S&P Dow Jones
Indices

A Division of S&P Global

S&P VIX Futures Indices
Methodology

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Introduction

S&P VIX Futures Indices

Index Objective

The S&P VIX® Futures Index Series measures the performance of holding long and/or short positions in VIX[1] futures contracts, as defined below.

The S&P VIX Futures Index Series is comprised of the following indices:

- **S&P 500 VIX Short-Term Futures Index, S&P 500 VIX 2M Futures Index, S&P 500 VIX 3M Futures Index, and S&P 500 VIX 4M Futures Index.** The indices measure the return from a rolling long position in two VIX futures contracts with adjacent maturities. Each index rolls continuously throughout each month from the shorter-term VIX futures contract into the longer-term VIX futures contract. Please refer to Table 1 below.

- **S&P 500 VIX Mid-Term Futures Index and S&P 500 VIX 6M Futures Index.** The indices measure the return from a rolling long position in four VIX futures contracts with adjacent maturities. Each index rolls continuously throughout each month from the shortest-term contract into the longest-term contract while maintaining positions in the other two contracts.

- **S&P 500 VIX Futures Term-Structure Index.** The index measures the return from taking a 100% long position in the S&P 500 VIX Mid-Term Futures Index, and a 50% short position in the S&P 500 VIX Short-Term Futures Index. The weights of long and short positions are rebalanced daily.

- **S&P 500 VIX Front Month Futures Index.** The index measures the return from a long position in the first VIX futures contract. In the three trading days prior to the futures expiration day, the index rolls to the second month contract, with 1/3 of the portfolio being rolled each day.

- **S&P 500 Constant Vega (3%) and (6%) VIX Short Term Futures Indices.** Each index measures the return from a daily rolling long position in the first and second month VIX futures contracts and provides a constant preset vega exposure of 3% and 6%, respectively. Each index rolls continuously throughout the month to maintain a constant maturity and adjusts its holdings of VIX futures to maintain a constant vega exposure.

Table 1: Underlying contracts and rolling contracts

Index	Underlying Contracts	Roll Out (m)	Roll In (n)
S&P 500 VIX Short-Term Futures Index	1st, 2nd	1st	2nd
S&P 500 VIX 2M Futures Index	2nd, 3rd	2nd	3rd
S&P 500 VIX 3M Futures Index	3rd, 4th	3rd	4th
S&P 500 VIX 4M Futures Index	4th, 5th	4th	5th
S&P 500 VIX Mid-Term Futures Index	4th, 5th, 6th, 7th	4th	7th
S&P 500 VIX 6M Futures Index	5th, 6th, 7th, 8th	5th	8th
S&P 500 VIX Front Month Futures Index	1st	1st	2nd
S&P 500 Constant Vega (3%) and (6%) VIX Short-Term Futures Indices	1st, 2nd	1st	2nd

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[1] The VIX® methodology is the property of Cboe Options Exchange (Cboe). Cboe has granted S&P Dow Jones Indices a license to use the VIX methodology to create the S&P 500 VIX Futures Index.

S&P 500 Dynamic VIX Futures Indices

Index Objective

The S&P 500 Dynamic VIX Futures Index series dynamically allocates between the short-term and mid-term VIX futures indices excess return to provide cost efficient exposure to forward implied volatility.

The following indices are included in the series:

- **S&P 500 VIX Short-Term Futures Index Excess Return**
- **S&P 500 VIX Mid-Term Futures Index Excess Return**

The S&P 500 Dynamic VIX Futures Index monitors the steepness of the implied volatility curve to provide information about future expectations of market volatility and the expected roll cost of VIX futures investments. The index dynamically allocates between positions across the VIX futures curve aiming to lower the holding cost of investments linked to forward implied volatility.

The allocations are evaluated daily, though changes in allocation may occur less frequently.

S&P 500 VIX Futures Enhanced Roll Indices

Index Objective

The S&P 500 VIX Futures Enhanced Roll Index holds positions in the first through fifth expirations of VIX futures contracts with the relative weights determined from the levels of VIX and a 15 day moving average of VIX.

- **S&P 500 VIX Futures Enhanced Roll Index ER**
- **S&P 500 VIX Futures Enhanced Roll Index TR**

The S&P 500 VIX Futures Enhanced Roll Index dynamically switches between a short-term VIX futures portfolio and a mid-term VIX futures portfolio in order to model a cost efficient exposure to volatility in the broad equity market. The short-term VIX futures portfolio is represented by the S&P 500 VIX Short-Term Futures Index. The mid-term VIX futures portfolio models a daily rolling position in the third, fourth and fifth month VIX futures contracts.

