S. equity markets are open.

A complete holiday schedule for the year is available on 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' Commodities Indices Policies & Practices Methodology.

Recalculation Policy

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

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

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.spglobal.com/spdji,* 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	BBG	RIC
S&P 500 Futures 35% Edge Volatility Index (USD) ER	SPXF3EVE	.SPXF3EVE
S&P 500 Futures 35% Edge Volatility 6% Decrement Index (USD) ER	SPXF3EV6	.SPXF3EV6
S&P 500 Futures 40% Edge Volatility Index (USD) ER	SPXF4EVE	.SPXF4EVE
S&P 500 Futures 40% Edge Volatility 6% Decrement Index (USD) ER	SPXF4EV6	.SPXF4EV6
S&P 500 35% Edge Volatility Index (USD) ER	SPEV35DE	.SPEV35DE
S&P 500 35% Edge Volatility 1% Decrement Index (USD) ER	SPEV35D1	.SPEV35D1

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

Determination of Maturity Date

On each weekday, the index selects PM-settled SPXW options expiring in one week (seven calendar days). If the weekday is a holiday, the corresponding subindex rebalances on the next business day. At any calculation time t, the time to expiry calculates as the total time from t to the selected option expiry time (4:00 p.m. on the maturity date), expressed as a fraction of the number of annual calendar days (365).

Calculation of Forward Price and Delta

The risk-free interest rate R is based on U.S. Treasury yield curve rates[3], applying linear interpolation to derive the yield on maturity date T.

At each minute from Implied Volatility Calculation Window, the forward price calculates by applying put-call parity. The delta calculation uses the same forward price (ATM forward) for all strikes with the same expiration, using the same forward price for the calculation of implied volatility:

$$F = Ka + e^{rT}(Call_K - Put_K)$$

where:

Ka = Strike at which the difference between the call and the put mid-prices is the smallest, also referred to as the at-the-money (ATM) strike Ka. If there are multiple put-call pairs with the same minimum absolute difference, then select the lowest strike among them.

T = Time to expiry, defined in accordance with *Determination of Maturity Date* above

$r = \log\left(1 + \frac{R}{2}\right)^2$ = Continuously compounded interest rate

$Call_K$ = Mid price for call option, calculated as the average of its bid and ask prices

Put_K = Mid price for put option, calculated as the average of its bid and ask prices

Calculate implied volatility σ using F using the Black model with F as underlier.

Calculate Δ_{call} and Δ_{put} using the Black model (with F and σ):

$$\Delta_{call} = e^{-rT} N\left(\frac{\log\left(\frac{F}{K}\right) + \frac{\sigma^2 T}{2}}{\sigma\sqrt{T}}\right)$$

$$\Delta_{put} = e^{-rT}\left(N\left(\frac{\log\left(\frac{F}{K}\right) + \frac{\sigma^2 T}{2}}{\sigma\sqrt{T}}\right) - 1\right)$$

---

[3] Source: Government Treasury Website | US Department of the Treasury. The rates are captured around 18:00 New York time every day and used for the following business day.

Calculation of Implied Volatility

The implied volatility calculates every minute during the Implied Volatility Calculation Window, using the last snapshot of bid/ask prices for each option at the end of each minute, as follows:

1. Find the strike at which the difference between the call and the put mid-prices is the smallest, also referred to as the at-the-money (ATM) strike Ka. If there are multiple put-call pairs with the same minimum absolute difference, then select the lowest strike among them.

2. Calculate forward price using put-call parity:

$$F = Ka + e^{rT}(Call_{Ka} - Put_{Ka})$$

3. Select K_0 as the strike price equal to or immediately below *F*.

4. Select out-of-the-money call options with delta > 0.01. Start at the call with strike K immediately greater than K_0 and move to successively higher strike prices. After encountering two consecutive calls with a bid price of 0, no calls with higher strikes are considered.

5. Select out-of-the-money put options with delta < -0.01. Start at the put with strike K immediately less than K_0 and move to successively lower strike prices. After encountering two consecutive puts with a bid price of 0, no puts with lower strikes are considered.

