S&P Dow Jones Indices

A Division of S&P Global

S&P 500 Duo Swift Indices
Methodology

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Introduction

Index Objective and Highlights

The S&P 500 Duo Swift Indices aim to measure exposure to the S&P 500 with controlled volatility and reduced path dependency. The indices feature a risk control mechanism on S&P 500 E-mini futures with a 10-year U.S. Treasury futures overlay that uses an intraday volatility rebalancing methodology based on time-weighted average prices (TWAPs) computed during different time windows in the day.

For information on the underlying indices and the S&P 500, please refer to the S&P Futures Indices Methodology, S&P Global Bond Futures Index Series Methodology and S&P U.S. Indices Methodology, available at www.spglobal.com/spdji.

Index Family

The index family includes the following:

Index	Volatility Target (VolTarget)	Max Allocation to the Basket (MaxBasketAlloc)[1]	Monthly Performance Cap (cap)	Decrement Factor (DF)
S&P 500 Duo Swift Index (USD) ER	12.5%	175%	N/A	0%
S&P 500 Duo Swift Capped Index (USD) ER	12.5%	175%	4%	0%
S&P 500 Duo Swift Capped 0.5% Decrement Index (USD) ER	12.5%	175%	4%	0.5%

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' 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.

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[1] *MaxBasketAlloc* is the maximum allocation to the equity/bond basket. Since the index can take short positions in the bond, the actual equity allocation can be higher than this value.

Index Construction

For each index calculation day, the index level is the average of 22 staggered and capped sub-indices' levels available on that day:

$$Index_t = \frac{\sum_{n=1}^{22}(\delta_{n,t} \times CappedIndex_{n,t})}{\sum_{n=1}^{22}\delta_{n,t}} \qquad (1)$$

$$\delta_{n,t} = \begin{cases} 1 & \text{if } CappedIndex_{n,t} \text{ exists} \\ 0 & \text{otherwise} \end{cases}$$

where:

$Index_t$ = The closing level of the index for day t

n = Identifier for series of capped indices going from 1 to 22

$CappedIndex_{n,t}$ = The level of the Capped Index for identifier n on day t

Each capped index, $n = 1, \cdots, 22$, is initialized as follows:

$$CappedIndex_{n,t} = \begin{cases} \text{N/A} & \text{if } t < n \\ BaseIndex_t & \text{if } t = n \end{cases} \qquad (2)$$

For every subsequent index calculation day, the capped index returns are capped from the reference value computation day, and the levels are calculated as follows:

$$CappedIndex_{n,t} = CappedRefVal_{n,t-1} \times \left(1 + \min\left(cap, \left(\frac{BaseIndex_t}{BaseRefVal_{n,t-1}} - 1\right)\right)\right) \qquad (3)$$

where:

$CappedRefVal_{n,t-1}$ = Capped Index Reference value for identifier n on day t-1

cap = The monthly performance cap level

$BaseIndex_t$ = The level of the Base Index for day t

$BaseRefVal_{n,t-1}$ = Base Index Reference value for identifier n on day t-1

For each capped index $n = 1, \cdots, 22$, the base reference values and capped reference values are reset every 22 business days. They are computed as follows:

$$BaseRefVal_{n,t} = \begin{cases} \text{N/A} & \text{if } t < n \\ BaseIndex_t & \text{if } (t - n + 1) \bmod 22 = 1 \\ BaseRefVal_{n,t-1} & \text{otherwise} \end{cases} \qquad (4)$$

$$CappedRefVal_{n,t} = \begin{cases} \text{N/A} & \text{if } t < n \\ BaseIndex_t & \text{if } t = n \\ CappedIndex_{n,t} & \text{if } t > n \text{ and } (t - n + 1) \bmod 22 = 1 \\ CappedRefVal_{n,t-1} & \text{otherwise} \end{cases}$$

The base index value is initialized at 1000 for $t = 1$. For every subsequent index calculation day:

$$BaseIndex_t = \left[BaseIndex_{t-1} \times \left(1 - DF \times \frac{D_{t-1,t}}{365}\right)\right] + Perf_{t-1,t} \qquad (5)$$

where:

DF = The index decrement factor

$D_{t-1,t}$ = The number of calendar days from day *t-1* to day *t*

$Perf_{t-1,t}$ = The base index performance from day *t-1* to *t,* computed as:

$$Perf_{t-1,t} = EQPerf_{t-1,t} + BOPerf_{t-1,t}$$

        where:

           $EQPerf_{t-1,t}$ = Equity performance from day *t-1* to *t,*

           $BOPerf_{t-1,t}$ = Bond performance from day *t-1* to *t,*

Equity and bond performance are evaluated through a total of K intraday windows[2].