The allocations are evaluated daily, though changes in allocation may occur less frequently.

S&P 500 VIX Futures Long/Short Strategy Indices

Index Objective

Each index seeks to gain exposure to a specific volatility strategy by taking advantage of the convex return profile of a series which is rebalanced daily.

The S&P 500® VIX® Futures Long/Short Strategy Index Series has six indices:

- **S&P 500 VIX Futures Tail Risk Index – Short Term**
- **S&P 500 VIX Futures Tail Risk Index – Mid Term**
- **S&P 500 VIX Futures Variable Long/Short Index –Short Term**
- **S&P 500 VIX Futures Variable Long/Short Index –Mid Term**
- **S&P 500 VIX Futures Short Volatility Hedged Index – Short Term**
- **S&P 500 VIX Futures Short Volatility Hedged Index – Mid Term**

The long-short indices result in a convex return profile, combined with the negative mean and positive skew of VIX Futures returns. This is accomplished by pairing both long and short positions (each rebalanced daily) in VIX Futures. The target ratio of long and short exposure is different for each index and is rebalanced to target weights on a quarterly basis. In order to reduce the path-dependent nature of such an exposure, the index tracks 13 sub-portfolios, each of which allocates between a leveraged and inverse exposure to VIX futures indices. Each sub-portfolio is rebalanced back to its target weight independently and quarterly, with rebalancing dates spread evenly in a quarter on a weekly basis. Each strategy then simulates the return of owning the 13 sub-portfolios on an equally weighted basis, with a quarterly rebalancing back to equal weight.

All of the Indices are constructed so that each sub-portfolio has a 2x leveraged position, rebalanced daily, in the S&P 500 VIX Short-Term or S&P 500 VIX Mid-Term Futures Index, and a daily rebalanced inverse position in the S&P 500 VIX Short-Term Futures Index. Due to the nature of the daily rebalancing, if the underlying VIX futures trend up, the exposure in the leveraged position increases more than linearly and the exposure in the inverse position decreases more than linearly, resulting in a net increase in long exposure. If the underlying futures trend down, the opposite is true and the result is a net increase in short exposure. This dynamic leads the net exposure to be increasing when the VIX futures are moving up and decreasing when the underlying futures are moving down.

The S&P 500 VIX Futures Variable Long/Short Index – Short Term and the S&P 500 VIX Futures Variable Long/Short Index – Mid Term are constructed so that each sub-portfolio has a variable volatility profile on the quarterly rebalancing day. The goal of each index is to provide an opportunity to achieve a positive expected return from either the negative carry in VIX futures or a large spike in VIX futures.

The S&P 500 VIX Futures Tail Risk Index – Short Term and the S&P 500 VIX Futures Tail Risk Index – Mid Term are constructed so that each sub-portfolio has a long volatility profile on the quarterly rebalancing day. The goal of each index is to provide a long volatility exposure whose cost is partially or completely mitigated (due to negative roll yield) via a rebalanced short exposure.

The S&P 500 VIX Futures Short Volatility Hedged Index – Short Term and the S&P 500 VIX Futures Short Volatility Hedged Index – Mid Term are constructed so that each sub-portfolio has a short volatility profile on the quarterly rebalancing day. The goal of each index is to provide an opportunity to achieve a positive expected return from the negative carry in VIX futures, while providing a hedge against a large spike in VIX futures.

To further reduce the path dependency associated with the choice of rebalancing days, at the last business day of every quarter each index is equally invested in 13 sub-portfolios, P_1, P_2,…, P_{13}, with the rebalancing days of P_{i+1} being one week later than that of P_i. Each individual portfolio has a leveraged leg and an inverse leg, rebalanced every 13 weeks to its target weights as listed below.