6. At strike K_0, take the average of put and call prices.

7. Calculate implied volatility at the given minute:

$$\sqrt{\frac{2}{T}\sum_i \frac{\Delta K_i}{K_i^2} e^{rT} Q(K_i) - \frac{1}{T}\left(\frac{F}{K_0} - 1\right)^2}$$

Calculation of Average Implied Volatility

The average implied volatility over the specified window calculates on each business day and is used to rebalance that day's subindex.

As previously mentioned, the target expiration on each weekday *d* is seven calendar days away, i.e. *d* + 7. If a given weekday *d* is a holiday, then the subindex corresponding to it rebalances on the next business day. Therefore, effectively, on *d*+1, the index calculates two implied volatilities: one for day *d* (with target expiration *d*+7) and one for day *d*+1 (with target expiration *d*+8).

If the target expiration is a business day but not a valid expiry date, the implied volatility for the preceding and following expiration dates interpolate using the exact time to expiry for each, as follows:

$$IV = \sqrt{\frac{T_L IV_L^2(T_U - T) + T_U IV_U^2(T - T_L)}{T(T_U - T_L)}}$$

where:

IV_L = Implied volatility (IV) calculated for the preceding expiration date L

T_L = Time from the end of IV calculation to the expiry-time on day L

IV_U = Implied volatility (IV) calculated for the following expiration date U

T_U = Time from the end of IV calculation to the expiry-time on day U

T = Expiration time (4:00 pm ET) on the target expiration date

If the target expiration is a holiday, then the next day is the target if it is a valid expiry date. Otherwise, interpolation applies as shown above.

Appendix B

Historical Data Used for Calculating Index Levels

Prior to 05/06/2022, the indices only include SPXW options listed on some weekdays. Beginning on 05/06/2022, the indices include SPXW options listed to expire on each business weekday. For each weekday d, the index identifies the nearest day preceding its target expiration (< d+7) on which an SPXW option is listed to expire. The index also identifies the nearest day following its target expiration (> d+7) that corresponds to a listed SPXW option expiry.

Appendix C

Historical Calculations for Back-Test Extension

S&P 500 Futures Edge Volatility Indices

For history from 01/04/2007 to 07/05/2013, due to the lack of intraday option data prior to 2013, the indices used end-of-day values in lieu of intraday values for the Fixing and TWAP Values used in the Rebalancing and Implied Volatility Calculations. To account for different data availability timing, the indices used the below formulas for calculations.

Index Calculation. For history prior to 2013, the index level calculated as follows:

$$Index_t = Index_{t-1} + \sum_{i=1}^{5} N_{t-1}^i \left(SubIndex_t^i - SubIndex_{t-1}^i \right)$$

where:

$$SubIndex_t^i = \max \left\{ \begin{array}{c} 0.25 \times SubIndex_{rb-1}^i, \\ SubIndex_{rb-1}^i + n_{rb-1}^i \left[Underlying_t - Underlying_{rb-1}^i \right] - SubIndex_{rb-1}^i \times DF \dfrac{Days_{rb-1,t}^i}{360} \end{array} \right\}$$

$$n_t^i = Leverage_t^i \times \frac{SubIndex_t^i}{Underlying_t}$$

$$Leverage_t^i = \min \left(maxL, \frac{TV}{IV_t} \right)$$

If $SubIndex_t^i$ rebalanced on date t, then:

$$N_t^i = \frac{0.2 \times Index_t}{SubIndex_t^i}$$

otherwise:

$$N_t^i = N_{t-1}^i$$

Implied Volatility Calculation. For history prior to 2013, the indices calculated the implied volatility (*IV*) using end-of-day options data in lieu of intraday data on each business day to rebalance the subindex corresponding to that day. The indices calculated implied volatility using the same approach as described in *Index Construction*.

The target expiration on each weekday d is seven calendar days away, i.e., $d + 7$. If a given weekday d is a holiday, then the subindex corresponding to it rebalances on the next business day. Therefore, on $d + 1$, two implied volatilities calculate: one for day d (with target expiration $d + 7$) and one for day $d + 1$ (with target expiration $d + 8$).

If the target expiration was a business day but not a valid expiry date, the implied volatility for the preceding (*L*) and subsequent (*U*) expiration dates were interpolated using the exact time to expiry for each, as follows:

$$IV = \sqrt{\frac{T_L IV_L^2 (T_U - T) + T_U IV_U^2 (T - T_L)}{T(T_U - T_L)}}$$

If the target expiration was a holiday, then the next day was the target if it was a valid expiry date. Otherwise, interpolation applied as shown above.