If the index calculation day, *t-1,* is a futures contract roll day for the equity asset:

$$\begin{aligned} EQPerf_{t-1,t} = {} & N_{E,K}^{t-1} \times (EqExec_1^t - NewEqExec_K^{t-1}) \\ & + \sum_{c=2}^{K} N_{E,c-1}^t \times (EqExec_c^t - EqExec_{c-1}^t) \end{aligned} \qquad (6)$$

Otherwise,

$$\begin{aligned} EQPerf_{t-1,t} = {} & N_{E,K}^{t-1} \times (EqExec_1^t - EqExec_K^{t-1}) \\ & + \sum_{c=2}^{K} N_{E,c-1}^t \times (EqExec_c^t - EqExec_{c-1}^t) \end{aligned}$$

If the index calculation day, *t-1,* is a futures contract roll day for the bond asset:

$$\begin{aligned} BOPerf_{t-1,t} = {} & N_{B,K}^{t-1} \times (BndExec_1^t - NewBndExec_K^{t-1}) \\ & + \sum_{c=2}^{K} N_{B,c-1}^t \times (BndExec_c^t - BndExec_{c-1}^t) \end{aligned} \qquad (7)$$

Otherwise,

$$\begin{aligned} BOPerf_{t-1,t} = {} & N_{B,K}^{t-1} \times (BndExec_1^t - BndExec_K^{t-1}) \\ & + \sum_{c=2}^{K} N_{B,c-1}^t \times (BndExec_c^t - BndExec_{c-1}^t) \end{aligned}$$

where:

$N_{E,c}^t$ = The number of equity units with respect to equity observation window *c* on day *t*

$EqExec_c^t$ = The equity execution value corresponding to equity execution window *c* on day *t*

$NewEqExec_c^t$ = The equity execution value for the new equity contract corresponding to equity execution window *c* on day *t*

$N_{B,c}^t$ = The number of bond units with respect to bond observation window *c* on day *t*

$BndExec_c^t$ = The bond execution value corresponding to bond execution window *c* on day *t*

$NewBndExec_c^t$ = The bond execution value for the new bond contract corresponding to bond execution window *c* on day *t*

The number of equity units is determined by the basket weight, base index value, and its observation value.

If the index calculation day, *t,* is a futures contract roll day for the equity asset and observation window, *c = K*:

$$N_{E,K}^t = W_{basket,K}^t \times \frac{BaseIndex_{t-1}}{NewEqObs_K^t} \qquad (8)$$

Otherwise,

$$N_{E,c}^t = W_{basket,c}^t \times \frac{BaseIndex_{t-1}}{EqObs_c^t}$$

The number of bond units is determined by the basket weight, base index value, its observation value, and the momentum signal. If the index calculation day, t, is a futures contract roll day for the bond asset and observation window, $c = K$:[3]

$$N_{B,K}^t = MomSig_{K-1}^t \times W_{basket,K}^t \times \frac{BaseIndex_{t-1}}{NewBndObs_K^t} \tag{9}$$

Otherwise,

$$N_{B,c}^t = MomSig_{c-1}^t \times W_{basket,c}^t \times \frac{BaseIndex_{t-1}}{BndObs_c^t}$$

where:

$W_{basket,c}^t$	= The weight of the *Basket* in the index in index observation window c on day t
$MomSig_c^t$	= The momentum signal value for the bonds corresponding to bond observation window c on day t
$EqObs_c^t$	= The equity observation value corresponding to equity observation window c on day t
$NewEqObs_c^t$	= The equity observation value for the new equity contract corresponding to equity observation window c on day t
$BndObs_c^t$	= The bond observation value corresponding to bond observation window c on day t
$NewBndObs_c^t$	= The bond observation value for the new bond contract corresponding to bond observation window c on day t