Table 2: Underlying Index and Weights:

| Index Name | Leveraged Leg | | Inverse Leg | |
	Underlying Index	Weight (W_L)	Underlying Index	Weight (W_I)
S&P 500 VIX Futures Tail Risk Index – Short Term	2x S&P 500 VIX Short-Term Futures Index	45%	Inverse S&P 500 VIX Short-Term Futures Index	55%
S&P 500 VIX Futures Tail Risk Index – Mid Term	2x S&P 500 VIX Mid-Term Futures Index	60%	Inverse S&P 500 VIX Short-Term Futures Index	40%
S&P 500 VIX Futures Variable Long/Short Index – Short Term	2x S&P 500 VIX Short-Term Futures Index	33.33%	Inverse S&P 500 VIX Short-Term Futures Index	66.67%
S&P 500 VIX Futures Variable Long/Short Index – Mid Term	2x S&P 500 VIX Mid-Term Futures Index	45%	Inverse S&P 500 VIX Short-Term Futures Index	55%
S&P 500 VIX Futures Short Volatility Hedged Index – Short Term	2x S&P 500 VIX Short-Term Futures Index	10%	Inverse S&P 500 VIX Short-Term Futures Index	90%
S&P 500 VIX Futures Short Volatility Hedged Index – Mid Term	2x S&P 500 VIX Mid-Term Futures Index	30%	Inverse S&P 500 VIX Short-Term Futures Index	70%

S&P 500 VIX Futures Long/Short Switch Indices

Index Objective

The S&P 500 VIX Futures Long/Short Switch Index seeks to simulate a dynamic portfolio that allocates between cash and one-month VIX futures with the aim of capturing VIX futures roll yield and volatility drops ("short") when volatility declines and VIX futures upside when volatility spikes ("long").

The VIX futures component switches between a long and short S&P 500 VIX futures position with a constant one-month maturity. The long or short position is determined by the curvature of the VIX futures term structure.

The S&P 500 VIX Futures Long/Short Switch Index monitors the curvature of the VIX futures term structure and allocates to cash and VIX futures, which could be either a long or a short position in the one-month S&P 500 VIX futures contracts.

The curvature of the VIX futures term structure is calculated by comparing the price difference between the first month and second month futures, and the price difference between the fourth and the seventh month futures. When the futures term structure is convex, the index takes a long position in VIX one-month futures; when the futures term structure is concave, the index takes a short position in VIX one-month futures. Historically, the index has mostly had a short position in VIX futures since the S&P 500 VIX futures curve is usually concave.

The curvature of the VIX futures term structure is calculated based on the mid prices (i.e. the average of the bid and ask prices) of the VIX futures contracts. The bid and ask prices of the VIX futures contracts used in this calculation are captured at 04:15 PM ET. If the price of any contract is not observed at 04:15 PM, the latest available price is used.

The long and short VIX one-month futures positions are modeled in the following two indices:

- **S&P 500 VIX Short-Term Futures Spread Adjusted Index**

- **S&P 500 VIX Short-Term Futures Inverse Daily Spread Adjusted Index**

The S&P 500 VIX Short-Term Futures Spread Adjusted Index and the S&P 500 VIX Short-Term Futures Inverse Daily Spread Adjusted Index adjust the returns of the S&P 500 VIX Short Term Futures Index,

which calculates index values using the last price of the two futures contracts. Instead, these two indices calculate index values using the mid-price throughout the day, and adjust end-of-day returns using the bid/ask spread.

The S&P 500 VIX Short-Term Futures Spread Adjusted Index rolls continuously from the first month to the second month and maintains a constant one-month maturity. The index sells the first month futures at bid and buys the second month futures at ask.

The S&P 500 VIX Short-Term Futures Inverse Daily Spread Adjusted Index assumes an inverse position of the S&P 500 VIX Short-Term Futures Spread Adjusted Index. The index buys the first month futures at ask and sells the second month futures at bid.

The bid and ask prices of the VIX futures contracts used in the S&P 500 VIX Short-Term Futures Spread Adjusted Index and the S&P 500 VIX Short-Term Futures Inverse Daily Spread Adjusted Index are captured at 04:00 PM ET. If the price of any contract is not observed at 04:00 PM, the latest available price is used.

For more details about these two indices, please refer to the Appendix of this document.

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.

Index Construction & Maintenance

S&P VIX Futures Indices

Calculation of the VIX Futures Index Excess Return (ER)

On any business day of the underlying futures, *t*, the index ER is calculated as follows:

$$IndexER_t = IndexER_{t-1} * (1 + CDR_t) \tag{1}$$

where:

$IndexER_{t-1}$ = The Index Excess Return on the preceding business day, defined as any date on which the index is calculated.

CDR_t = Contract Daily Return, as determined by the following formula:

$$CDR_t = \frac{TDWO_t}{TDWI_{t-1}} - 1 \tag{2}$$

where:

$t-1$ = The preceding business day.

