Cboe S&P 500 Dispersion Basket Index Methodology

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Introduction

Index Objective and Highlights

The Cboe S&P 500 Dispersion Basket Index, also called the Dispersion Basket Index or DSPBX, measures the performance of a subset of S&P 500 (the Underlying Index) constituents that have a wide range of quoted call and put options with expiry dates between 10 and 120 calendar days. The index provides a representative universe of large-cap U.S. equities conducive to the calculation of the 30-day implied dispersion of the S&P 500.


Data Source

Options Price Reporting Authority (OPRA) is the source for options data.

Collaboration

The Cboe S&P 500 Dispersion Basket Index is generated and published under agreements between Cboe and S&P Dow Jones Indices. Eligible constituents are selected with the assistance of Cboe, based on the rules defined in this documentation. S&P Dow Jones Indices (DJ) thanks Cboe for its contributions to the development and the calculation of the index.

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:

<table>
<thead>
<tr>
<th>Supporting Document</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;P Dow Jones Indices' Index Mathematics Methodology</td>
<td>Index Mathematics Methodology</td>
</tr>
<tr>
<td>S&amp;P Dow Jones Indices' Float Adjustment Methodology</td>
<td>Float Adjustment Methodology</td>
</tr>
</tbody>
</table>

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.

Cboe and VIX are registered trademarks of Cboe Exchange, Inc. and have been licensed for use by S&P Dow Jones Indices.
Eligibility Criteria

Index Universe

At each rebalancing, the index universe is all constituents of the underlying index, adjusted for any composition changes due to the current rebalancing.

Eligibility Factors

At each rebalancing, to be eligible for index inclusion an index universe constituent must satisfy the following:

- **Listed Options:** have listed options.
- **Multiple Share Classes and Dual Listed Companies:** All publicly listed multiple share class lines are eligible for index inclusion, subject to meeting the eligibility criteria. For more information regarding the treatment of multiple share classes, please refer to Approach A within the Multiple Share Classes section of the S&P Dow Jones Indices’ Equity Indices Policies & Practices Methodology.
Index Construction

Terms & Definitions

Valid Option Quotes. A valid option quote is a two-sided quote in which the ask price is non-zero and is greater than or equal to the bid price.

Daily Quote Measurement Point. Option quotes for the equity securities eligible for inclusion in the index are measured on each trading day at or around 2:58pm Chicago time – i.e. approximately two minutes prior to the equity market close at 3pm Chicago / 4pm New York.

Options, Classes, and Strips. Only standard monthly and weekly call and put options linked to members of the index universe that are listed on U.S. exchanges are eligible for consideration. For any member of the index universe on any trading day, the “option class” associated to that constituent is the set of all options sharing that underlying. Within a specific option class, an “option strip” refers to all the options in that class sharing a particular expiry date.

Valid Option Strips. For any options strip associated with a particular stock and expiry date on a particular trading day, that option strip is considered a “valid strip” if, at the daily quote measurement point of trading on that day, there is at least one strike in the strip for which there is a valid option quote for both the put and call.

Implied Forward. For each valid option strip, calculate an implied forward using put-call parity on the strike where the absolute difference between the call and put mid-price is minimized. If there are multiple strikes with the same difference between the call and put mid-price, select the lowest strike. The implied forward for an option strip \( j \) is equal to:

\[
F_j = K_j + e^{rT} \times (C_j - P_j)
\]

where:

- \( F_j \) = The implied forward
- \( K_j \) = The strike price at which the absolute difference between the call and put option mid-price is minimized
- \( C_j \) = The call midprice at strike \( K_j \)
- \( P_j \) = The put midprice at strike \( K_j \)
- \( r \) = The same interest rate used in the VIX calculation\(^1\)
- \( T \) = The annualized time to expiry given by:

\[
T = \frac{\text{Minutes in Current Day} + \text{Minutes in Settlement Day} + \text{Minutes in Other Days}}{\text{Minutes in a Year}}
\]

ATM Options and OTM Options. For each valid option strip, identify the ATM (at-the-money) option and associated strike \( K_{\text{zero}} \) by taking the strike at or directly below the implied forward.

Identify OTM (out-of-the-money) options for that strip by selecting all calls with strikes greater than \( K_{\text{zero}} \) and put strikes less than \( K_{\text{zero}} \).

\(^1\) For more information on VIX calculations, please refer to the Cboe Volatility Index Mathematics Methodology, available [here](https://www.cboe.com/micro/vixmath).
Valid Options for the Filter Condition Rules. For each valid option strip on any given trading day, filter the options in sequence by the following rules:

- Filter out any OTM call options with strikes higher than two consecutive OTM call options with zero bids, even if they have non-zero bids.
- Filter out any OTM put options with strikes lower than two consecutive OTM put options with zero bids, even if they have non-zero bids.
- Filter out any remaining options without valid quotes.
- Filter out any remaining options with zero bids.

The remaining OTM call and put options are “valid options” for the purposes of calculating the Filter Condition on that trading day.

Possible Near Term and Next Term Strips for the Filter Condition Rules. For each constituent on any given trading day, possible “near term” and “next term” options strips are defined by the timing of the expiration date.

- **Near Term:** options strips with an expiration date between or equal to 10 to 30 calendar days
- **Next Term:** options strips with an expiration date between or equal to 31 to 120 calendar days

Lookback Period. At each quarterly rebalancing, the lookback period is from the monthly VIX futures expiration date three months prior to the reference date to the day before the reference date. For example, if the reference date was 11/16/2022, the look-back period was from 08/17/2022 to 11/15/2022.