For index calculation day, t, and index observation window, c, the basket weight is computed as:

$$W_{basket,c}^t = \max\left[0, \min\left(MaxBasketAlloc, \frac{VolTarget}{\sigma_{c,t}^B}\right)\right] \tag{10}$$

where:

$MaxBasketAlloc$	= The maximum allocation specified for the basket
$VolTarget$	= The volatility target specified for the index
$\sigma_{c,t}^B$	= The realized volatility of the basket corresponding to index observation window c on day t

For index calculation day t, and index observation window c, the realized volatility computes as:

$$\sigma_{c,t}^B = \max\left(\sigma_{c-1,t}^{ST}, \sigma_{c-1,t}^{LT}\right) \tag{11}$$

$$\sigma_{c,t}^{ST} = \sqrt{\frac{252 \times K}{3K - 1} \sum_{previous\ 3\times K} \left(R_{Basket,c}^t\right)^2}$$

$$\sigma_{c,t}^{LT} = \sqrt{\frac{252 \times K}{10K - 1} \sum_{previous\ 10\times K} \left(R_{Basket,c}^t\right)^2}$$

$$R_{Basket,c}^t = \begin{cases} \ln\left(\frac{Basket_c^t}{Basket_K^{t-1}}\right) & \text{if } c = 1 \\ \ln\left(\frac{Basket_c^t}{Basket_{c-1}^t}\right) & \text{otherwise} \end{cases} \tag{12}$$

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[3] For K-1 = 0, the index uses the previous day's value from the last available cycle.

where:

$$K = 7$$

$$\sum_{previous\ 3\times K} \left(R_{Basket,c}^t\right)^2 = \text{The sum of squared intraday basket returns over the previous } 3K \text{ observation windows inclusive of the window } c \text{ and day } t$$

$$\sum_{previous\ 10\times K} \left(R_{Basket,c}^t\right)^2 = \text{The sum of squared intraday basket returns over the previous } 10K \text{ observation windows inclusive of the window } c \text{ and day } t$$

The momentum signal value for the bonds corresponding to bond observation window c on day t is calculated as:

$$MomSig_c^t = \begin{cases} -57.14\%^4 & \text{if } MACD_c^t < -2.50 \\ interp(-57.14\%, 0\%) & \text{if } -2.50 \leq MACD_c^t < -1.50 \\ 0\% & \text{if } MACD_c^t = -1.50 \\ interp(0\%, 100\%) & \text{if } -1.50 < MACD_c^t < 0 \\ 100\% & \text{if } MACD_c^t \geq 0 \end{cases} \tag{13}$$

where $interp(x, y)$ stands for linear interpolation between values *x* and *y.*

$$MACD_c^t = MA_{50}(BndObs_c^t) - MA_{200}(BndObs_c^t)$$

where:

$$MA_{50}(BndObs_c^t) = \text{The average of up to 50 previous cycles of the bond observation value inclusive of the value on window } c \text{ and day } t$$

$$MA_{200}(BndObs_c^t) = \text{The average of up to 200 previous cycles of the bond observation value inclusive of the value on window } c \text{ and day } t$$

The basket must be initialized at least three days prior to the index start date because at least three days of returns are required for the basket to compute short-term volatility. On the initialization day of the basket, $t = 1$, the value for the first window, $c = 1$, is set to 1000. For every subsequent window,

$$Basket_c^t = \begin{cases} Basket_K^{t-1} \times \left[1 + R_{Eq,c}^t + \left(R_{Bnd,c}^t \times MomSig_K^{t-1}\right)\right] & \text{if } c = 1 \\ Basket_{c-1}^t \times \left[1 + R_{Eq,c}^t + \left(R_{Bnd,c}^t \times MomSig_{c-1}^t\right)\right] & \text{otherwise} \end{cases} \tag{14}$$

If the index calculation day, *t-1,* is a futures contract roll day for the equity asset and observation window, *c = 1:*

$$R_{Eq,c}^t = \left(\frac{EqObs_c^t}{NewEqObs_K^{t-1}} - 1\right)$$

Otherwise,

$$R_{Eq,c}^t = \begin{cases} \left(\frac{EqObs_c^t}{EqObs_K^{t-1}} - 1\right) & \text{if } c = 1 \\ \left(\frac{EqObs_c^t}{EqObs_{c-1}^t} - 1\right) & \text{otherwise} \end{cases} \tag{15}$$