$TDWO_t$ = Total Dollar Weight Obtained on *t*, as determined by the following formula for each of the indices:

$$TDWO_t = \sum_{i=m}^{n} CRW_{i,t-1} * DCRP_{i,t} \tag{3}$$

$TDWI_{t-1}$ = Total Dollar Weight Invested on *t-1*, as determined by the following formula for each of the indices:

$$TDWI_{t-1} = \sum_{i=m}^{n} CRW_{i,t-1} * DCRP_{i,t-1} \tag{4}$$

where:

$CRW_{i,t}$ = Contract Roll Weight of the ith VIX Futures Contract on date *t*.

$DCRP_{i,t}$ = Daily Contract Reference Price of the ith VIX Futures Contract on date *t*.

m = The term of the futures contract that is rolled out on date *t*. Please refer to Table 1.

n = The term of the futures contract that is rolled in on date *t*. Please refer to Table 1.

Contract Rebalancing

For all the indices except for the S&P 500 VIX Front Month Futures Index, the Roll Period starts after the close on the Tuesday prior to the monthly Cboe VIX Futures Settlement Date (the Wednesday falling 30 calendar days before the S&P 500 option expiration for the following month), and runs through the Tuesday prior to the subsequent month's Cboe VIX Futures Settlement Date. Thus, the indices are rolling on a continual basis. On the business date after the current Roll Period ends the following Roll Period begins.

In calculating the Excess Return of each of the indices, the Contract Roll Weights ($CRW_{i,t}$) of each of the contracts in the index, on a given day, t, are determined as follows:

S&P 500 VIX Short-Term / 2M / 3M / 4M Futures Index Short-Term Futures Index

$$CRW_{m,t} = 100 * \frac{dr}{dt}$$

$$CRW_{n,t} = 100 * \frac{dt - dr}{dt}$$

where:

    dt = The total number of business days in the current Roll Period beginning with, and including, the starting Cboe VIX Futures Settlement Date and ending with, but excluding, the following Cboe VIX Futures Settlement Date. The number of business days stays constant in cases of a new holiday introduced intra-month or an unscheduled market closure.

    dr = The total number of business days within a Roll Period beginning with, and including, the following business day and ending with, but excluding, the following Cboe VIX Futures Settlement Date. The number of business days includes a new holiday introduced intra-month up to the business day proceeding such a holiday.

After the close on the Tuesday, corresponding to the start of the Roll Period, all of the weight is allocated to the shorter-term (i.e. m^{th} month) contract. Then on each subsequent business day a fraction of the mth month VIX futures holding is sold and an equal notional amount of the longer-term (n^{th} month) VIX futures is bought. The fraction, or quantity, is proportional to the number of mth month VIX futures contracts as of the previous index roll day, and inversely proportional to the length of the current Roll Period. In this way the initial position in the mth month contract is progressively moved to the nth month one over the course of the month, until the following Roll Period starts when the old n^{th} month VIX futures contract becomes the new m^{th} month VIX futures contract and gets sold every day afterward as the process begins again.

In addition to the transactions described above, the weight of each index component is also adjusted every day to ensure that the change in total dollar exposure for the index is only due to the price change of each contract and not due to using a different weight for a contract trading at a higher price.

S&P 500 VIX Mid-Term / 6M Futures Index

$$CRW_{m,t} = 100 * \frac{dr}{dt}$$

$$CRW_{i,t} = 100$$

$$CRW_{j,t} = 100$$

$$CRW_{n,t} = 100 * \frac{dt - dr}{dt}$$

After the close on the Tuesday, corresponding to the start of the Roll Period, an equal weight is allocated to the mth, i^{th}, j^{th} and n^{th} month contracts. Then on each subsequent business day a fraction of the shortest term (i.e. m^{th} month) VIX futures holding is sold and an equal notional amount of the longest-term (i.e. n^{th} month) VIX futures is bought. The fraction, or quantity, is proportional to the number of mth month VIX futures contracts as of the previous index roll day, and inversely proportional to the length of the current Roll Period. In this way the initial position in the mth month contract is progressively moved to the nth month contract over the course of the month, until the following Roll Period start when the old i^{th} month VIX futures contract becomes the new m^{th} month VIX futures contract and gets sold every day afterwards as the process begins again.

In addition to the transactions described above, the weight of each index component is also adjusted every day to ensure that the change in total dollar exposure for the index is only due to the price change of each contract and not due to using a different weight for a contract trading at a higher price.