Constituent Filter Condition Rules. For a given constituent in the index universe on a particular trading day \( t \), for each valid option strip on that constituent with expiration date \( e \), define \( y_{e,t} \) as the minimum:

\[
y_{e,t} = \min(O^C_{e,t}, O^P_{e,t})
\]

where:

- \( O^C_{e,t} \) = the number of valid OTM call options on that trading day
- \( O^P_{e,t} \) = the number of valid OTM put options on that trading day

A stock meets the filter condition \( N \) over the lookback period \( R \) if, at the daily quote measurement on every trading day \( t \) during the lookback period, there are at least three expiration dates \( e \), with at least one possible near term strip and at least two possible next term strips, such that:

\[
y_{e,t} \geq N
\]

In this case, the stock meets the filter condition \( J_{t,R}^N \) over lookback period \( R \).

Constituent Selection

At each rebalancing, the index selects constituents according to the following process:

1. Sort each eligible stock into one of the following categories and apply the respective filter rule over the quarterly lookback period \( R \):

   **Category 1: Top 50 Stocks by Market Capitalization or Option Volume:** Rank all eligible stocks, in descending order, by the mean of FMC and the mean of option contract volume over the entire lookback period. Select the top 50 stocks from each ranking that satisfy the filter condition \( J_{t,R}^N \).
Category 2: Stocks Included in the Prior Eligible Basket: If there is a prior basket, select all stocks from the prior basket not sorted into Category 1 that satisfy the filter condition \( J_R^{6,2} \).

Category 3: Remaining Stocks: Select all stocks from the underlying index not already sorted included in the other categories and which satisfy the filter condition \( J_R^{10} \).

2. Combine the selected stocks from each category to form the index.

Constituent Weighting

At each rebalancing, constituents are FMC weighted.

Index Calculations

The index calculates by means of the divisor methodology used in most S&P Dow Jones Indices equity indices.

\footnote{If no prior basket exists, Category 2 remains empty.}
Index Maintenance

Rebalancing

The index rebalances quarterly, effective after the close of VIX expiration dates (generally, the Wednesday 30 days prior to the third Friday of the subsequent calendar month) in March, June, September, and December, with a reference date of the VIX expiration date in February, May, August, and November, respectively.

Additions and Deletions

Additions. Except for spin-offs, there are no intra-rebalancing additions.

Spin-offs. A spin-off company is added to the index at a zero price on the ex-date. Eligible spin-offs remain in the index, while ineligible spin-offs are removed after at least one day of trading.

Deletions. Constituents removed from the underlying index are removed from the index simultaneously.

Corporate Actions

The equity option classes used to determine eligible constituents for DSPBX may be changed to reflect corporate actions, including stock splits, special dividends, merger & acquisition, spin-offs, and delisting. Adjusted options series are used to determine eligible constituents for DSPBX until unadjusted series with the same expiration dates are available for trading.

Mergers & Acquisitions (M&A). An M&A target company is dropped from the index on the target company’s expected delisting date.

For more information on Corporate Actions, please refer to the Market Capitalization Indices section of S&P Dow Jones Indices’ Equity Indices Policies & Practices Methodology.

Currency of Calculation and Additional Index Return Series

The index calculates in U.S. dollars.

WM/Refinitiv foreign exchange rates are taken daily at 4:00 PM London time and used in the calculation of the indices. These mid-market fixings are calculated by the WM Company based on Refinitiv data and appear on Refinitiv pages WMRA.

In addition to the indices detailed in this methodology, additional return series versions of the indices may be available, including, but not limited to: currency, currency hedged, decrement, fair value, inverse, leveraged, and risk control versions. For a list of available indices, please refer to 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.spqglobal.com/spdji.
Base Date and History Availability

The index history availability, base date, and base value are shown in the table below.

<table>
<thead>
<tr>
<th>Index</th>
<th>Launch Date</th>
<th>First Value Date</th>
<th>Base Date</th>
<th>Base Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cboe S&amp;P 500 Dispersion Basket Index</td>
<td>07/28/2023</td>
<td>06/18/2014</td>
<td>06/18/2014</td>
<td>1000</td>
</tr>
</tbody>
</table>
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 S&P Dow Jones Indices’ Index Committee maintains the index. All committee members are full-time professional members of S&P Dow Jones Indices’ staff or full-time professional members of Cboe’s 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

All index constituents are evaluated daily for data needed to calculate index levels and returns. All events affecting the daily index calculation are typically announced in advance via the Index Corporate Events report (.SDE), delivered daily to all clients. Any unusual treatment of a corporate action or short notice of an event may be communicated via email to clients.

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

Pro-forma Files

In addition to the corporate events file (.SDE), S&P Dow Jones Indices provides constituent pro-forma files each time the index rebalances. The pro-forma file is typically provided daily in advance of the rebalancing date and contains all constituents and their corresponding weights and index shares effective for the upcoming rebalancing. Since index shares are assigned based on prices prior to the rebalancing, the actual weight of each stock at the rebalancing differs from these weights due to market movements.

Please visit www.spglobal.com/spdji for a complete schedule of rebalancing timelines and pro-forma delivery times.

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’ 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, intra-day, index calculations are executed for some versions of the index, whenever the index’s primary exchanges are open. 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 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.

<table>
<thead>
<tr>
<th>Index</th>
<th>Return Type</th>
<th>Bloomberg</th>
<th>RIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cboe S&amp;P 500 Dispersion Basket Index (USD)</td>
<td>Price Return</td>
<td>DSPBX</td>
<td>.DSPBX</td>
</tr>
<tr>
<td></td>
<td>Total Return</td>
<td>SPDSPBUT</td>
<td>.SPDSPBUT</td>
</tr>
<tr>
<td></td>
<td>Net Total Return</td>
<td>SPDSPBUN</td>
<td>.SPDSPBUN</td>
</tr>
</tbody>
</table>

Index Data

Daily constituent and index level data are available via subscription.


Web Site

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

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