S&P Dow Jones Indices

Indices

A Division of S&P Global

S&P Dow Jones Indices' Options Indices Policies & Practices
Methodology

November 2024

Table of Contents

Introduction

Overview

This document covers constituent and index actions, used in the management of S&P Dow Jones options indices. To understand and successfully use indices for investment analysis, it is important to know how adjustments are made, when different kinds of index actions occur, and S&P Dow Jones Indices' treatment of these events. The goal is to provide consistent and transparent global treatment of index actions, to the greatest extent possible. However, please note that local market and sector practices may dominate major decisions. Thus, S&P Dow Jones Indices (S&P DJI) has general approaches applicable to most options indices, but it is imperative to review each specific index methodology, as certain indices may differ from the general approaches.

This document does not aim to be a substitute for the various policies and procedures outlined in each respective index's methodology.

Please refer to each index's methodology for further policies and procedures applicable to each particular index.

Index Policy

Announcements

S&P DJI notifies clients either via email or, in certain instances, via Index Announcements posted at *www.spglobal.com/spdji*.

Announcement Type	Notification	Frequency
Policy or methodology change	At least two weeks' notice	As needed
Product Enhancements	Five-to-seven business days	As needed
Rebalancing and Index Holiday Calendars	December for the following year	Annual

Calculations and Pricing Disruptions

Depending on the index methodology, S&P DJI utilizes prices provided by external providers for end-of-day index calculations. In situations where this data, based on expert judgement, is incomplete or incorrect, S&P DJI will correct or amend this data.

Please refer to the Error Correction Policy section of this document.

For information on indices that include commodities or futures contracts, or for the treatment of commodity pricing disruptions, please refer to S&P Dow Jones Indices' Commodities Indices Policies & Practices Methodology available at *www.spglobal.com/spdji.*

In extreme circumstances, S&P DJI may decide to delay index adjustments or not publish an index.

Real-time Pricing Disruptions

For certain indices, S&P Dow Jones Indices calculates intraday index calculations using real-time exchange traded prices. S&P Dow Jones Indices does not calculate with each traded price, but rather, calculates on a pre-determined fixed interval (e.g., every five seconds). At each fixed interval, the index calculates with the latest real-time pricing for each underlying security included in the index. If a new price is not available since the last real-time calculation, the calculation will leverage the last available traded price provided by the exchange. In the absence of a real-time traded price for a given security, the calculation will leverage the prior days' closing price adjusted for corporate actions.

S&P DJI also maintains price thresholds for real-time securities and indices to prevent unusually large price movements or incorrect price adjustments to adversely impact index calculations.

- **Security Level:** If a security price breaches a threshold, the system generates an internal alert and temporarily holds the last price prior to the breach. For index calculations, a held security is included in the calculation, but the calculation uses the security's last accepted price prior to the breach. Once the held price is confirmed or falls back within the acceptable tolerance, the latest real-time price for the security is used for index calculations.

- **Index Level:** If an index calculation breaches a threshold the system generates an internal alert but continues calculating and disseminating the index level as an S&P analyst investigates and responds to the alert accordingly.

S&P Dow Jones Indices seeks to minimize any disruptions to its index calculations, so if there is a disruption in intraday calculations S&P Dow Jones Indices does not recalculate the impacted period.

Negative Index Levels

Zero and Negative Index Levels

A negative index level is possible for certain types of indices including hedged, long/short, inverse and leveraged indices, particularly for inverse indices that apply leverage.

- In the event an intraday index calculation results in a zero or negative value, S&P DJI will publish the zero or negative value as calculated.

- In the event an end-of-day index calculation results in a zero value or negative value, S&P DJI will publish an official closing index value of zero on that day. Index levels will only be assessed after the close of trading for purposes of this determination and will not take into consideration intraday levels for those indices calculated in real-time.