For the S&P 500 VIX Front Month Futures Index, the long position in the first month VIX futures is rolled to the second month VIX futures contract during the three business days prior to the first month expiration day, with 1/3 of the portfolio being rolled on each day.

Calculation of the VIX Futures Index Total Return (TR)

A total return version of each of the indices is calculated, which includes interest accrual on the notional value of the index based on the three-month U.S. Treasury rate, as follows:

$$IndexTR_t = IndexTR_{t-1} * (1 + CDR_t + TBR_t) \tag{5}$$

where:

$IndexTR_{t-1}$ = The index TR on the preceding business day.

CDR_t = Contract Daily Return as defined in equation (2).

TBR_t = Treasury Bill Return, as determined by the following formula:

$$TBR_t = \left[\frac{1}{1 - \frac{91}{360} * TBAR_{t-1}} \right]^{\frac{Delta_t}{91}} - 1 \tag{6}$$

where:

$Delta_t$ = The number of calendar days between the current and previous business days.

$TBAR_{t-1}$ = The most recent weekly high discount rate for 91-day U.S. Treasury bills effective on the preceding business day. Generally the rates are announced by the U.S. Treasury on each Monday. On Mondays that are bank holidays, Friday's rates apply.

Calculation of the VIX Futures Term-Structure Excess Return (ER)

The Term-Structure Index is a composite index that consists of taking a long position on the S&P 500 VIX Mid-Term Futures Index with 100% weight, and a short position on the S&P 500 VIX Short-Term Futures Index with 50% weight. On any S&P 500 VIX Futures Business Day, t, the index ER is calculated as follows:

$$IndexER_t = IndexER_{t-1} * (1 + ExcessReturn_t) \tag{7}$$

where:

$IndexER_{t-1}$ = The Index Excess Return on the preceding business day, defined as any date on which the index is calculated,

and

$$ExcessReturn_t = (W_{Long} * ExcessReturn_{Long} - W_{Short} * ExcessReturn_{Short}) \tag{8}$$

where:

W_{Long} = 100%, is the weight of the long position.

$ExcessReturn_{Long}$ = Excess Return of the long position in S&P 500 VIX Mid-term Futures Index.

W_{Short} = 50%, is the weight of the short position.

$ExcessReturn_{Short}$ = Excess Return of the short position in S&P 500 VIX Short-term Futures Index.

Calculation of the VIX Futures Term-Structure Total Return (TR)

A total return version of the index is calculated, which includes interest accrual on the notional value of the index based on the three-month U.S. Treasury rate, as follows:

$$IndexTR_t = IndexTR_{t-1} * \left(1 + ExcessReturn_t + TBR_t\right) \tag{9}$$

where:

$IndexTR_{t-1}$ = The index's total return on the preceding business day.

$ExcessReturn_t$ = Excess Return, as defined in equation (8).

TBR_t = Treasury Bill Return, as defined in equation (6).

Calculation of the Constant Vega (3%) and (6%) VIX Short Term Futures Excess Return (ER)

The S&P 500 Constant Vega (3%) and (6%) VIX Short Term Futures Indices ER are calculated as follows:

$$IndexER_t = IndexER_{t-1} + L_{t-1} * (TDWO_t - TDWI_{t-1}) \tag{16}$$

where:

$TDWO_t$ = Total Dollar Weight Obtained on t, as defined in equation (3)

$TDWI_t$ = Total Dollar Weight Invested on t, as defined in equation (4)

L_t = Weight of the long VIX futures position, calculated as:

$$L_t = \frac{m}{100} * IndexER_t \tag{17}$$

where:

m = Constant vega

Calculation of the Asian End-of-Day VIX Futures Indices

Asian end-of-day versions of the S&P 500 VIX Short Term Futures Index, the S&P 500 VIX Short Term Futures Daily Inverse Index, the S&P 500 VIX Front Month Futures Index, and the S&P 500 VIX Front Month Futures Daily Inverse Index are calculated using the following index values as of 4:00 PM Hong Kong time:

1. Cboe Near-Term VIX Futures Contract 2 Minute VWAP, and
2. Cboe Second-Term VIX Futures Contract 2 Minute VWAP.

Base Date and Base Value

The base dates of the S&P 500 VIX Futures indices are December 20, 2005 at base values of 100,000.

Historical Assumptions

Prior to April 2008, not all consecutive first to seventh month VIX futures were listed. For the purpose of the historical S&P 500 VIX Futures Index series calculations, the following assumptions have been made in interpolating VIX futures contract prices from near-by listed contracts.