In cases where both the nearest expiration dates were past the target expiration date, the indices applied linear interpolation to calculate the implied volatility. If only one value from (IV_L, IV_U) was not available, the indices used VIX as a 30-day measure of implied volatility and applied linear interpolation to estimate the one-week implied volatility. In rare cases where both IV_L and IV_U could not calculate, the indices directly used VIX as a substitute for the one-week implied volatility.

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.

Index returns do not reflect payment of any sales charges or fees an investor may pay to purchase the securities underlying the Index or investment funds that are intended to track the performance of the Index. The imposition of these fees and charges would cause actual and back-tested performance of the securities/fund to be lower than the Index performance shown. As a simple example, if an index returned 10% on a US $100,000 investment for a 12-month period (or US $10,000) and an actual asset-based fee of 1.5% was imposed at the end of the period on the investment plus accrued interest (or US $1,650), the net return would be 8.35% (or US $8,350) for the year. Over a three-year period, an annual 1.5% fee taken at year end with an assumed 10% return per year would result in a cumulative gross return of 33.10%, a total fee of US $5,375, and a cumulative net return of 27.2% (or US $27,200).

Intellectual Property Notices/Disclaimer

EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, FREEDOM FROM BUGS, SOFTWARE ERRORS OR DEFECTS, THAT THE CONTENT'S FUNCTIONING WILL BE UNINTERRUPTED OR THAT THE CONTENT WILL OPERATE WITH ANY SOFTWARE OR HARDWARE CONFIGURATION. In no event shall S&P Dow Jones Indices Parties be liable to any party for any direct, indirect, incidental, exemplary, compensatory, punitive, special, or consequential damages, costs, expenses, legal fees, or losses (including, without limitation, lost income or lost profits and opportunity costs) in connection with any use of the Content even if advised of the possibility of such damages.

Credit-related information and other analyses, including ratings, research and valuations are generally provided by licensors and/or affiliates of S&P Dow Jones Indices, including but not limited to S&P Global's other divisions such as S&P Global Market Intelligence. Any credit-related information and other related analyses and statements in the Content are statements of opinion as of the date they are expressed and not statements of fact. Any opinion, analyses and rating acknowledgement decisions are not recommendations to purchase, hold, or sell any securities or to make any investment decisions, and do not address the suitability of any security. S&P Dow Jones Indices does not assume any obligation to update the Content following publication in any form or format. The Content 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. S&P DJI does not act as a fiduciary or an investment advisor. While S&P DJI has obtained information from sources it believes to be reliable, S&P DJI does not perform an audit or undertake independent verification of any information it receives. S&P DJI reserves the right to vary or discontinue any index at any time for regulatory or other reasons. Various factors, including external factors beyond S&P DJI's control might necessitate material changes to indices.

To the extent that regulatory authorities allow a rating agency to acknowledge in one jurisdiction a rating issued in another jurisdiction for certain regulatory purposes, S&P Global Ratings reserves the right to assign, withdraw or suspend such acknowledgement at any time and in its sole discretion. S&P Dow Jones Indices, including S&P Global Ratings, disclaim any duty whatsoever arising out of the assignment, withdrawal, or suspension of an acknowledgement as well as any liability for any damage alleged to have been suffered on account thereof. Affiliates of S&P Dow Jones Indices LLC, including S&P Global Ratings, may receive compensation for its ratings and certain credit-related analyses, normally from issuers or underwriters of securities or from obligors. Such affiliates of S&P Dow Jones Indices LLC, including S&P Global Ratings, reserve the right to disseminate its opinions and analyses. Public ratings and analyses from S&P Global Ratings are made available on its Web sites, www.standardandpoors.com (free of charge), and www.ratingsdirect.com and www.globalcreditportal.com (subscription), and may be distributed through other means, including via S&P Global Ratings publications and third-party redistributors. Additional information about our ratings fees is available at www.standardandpoors.com/usratingsfees.

S&P Global keeps certain activities of its various divisions and business units separate from each other to preserve the independence and objectivity of their respective activities. As a result, certain divisions and business units of S&P Global may have information that is not available to other business units. S&P Global has established policies and procedures to maintain the confidentiality of certain nonpublic information received in connection with each analytical process.

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.