If *t-1* is a futures contract roll day for the bond asset and observation window, *c = 1:*

$$R_{Bnd,c}^t = \left(\frac{BndObs_c^t}{NewBndObs_K^{t-1}} - 1\right)$$

Otherwise,

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[4] Index calculations use full 14-decimal precision, where short intercept = 0.57142857142857.

$$R_{Bnd,c}^{t} = \begin{cases} \left(\dfrac{BndObs_{c}^{t}}{BndObs_{K}^{t-1}} - 1\right) & \text{if } c = 1 \\[4mm] \left(\dfrac{BndObs_{c}^{t}}{BndObs_{c-1}^{t}} - 1\right) & \text{otherwise} \end{cases} \tag{16}$$

On each index calculation day there are *K* intraday observation windows during which the observation values for the equity asset and the bond asset are calculated using a time-weighted average price (TWAP) within each window. The observation values for the equity and bond asset are computed as:

$$\begin{aligned} EqObs_{c}^{t} &= TWAP(Equity\ Current\ Contract\ mid\ price, ObsStartTime_{c}, ObsEndTime_{c}, t) \\ NewEqObs_{c}^{t} &= TWAP(Equity\ Next\ Contract\ mid\ price, ObsStartTime_{c}, ObsEndTime_{c}, t) \\ BndObs_{c}^{t} &= TWAP(Bond\ Current\ Contract\ mid\ price, ObsStartTime_{c}, ObsEndTime_{c}, t) \\ NewBndObs_{c}^{t} &= TWAP(Bond\ Next\ Contract\ mid\ price, ObsStartTime_{c}, ObsEndTime_{c}, t) \end{aligned}$$

where:

$ObsStartTime_{c}$ = The start time for observation window *c*

$ObsEndTime_{c}$ = The end time for observation window *c*

t = The day on which TWAP is calculated

On each index calculation day there are *K* intraday execution windows for each of the equity asset and the bond asset during which the corresponding execution values are calculated using a time-weighted average price (TWAP) within each window. The execution value for the equity asset is computed as:

If the equity execution window, $c = K$, then

$$\begin{aligned} EqExec_{c}^{t} &= Close\ price\ of\ the\ S\&P\ 500\ Price\ Index \\ &\quad + TWAP(Equity\ Current\ Contract\ mid\ price, EqExecStartTime_{c}, EqExecEndTime_{c}, t) \\ &\quad - TWAP(S\&P\ 500\ Price\ Index\ level, EqExecStartTime_{c}, EqExecEndTime_{c}, t) \\ NewEqExec_{c}^{t} &= Close\ price\ of\ the\ S\&P\ 500\ Price\ Index \\ &\quad + TWAP(Equity\ Next\ Contract\ mid\ price, EqExecStartTime_{c}, EqExecEndTime_{c}, t) \\ &\quad - TWAP(S\&P\ 500\ Price\ Index\ level, EqExecStartTime_{c}, EqExecEndTime_{c}, t) \end{aligned}$$

otherwise,

$$\begin{aligned} EqExec_{c}^{t} &= TWAP(Equity\ Current\ Contract\ mid\ price, EqExecStartTime_{c}, EqExecEndTime_{c}, t) \\ NewEqExec_{c}^{t} &= TWAP(Equity\ Next\ Contract\ mid\ price, EqExecStartTime_{c}, EqExecEndTime_{c}, t) \end{aligned}$$

The execution value for the bond asset is computed as:

$$\begin{aligned} BndExec_{c}^{t} &= TWAP(Bond\ Current\ Contract\ mid\ price, BndExecStartTime_{c}, BndExecEndTime_{c}, t) \\ NewBndExec_{c}^{t} &= TWAP(Bond\ Next\ Contract\ mid\ price, BndExecStartTime_{c}, BndExecEndTime_{c}, t) \end{aligned}$$

where:

$EqExecStartTime_{c}$ = The start time for execution window *c,* for the equity asset

$EqExecEndTime_{c}$ = The end time for execution window *c,* for the equity asset

$BndExecStartTime_{c}$ = The start time for execution window *c,* for the bond asset

$BndExecEndTime_{c}$ = The end time for execution window *c,* for the bond asset

For the equity future, the roll date is the Friday immediately preceding the futures contract expiry date (if Friday is not an index calculation day, the immediately preceding index calculation day).