When the ith future was not listed, but $i^{th}+1$ and $i^{th}-1$ futures were listed, the following interpolation has been assumed:

$$DCRP_{i,t}{}^2 = DCRP_{i-1,t}{}^2 + \frac{BDays(T_i - T_{i-1})}{BDays(T_{i+1} - T_{i-1})}(DCRP_{i+1,t}{}^2 - DCRP_{i-1,t}{}^2)$$

When i^{th} and $i^{th}+1$ futures were not listed, but $i^{th}+2$ and $i^{th}-1$ futures were listed, the following interpolation has been assumed:

$$DCRP_{i,t}{}^2 = DCRP_{i-1,t}{}^2 + \frac{BDays(T_i - T_{i-1})}{BDays(T_{i+2} - T_{i-1})}(DCRP_{i+2,t}{}^2 - DCRP_{i-1,t}{}^2)$$

When i^{th}, $i^{th}+1$ and $i^{th}+2$ futures were not listed, the following interpolation has been assumed:

$$DCRP_{i,t}{}^2 = DCRP_{i-1,t}{}^2 + \frac{BDays(T_i - T_{i-1})}{BDays(T_{i-1} - T_{i-2})}(DCRP_{i-1,t}{}^2 - DCRP_{i-2,t}{}^2)$$

where:

T_i =   Last Trade Day of the ith VIX Futures contract

$BDays$ =   Number of Business days between VIX Futures Last Trade Days

S&P 500 Dynamic VIX Futures Index

Constituents

The S&P 500 Dynamic VIX Futures Index is comprised of two components:

1. Short-term volatility, represented by the S&P 500 VIX Short-Term Futures Index Excess Return

2. Mid-term volatility, represented by the S&P 500 VIX Mid-Term Futures Index Excess Return

Allocations

On any business day, *t*, the S&P 500 Dynamic VIX Futures Index allocates between the short-term and mid-term volatility based on of the implied volatility term structure variable (*IVTS*). While the allocations are reviewed daily, they may change on a less frequent basis.

The target allocations to the short-term volatility (*TS*) and the mid-term volatility (*TM*) are determined by the implied volatility term structure (*IVTS*) and implied volatility trend (*IVT*) as follows:

Implied Volatility Term Structure $(IVTS_{t-1})$	Target Short-Term Volatility Allocation (TS_t)	Target Mid-Term Volatility Allocation (TM_t)
Less than 90%	-0.30	0.70
90% ≤ IVTS$_{t-1}$ < 100%	-0.20	0.80
100% ≤ IVTS$_{t-1}$ < 105%	0	1.00
105% ≤ IVTS$_{t-1}$ ≤ 115%	0.25	0.75
More than 115%	0.50	0.50

The S&P 500 Dynamic VIX Futures Index limits the size of changes to its daily allocation rebalancing. The Short-Term and Mid-Term Volatility Allocations (S_t and M_t, respectively) are determined as follows:

$$S_t = \begin{cases} S_{t-1} \ldots if \ldots S_{t-1} = TS_t \\ \min(S_{t-1} + 0.125, TS_t) \ldots if \ldots S_{t-1} < TS_t \\ \max(S_{t-1} - 0.125, TS_t) \ldots if \ldots S_{t-1} > TS_t \end{cases}$$

$$M_t = \begin{cases} M_{t-1} \ldots if \ldots M_{t-1} = TM_t \\ \min(M_{t-1} + 0.125, TM_t) \ldots if \ldots M_{t-1} < TM_t \\ \max(M_{t-1} - 0.125, TM_t) \ldots if \ldots M_{t-1} > TM_t \end{cases}$$

(1)

Evaluating implied volatility term structure

The implied volatility term structure measures the slope of the VIX futures curve. Let $IVTS$ denote the implied volatility term structure, where:

$$IVTS_{t-1} = \frac{VIX_{t-1}}{VXV_{t-1}}$$

(2)

where:

VIX_{t-1} and VXV_{t-1} refer to the Cboe Volatility Index (*VIX*) and the Cboe S&P 500 3-Month Volatility Index (*VXV*), respectively.