Any index assigned an official closing level of zero will be reviewed by the Index Committee to determine if the index will be discontinued or if the index will be restarted with a new base value. In the event the index is restarted, S&P DJI will announce such action and will treat these indices as two separate time series. Until the Index Committee has made this determination, the intraday and end-of-day index level will continue to be published with a value of zero.

Data Discrepancy Validations

In some indices, depending on the index methodology, third party data will be used to price and publish index values. This includes options data, as well as other index components such as other indices, futures contracts, currencies, or stock data.

S&P DJI has a robust data validation process to ensure the quality of underlying data, as well as the precision of index values.

Time Value Price Adjustments

Due to differences in the time of the closing prices of underlying securities and contracts, across different asset classes, as compared to vendor data capture times, occasional mismatches can occur in options data. These are observable most easily in options when recorded options prices are lower than their intrinsic value. An option's intrinsic value is determined as follows:

For Index or Single Stock Options:

    For Calls:

        Intrinsic Value = (Underlying closing level or price * $e^{(r-q)*t}$ - Strike Price)

    For Puts:

        Intrinsic Value = Strike Price - (Underlying closing level or price * $e^{(r-q)*t}$)

For Options on Futures:

    For Calls:

        Intrinsic Value = Maturity matched futures price – Strike Price

    For Puts:

        Intrinsic Value = Strike Price – Maturity matched futures price

where:

    q = Annual dividend yield of underlying

    r = annual interest rate, continuously compounded

    t = days to expiry/365

    e = the base of the natural log

For any option with a negative time value, S&P DJI makes the following adjustment:

The option's price is adjusted to its intrinsic value, with an additional $.05 added to the price to account for time value. In the case of options expiring on that day, the price will be equal to intrinsic value.

Index Recalculation Policy

S&P DJI reserves the right to recalculate an index at its discretion in the event one of the following occurs:

1. Closing input prices are amended

2. Missed or misapplied index methodology event (deviation from what is stated in the methodology document)

3. Incorrect calculation or data entry error

The decision to recalculate an index is made at the discretion of the applicable Index Manager and/or Index Committee, as set forth herein. The potential market impact or disruption resulting from a recalculation is considered when making any such decision.

In the event one of the following recalculation events is discovered within two trading days of its occurrence, generally the index is recalculated. If any such recalculation event is discovered beyond the two-trading-day period, the applicable Index Committee shall decide whether the index should be recalculated.

Type of Error	Treatment in S&P Dow Jones Indices' Option Indices
Amended Input Price	If amended input prices due to vendor errors or exchange updates are discovered within two trading days of its occurrence, the Index Manager may, at their discretion, recalculate the index without involving the Index Committee. In the event any such recalculation event is discovered beyond such two-trading day period, the applicable Index Committee shall decide whether the index should be recalculated.
Deviation from Treatment Stated in the Index Methodology	Errors identified prior to the next day open are corrected and the indices are reposted. Other errors are reviewed by the Index Committee, which is responsible for determining what actions should be taken.
Implementation Errors	In that case that differences occur between announced rebalances and implemented rebalances are discovered, the index committee will meet to determine whether these are corrected.
Errors due to S&P DJI data entry errors, methodology misapplication, etc.	These errors are reviewed by the Index Committee. The Index Committee then determines whether an index or indices impacted by such an error/s should be recalculated and reposted.

Clients are notified of index recalculations and files being reposted.

Unexpected Exchange Closures

Full Day Exchange Closure

If an exchange fails to open due to unforeseen circumstances, such as natural disasters, inclement weather, outages, or other events, the index uses the prior day's closing prices for calculation purposes.

Partial Day or Early Exchange Closure

In situations where an exchange is forced to close early due to unforeseen events, such as computer or electric power failures, weather conditions, or other events, S&P DJI calculates the closing price of the indices based on (1) the end of day prices provided, or (2) if no end of day prices are available, the Index Committee determines the course of action and notifies clients accordingly.

Rebalancing

If the rebalancing of an index takes place over a period of time, and during this period an exchange is fully or partially closed on one or more days, and S&P DJI cannot obtain official end of day prices, the Index Committee will review the situation on a case-by-case basis with the appropriate treatment announced to clients.