For the bond future, the roll date is the trading day that falls two trading days before the first notice day of the first listed futures contract specified by the relevant futures exchange.

For detailed information on the TWAP calculation, please refer to Appendix I

Index Maintenance

Rebalancing

The index rebalances intraday at the end of each TWAP observation window defined in *Appendix II*. Due to certain market events, the timing of the rebalancing can change, as defined below:

- For any trading day that has been regularly scheduled as an early market closure day, the following changes are made to the index calculation:

  o There are only K=4 windows for index calculation, and the first three windows use the same start and end times as defined in Appendix II

  o For both equity and bond future assets, the start and end time for the fourth and last observation window is 11:25:00 and 11:30:00 US/Central time respectively

  o For the equity future asset and equity index asset, the start and end time for the fourth and last execution window is 11:40:00 and 11:45:00 US/Central time respectively

  o For the bond future asset, there is no TWAP calculation for the final execution price. It is set to the settlement price on that day

- For any unscheduled intraday closure prior to the end of the last TWAP observation window, the index value is computed from the number of windows for which the TWAP could be fully calculated prior to the closure. For example, if the unexpected closure occurred during the third observation window, the equity performance and bond performance for the day (equations 6 and 7) is computed using just the first two TWAP windows

- For any unscheduled full-day market closure, the rebalancing occurs on the next business day

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.[5]

Index	Launch Date	First Value Date	Base Date	Base Value
S&P 500 Duo Swift Index (USD) ER	03/06/2023	03/10/2008	03/07/2008	1000
S&P 500 Duo Swift Capped Index (USD) ER	03/06/2023	03/10/2008	03/07/2008	1000

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[5] For further information regarding back-test historical rule deviations, please refer to *Appendix III*.

Index	Launch Date	First Value Date	Base Date	Base Value
S&P 500 Duo Swift Capped 0.5% Decrement Index (USD) ER	03/06/2023	03/10/2008	03/07/2008	1000

There are certain days in the historical dataset on which tick data for the second contract of the bond future asset is not available for every observation window. For these missing windows the TWAP data is filled in from the last computed TWAP for the asset.

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. 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 Commodities 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 Commodities Indices Policies & Practices Methodology.

Holiday Schedule

The index is calculated daily, throughout the calendar year, when the U.S. equity markets are open, the relevant futures exchange is open for trading in the equity and bond future assets, and the bond future asset is scheduled to be assigned a settlement price.

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 Commodities Indices Policies & Practices Methodology.

Recalculation Policy

Intraday index calculations are executed for some index versions whenever the index's primary exchanges are open. In case an issue arises during calculation, the index is restated, based on feasibility assessment by the index committee, for every reported intraday index level period following the issue.

Real-Time Calculation

Real-time, intraday, 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 Commodities 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.

Index	BBG
S&P 500 Duo Swift Index (USD) ER	SPDUWE
S&P 500 Duo Swift Capped Index (USD) ER	SPDUWER
S&P 500 Duo Swift Capped 0.5% Decrement Index (USD) ER	SPDUWED

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 I: Calculation of Time Weighted Average Price (TWAP)

Given an intraday time window defined by a window start time and a window end time, in order to compute the TWAP for an asset, first, the tick level pricing data is grouped as follows:

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

- The time window is then split into k 60-second intervals. For example, assuming start time of 8:30:00 and end time of 8:45:00, there will be $k = 15$, 60-second intervals starting at each minute from 8:30 to 8:44.