Excess Return (ER) Calculations

On any business day, *t*, the excess return index levels are calculated. The excess return indices assume no accruals from cash. The S&P 500 Dynamic VIX Futures Index excess return is calculated as follows:

$$IndexER_t = IndexER_{t-1} * (1 + S_{t-1} * SEDR_r + M_{t-1} * MEDR_t) \tag{3}$$

where:

$IndexER_{t-1}$ = The S&P 500 Dynamic VIX Futures Index Excess Return on the preceding business day, *t-1*

S_{t-1} = Allocation to the S&P 500 VIX Short-Term Futures Index on the prior business day, *t-1*

$SEDR_t$ = Short-Term Volatility Daily Excess Return, as determined by the following formula:

$$SEDR_t = \frac{SPVXSP_t}{SPVXSP_{t-1}} - 1 \tag{4}$$

where:

$SPVXSP_t$ = The S&P 500 VIX Short-Term Futures Excess Return Index closing level on the current business day, *t*.

M_{t-1} = Allocation to the S&P 500 VIX Mid-Term Futures Index on the prior business day, *t-1*

$MEDR_t$ = Mid-Term Volatility Daily Excess Return, as determined by the following formula:

$$MEDR_t = \frac{SPVXMP_t}{SPVXMP_{t-1}} - 1 \tag{5}$$

where:

$SPVXMP_t$ = The S&P 500 VIX Mid-Term Futures Excess Return Index closing level on the current business day, *t*.

Total Return (TR) Calculations

A total return index is calculated for the S&P 500 Dynamic VIX Futures Index, which includes interest based on the three-month U.S. Treasury rate.

$$IndexTR_t = IndexTR_{t-1} * (1 + S_{t-1} * SEDR_r + M_{t-1} * MEDR_t + TBR_t) \tag{6}$$

where:

$IndexTR_{t-1}$ = The S&P 500 Dynamic VIX Futures Index Total Return on the preceding business day, *t-1*

S_{t-1} = Allocation to the S&P 500 VIX Short-Term Futures Index on the prior business day, t-1

$SEDR_t$ = Short-Term Volatility Daily Excess Return, as determined by formula (4)

M_{t-1} = Allocation to the S&P 500 VIX Mid-Term Futures Index on the prior business day, t-1

$MEDR_t$ = Mid-Term Volatility Daily Excess Return, as determined by formula (5)

TBR_t = Treasury Bill Return, as determined by the following formula:

$$TBR_t = \left[\frac{1}{1 - \frac{91}{360} * TBAR_{t-1}} \right]^{\frac{Delta_t}{91}} - 1 \qquad (7)$$

$Delta_t$ = the number of calendar days between the current and previous business days.

$TBAR_{t-1}$ = the most recent weekly high discount rate for 91-day US Treasury bills effective on the preceding business day. Generally the rates are announced by the US Treasury on each Monday. On Mondays that are bank holidays, Friday's rates will apply.

Base Date and Base Value

The base date for the indices is December 20, 2005 and the base value is 1,000 for both the excess and total return indices.

S&P 500 VIX Futures Enhanced Roll Indices

The S&P 500 VIX Futures Enhanced Roll Index dynamically switches between two long portfolios of VIX futures:

1. Short-term portfolio, represented by the S&P 500 VIX Short-Term Futures Index
2. Mid-term portfolio, illustrated below

Short-Term Portfolio

The short-term portfolio assumes a long position in the S&P 500 VIX Short-Term Futures Index, which models a rolling long position in the first and second month VIX futures contracts. It rolls continuously throughout each month from the first month VIX futures contract into the second month VIX futures contract.

On any business day, the excess return of the short-term portfolio is calculated as illustrated in the *S&P 500 VIX Futures Index Methodology* document.

Mid-Term Portfolio

The mid-term portfolio assumes a rolling long position in the third, fourth and fifth month VIX futures contracts. It rolls continuously throughout each month from the third month contract into the fifth month contract, while maintaining positions in the fourth month contracts.

On any business day, t, the excess return of the mid-term portfolio ($MidER_t$) is calculated as follows:

$$MidER_t = MidER_{t-1} * (1 + CDR_t) \tag{1}$$

where:

$MidER_{t-1}$ = The Excess Return of the Mid-Term Portfolio on the preceding business day, defined as any date on which the index is calculated.

CDR_t = Contract Daily Return, as determined by the following formula:

$$CDR_t = \frac{TDWO_t}{TDWI_{t-1}} - 1 \tag{2}$$

where:

$t-1$ = the preceding business day.