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.

Pricing Types

S&P Dow Jones options indices will make use of different pricing types based on index methodology. Some of these pricing types include, but are not limited to:

1. End of day (EOD) prices from vendors
2. EOD prices collected at a predetermined time by S&P Dow Jones Indices from vendors (Snap Price)
3. Volume Weighted Average Price (VWAP) calculated from vendors
4. Time Weighted Average Price (TWAP), calculated from vendors
5. Theoretical Pricing

For more information on VWAP and TWAP pricing, see refer to S&P Dow Jones Indices' Index Mathematics Methodology available on our Web site, *www.spglobal.com/spdji*.

S&P DJI is unable to guarantee exact pricing due to the nature of intraday price captures from vendor-derived data. S&P DJI makes best efforts to fulfill pricing according to a respective methodology, but it is S&P DJI policy to use these best efforts, and not restate indices due to intraday pricing discrepancies that are not related to misapplication of index methodology.

Unavailable Pricing

In the case that an index uses VWAP or TWAP pricing—and the particular price was unable to be captured during that index day (e.g., VWAP pricing with no recorded trades)—the EOD price, depending on index strategy, may be used for index calculation.

Theoretical Options Calculation

Some S&P DJI indices involve the use of theoretical options. Such options are calculated using a formulaic approach rather than an observable, market-based price. Any index utilizing theoretical options will detail the use of such options, and the approach for calculating such theoretical values in the relevant index methodology.

S&P DJI maintains a quality control process to ensure that the procedure for calculating a theoretical option's value remains accurate and in accordance with the index methodology.

Index Cessations

For information on index cessations, please refer to the *S&P Dow Jones Indices Cessations Policy*.

Index Governance

For more information on Index Governance, please refer to the [S&P Dow Jones Indices' Index Governance Policies Methodology](#).

Appendix I: The Black-Scholes Formula

The choice of which model to be used will be specified in the index methodology.

Black Scholes Formula:

For Calls:

$$C = S * N(D_1)e^{-qt} - K\,e^{-rt}N(D_2)$$

For Puts:

$$P = K\,e^{-rt}N(-D_2) - (S * N(-D_1)e^{-qt})$$

where:

    C = Price of Call Option

    P = Price of Put option

    S = Spot price of underlying asset

    K = Option Strike Price

    q = Continuously Compounded Annual Dividend Yield of underlying asset

    r = continuously compounded annual interest rate

    t = calendar days to expiry/365

    σ = Annual volatility in percent

    e = Base of the natural log

    ln = Natural Log

    N = Cumulative Normal Distribution Function

    N' = Normal Density Function:

$$\frac{1}{\sqrt{2\pi}} * e^{\frac{-d1^2}{2}}$$

$$D1 = \frac{\ln\left(\frac{S}{X}\right) + t\left(r - q + \frac{\sigma^2}{2}\right)}{\sigma\sqrt{t}}$$

$$D2 = d1 - \sigma\sqrt{t}$$

Delta: Measuring the sensitivity of the option to movements in the price of the underlying asset:

$$\Delta_{call(t)} = e^{-qT} * N(D_1)$$

$$\Delta_{put(t)} = e^{-qT} * (N(D_1) - 1)$$

Vega: Measuring the sensitivity of the options to changes in volatility:

$$\nu_{(t)} = \frac{1}{100} \, Se^{-qt} * N'(D_1) * \sqrt{t}$$

Gamma: Measuring how Delta changes as price changes:

$$\Upsilon_{(t)} = \frac{e^{-qt} N'(D_1)}{S * \sigma * \sqrt{t}}$$

Theta: Measuring how price changes as time changes:

For Calls:

$$\theta = \frac{1}{365} \left(-\frac{S\sigma e^{-qt}}{2\sqrt{t}} * N'(D_1) \right) - rXe^{-rt} N(d2) + qSe^{-qt} N(D_1)$$