Some indices use the Global Industry Classification Standard (GICS®), which was developed by, and is the exclusive property and a trademark of, S&P Global and MSCI. Neither MSCI, S&P DJI nor any other party involved in making or compiling any GICS classifications makes any express or implied warranties or representations with respect to such standard or classification (or the results to be obtained by the use

thereof), and all such parties hereby expressly disclaim all warranties of originality, accuracy, completeness, merchantability, or fitness for a particular purpose with respect to any of such standard or classification. Without limiting any of the foregoing, in no event shall MSCI, S&P DJI, any of their affiliates or any third party involved in making or compiling any GICS classifications have any liability for any direct, indirect, special, punitive, consequential or any other damages (including lost profits) even if notified of the possibility of such damages.

S&P Dow Jones Indices products are governed by the terms and conditions of the agreements under which they may be provided. A license is required from S&P Dow Jones Indices to display, create derivative works of and/or distribute any product or service that uses, is based upon and/or refers to any S&P Dow Jones Indices and/or index data.

ESG Indices Disclaimer

S&P DJI provides indices that seek to select, exclude, and/or weight index constituents based on, but not limited to, certain environmental, social or governance (ESG) indicators, or a combination of those indicators, including the following: environmental indicators (including the efficient use of natural resources, the production of waste, greenhouse gas emissions, or impact on biodiversity); social indicators (such as, inequality and investment in human capital); governance indictors (such as sound management structures, employee relations, remuneration of staff, tax compliance, respect for human rights, anti-corruption and anti-bribery matters), specific sustainability or values-related company involvement indicators (for example, production/distribution of controversial weapons, tobacco products, or thermal coal), or controversies monitoring (including research of media outlets to identify companies involved in ESG-related incidents).

S&P DJI ESG indices use ESG metrics and scores in the selection and/or weighting of index constituents. ESG scores or ratings seek to measure or evaluate a company's, or an asset's, performance with respect to environmental, social and corporate governance issues.

The ESG scores, ratings, and other data used in S&P DJI ESG indices is supplied directly or indirectly by third parties (note these parties can be independent affiliates of S&P Global or unaffiliated entities) so an S&P DJI ESG index's ability to reflect ESG factors depends on these third parties' data accuracy and availability.

ESG scores, ratings, and other data may be reported (meaning that the data is provided as disclosed by companies, or an asset, or as made publicly available), modelled (meaning that the data is derived using a proprietary modelling process with only proxies used in the creation of the data), or reported and modelled (meaning that the data is either a mix of reported and modelled data or is derived from the vendor using reported data /information in a proprietary scoring or determination process).

ESG scores, ratings, and other data, whether from an external and/or internal source, is based on a qualitative and judgmental assessment, especially in the absence of well-defined market standards, and due to the existence of multiple approaches and methodologies to assess ESG factors and considerations. An element of subjectivity and discretion is therefore inherent in any ESG score, rating, or other data and different ESG scoring, rating, and/or data sources may use different ESG assessment or estimation methodologies. Different persons (including ESG data ratings, or scoring providers, index administrators or users) may arrive at different conclusions regarding the sustainability or impact of a particular company, asset, or index.

Where an index uses ESG scores, ratings or other data supplied directly or indirectly by third parties, S&P DJI does not accept responsibility for the accuracy of completeness of such ESG scores, ratings, or data. No single clear, definitive test or framework (legal, regulatory, or otherwise) exists to determine 'ESG', 'sustainable', 'good governance', 'no adverse environmental, social and/or other impacts', or other equivalently labelled objectives. In the absence of well-defined market standards and due to the existence of multitude approaches, the exercise of judgment is necessary. Accordingly, different persons may classify the same investment, product and/or strategy differently regarding 'ESG', 'sustainable', 'good governance', 'no adverse environmental, social and/or other impacts', or other equivalently labelled

objectives. Furthermore, the legal and/or market position on what constitutes an 'ESG', 'sustainable', 'good governance', 'no adverse environmental, social and/or other impacts', or other equivalently labelled objectives may change over time, especially as further regulatory or industry rules and guidance are issued and the ESG sustainable finance framework becomes more sophisticated.

Prospective users of an S&P DJI ESG Index are encouraged to read the relevant index methodology and related disclosures carefully to determine whether the index is suitable for their potential use case or investment objective.