- For each 60-second interval, we will keep,

  - the last quoted bid price and the last quoted ask price in that interval, if we are computing TWAPs for the equity future asset and the bond future asset

  - the last available index level in that interval, if we are computing TWAP for the S&P 500 Price Index

If the asset for which TWAP is being computed is a futures contract, then:

$$Asset\ Price_{c,k}^t = \begin{cases} \dfrac{bid\ px_{c,k}^t + ask\ px_{c,k}^t}{2} & \text{if both } bid\ px_{c,k}^t \text{ and } ask\ px_{c,k}^t \text{ exist} \\ N/A & \text{otherwise} \end{cases}$$

If the asset for which TWAP is being computed is an index, then:

$$Asset\ Price_{c,k}^t = \begin{cases} Index\ Level_{c,k}^t & \text{if } Index\ Level_{c,k}^t \text{ exists} \\ N/A & \text{otherwise} \end{cases}$$

where:

$bid\ px_{c,k}^t$ = The last quoted bid price in interval k of window c on day t

$ask\ px_{c,k}^t$ = The last quoted ask price in interval k of window c on day t

$Index\ Level_{c,k}^t$ = The last available index level in interval k of window c on day t

The TWAP for the asset is computed as:

$$TWAP(Asset, StartTime_c, EndTime_c, t) = \frac{\sum_k \left(\delta_{c,k}^t \times Asset\ Price_{c,k}^t\right)}{\sum_k \delta_{c,k}^t}$$

where:

$$\delta_{c,k}^t = \begin{cases} 1 & \text{if } Asset\ Price_{c,k}^t \text{ exists} \\ 0 & \text{otherwise} \end{cases}$$

For definitions of the observation and execution windows for the equity future asset, bond future asset and equity index asset please refer to Appendix II.

Appendix II: TWAP Observation and Execution Time Windows

For the equity future asset and the bond future asset, the observation time windows are defined as follows:

Window ID	Start Time	End Time	Time zone
c = 1	08:30:00	08:45:00	US/Central
c = 2	09:30:00	09:45:00	US/Central
c = 3	10:30:00	10:45:00	US/Central
c = 4	11:30:00	11:45:00	US/Central
c = 5	12:30:00	12:45:00	US/Central
c = 6	13:30:00	13:45:00	US/Central
c = 7	14:25:00	14:30:00	US/Central

For the equity future asset and the equity index asset, the execution time windows are defined as follows:

Window ID	Start Time	End Time	Time zone
c = 1	09:00:00	10:00:00	US/Central
c = 2	10:00:00	11:00:00	US/Central
c = 3	11:00:00	12:00:00	US/Central
c = 4	12:00:00	13:00:00	US/Central
c = 5	13:00:00	14:00:00	US/Central
c = 6	14:00:00	15:00:00	US/Central
c = 7	14:40:00	14:45:00	US/Central

For the bond future asset, the execution time windows are defined as follows:

Window ID	Start Time	End Time	Time zone
c = 1	09:00:00	10:00:00	US/Central
c = 2	10:00:00	11:00:00	US/Central
c = 3	11:00:00	12:00:00	US/Central
c = 4	12:00:00	13:00:00	US/Central
c = 5	13:00:00	14:00:00	US/Central
c = 6	14:00:00	15:00:00	US/Central
c = 7	15:00:00	15:15:00	US/Central

Appendix III: Historical Back-Test Rule Deviations

The index history on 05/23/2011, from 06/03/2013 to 06/06/2013, and on 09/30/2016, $TWAP(S\&P\ 500\ Price\ Index\ level, EqExecStartTime_c, EqExecEndTime_c, t)$ is set to the closing index level of the S&P 500 Price Index due to missing historical tick data .

On 12/31/2010, the bond futures market had a partial trading day while the equity futures had a full trading day. On this day, the index calculated by holding the bond units constant for the final three cycles of the day while the equity units were calculated as per the stated methodology.

Appendix IV: Methodology Changes

Methodology changes since March 06, 2023, are as follows:

Change	Effective Date (After Close)	Methodology	
		Previous	**Updated**
Index Names: S&P Duo Swift Index	04/28/2023	The index names are: • S&P 500 Duo Swift Uncapped Index (USD) ER • S&P 500 Duo Swift (USD) ER • S&P 500 Duo Swift 0.5% Decrement Index (USD) ER	The index names are: • S&P 500 Duo Swift (USD) ER • S&P 500 Duo Swift Capped (USD) ER • S&P 500 Duo Swift Capped 0.5% Decrement Index (USD) ER

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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