For Puts:

$$\theta = \frac{1}{365} \left(-\frac{S\sigma e^{-qt}}{2\sqrt{t}} * N'(D_1) \right) + rXe^{-rt} N(-d2) - qSe^{-qt} N(-D_1)$$

Rho: Measuring how price changes as interest rates change:

For Calls:

$$\rho = Xte^{-rt} * N(D_2)$$

For Puts:

$$\rho = -Xte^{-rt} * N(-D_2)$$

Implied Volatility: Implied volatility is the volatility input that when provided, will produce the current market value of the option using the Black-Scholes formula. This value, when needed for S&P DJI's indices, is found by using a mathematical process to test a range of volatility inputs, until the value that yields the option price closest to market value is found.

Appendix II: The Black Model

The choice of which model to be used will be specified in index methodology.

Black Formula:

For Calls:

$$C = e^{-rt}(FN(D_1) - XN(D_2))$$

For Puts:

$$P = e^{-rt}(XN(-D_2) - FN(-D_1))$$

Where:

    F = Current Forward Price

    X = Strike Price of the options

    r = Continuously Compounded Interest Rate

    t = Time in years until the expiry of the options

    σ = Implied Volatility of the underlying forward price

    e = Base of the natural log

    ln = Natural Log

    N = Cumulative Normal Distribution Function

    N' = Normal Density Function:

$$\frac{1}{\sqrt{2\pi}} * e^{\frac{-d1^2}{2}}$$

$$D1 = \frac{\ln\left(\frac{F}{X}\right) + \left(\frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$$

$$D2 = d1 - \sigma\sqrt{t}$$

Delta: Measuring the sensitivity of the option to movements in the price of the underlying asset:

$$\Delta_{call(t)} = e^{-rT} * N(d_1)$$

$$\Delta_{put(t)} = e^{-rT} * (N(d_1) - 1)$$

Vega: Measuring the sensitivity of the option to changes in volatility:

$$V_{(t)} = \frac{1}{100} Fe^{-rt} N'(D_1)\sqrt{t}$$

Gamma: Measuring how Delta changes as price changes:

$$\gamma_{(t)} = e^{-rt} \frac{N'(D_1)}{F\sigma\sqrt{t}}$$

Theta: Measuring how price changes as time changes:

$$\theta call_{(t)} = \frac{1}{365} \left(-\frac{Fe^{-rt}N'(D_1)\sigma}{2\sqrt{t}} + rFe^{-rt}N(D_1) - rXe^{-rt}N(D_2) \right)$$

$$\theta Put_{(t)} = \frac{1}{365} \left(-\frac{Fe^{-rt}N'(D_1)\sigma}{2\sqrt{t}} - rFe^{-rt}N(-D_1) + rXe^{-rt}N(-D_2) \right)$$

Rho: Measuring how price changes as interest rates changes:

$$\rho_{call(t)} = -tc$$

$$\rho_{put(t)} = -tp$$

Implied Volatility: Implied volatility is the volatility input that when provided, will produce the current market value of the option using the Black formula. This value, when needed for S&P DJI's indices, is found by using a mathematical process to test a range of volatility inputs, until the value that yields the option price closest to market value is found.

Appendix III – Methodology Changes

Methodology changes are as follows:

Change	Effective Date (After Close)	Methodology Previous	Updated
Real-Time Index Calculations: Index Level Auto-Hold	11/17/2023	Index Level: In the event an index calculation breaches a threshold, the system will generate alerts and temporarily hold the last index value prior to the breach. While the index is held, the last held index value will be distributed as defined by the set dissemination frequency. Once the held index value is confirmed or falls back within the acceptable tolerance, index calculations will resume with the latest market data.	**Index Level:** If an index calculation breaches a threshold the system generates an internal alert but continues calculating and disseminating the index level as an S&P analyst investigates and responds to the alert accordingly.

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).

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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).

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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.