$TDWO_t$ = Total Dollar Weight Obtained on t, as determined by the following formula:

$$TDWO_t = \sum_{i=3}^{5} CRW_{i,t-1} * DCRP_{i,t} \tag{3}$$

$TDWI_{t-1}$ = Total Dollar Weight Invested on $t-1$, as determined by the following formula:

$$TDWI_{t-1} = \sum_{i=3}^{5} CRW_{i,t-1} * DCRP_{i,t-1} \tag{4}$$

where:

> $CRW_{i,t}$ = Contract Roll Weight of the ith VIX Futures Contract on date t.

> $DCRP_{i,t}$ = Daily Contract Reference Price of the ith VIX Futures Contract on date t.

The Roll Period starts after the close on the Tuesday prior to the monthly Cboe VIX Futures Settlement Date (the Wednesday falling 30 calendar days before the S&P 500 option expiration for the following month), and runs through the Tuesday prior to the subsequent month's Cboe VIX Futures Settlement Date. Thus, the mid-term portfolio is rolling on a continual basis. On the business date after the current Roll Period ends the following Roll Period will begin.

In calculating the Excess Return of the mid-term portfolio, the Contract Roll Weights ($CRW_{i,t}$) of each of the contracts in the portfolio, on a given day, t, are determined as follows:

$$CRW_{3,t} = 50\% * \frac{dr}{dt}$$

$$CRW_{4,t} = 50\%$$

$$CRW_{5,t} = 50\% * \frac{dt - dr}{dt}$$

where:

> dt = The total number of business days in the current Roll Period beginning with, and including, the starting Cboe VIX Futures Settlement Date and ending with, but excluding, the following Cboe VIX Futures Settlement Date. The number of business days stays constant in cases of a new holiday introduced intra-month or an unscheduled market closure.

> dr = The total number of business days within a Roll Period beginning with, and including, the following business day and ending with, but excluding, the following Cboe VIX Futures Settlement Date. The number of business days includes a new holiday introduced intra-month up to the business day preceding such a holiday.

> After the close on the Tuesday, corresponding to the start of the Roll Period, an equal weight is allocated to the third and fourth month contracts. Then on each subsequent business day a fraction of the third month VIX futures holding is sold and an equal notional amount of the fifth month VIX futures is bought. The fraction, or quantity, is proportional to the number of third month VIX futures contracts as of the previous index roll day, and inversely proportional to the length of the current Roll Period. In this way the initial position in the third month contract is progressively moved to the fifth month contract over the course of the month, until the following Roll Period start when the old fourth month VIX futures contract becomes the new third month VIX futures contract and gets sold every day afterwards as the process begins again.

> In addition to the transactions described above, the weight of each index component is also adjusted every day to ensure that the change in total dollar exposure for the index is only due to the price change of each contract and not due to using a different weight for a contract trading at a higher price.

> For the purpose of the historical mid-term portfolio calculations, when the ith future was not listed on day t, the closing price on the previous day, $t-1$, was used.

Dynamic Switch

Let w_t^{short} and w_t^{mid} denote the weight of the short-term portfolio and mid-term portfolio in the VIX futures contracts, respectively.

w_t^{short} = Weight of the S&P 500 VIX Short-Term Futures Index

w_t^{mid} = Weight of the mid-term portfolio in VIX futures

= 100% - w_t^{short}

At the inception of the index history ($t = 1$), the index is fully invested in the mid-term VIX futures portfolio.

w_1^{short} = 0

w_1^{mid} = 100%

On any business day, t, the index dynamically switches between the short-term portfolio and the mid-term portfolio based on the implied volatility signal.

The implied volatility signal evaluates whether the current implied volatility, represented by the spot VIX, is relatively high or low. Let the 15-day implied volatility average be denoted by $AvgIV_t$. The Daily Implied Volatility Signal ($DIVS_t$) is high (+1) if the current implied volatility is greater than 1.35 times $AvgIV_t$, and low (-1) if it is less than $AvgIV_t$.

$$IV_{t-1} = VIX_{t-1} \qquad (5)$$

$$AvgIV_{t-1} = \sum_{n=1}^{15} \frac{IV_{t-n}}{15} \qquad (6)$$

$$DIVS_{t-1} = \begin{cases} +1...if...IV_{t-1} > 1.35 * AvgIV_{t-1} \\ -1...if...IV_{t-1} < AvgIV_{t-1} \\ 0...otherwise \end{cases} \qquad (7)$$

where:

VIX_{t-1} refers to the Cboe Volatility Index (VIX).

On any business day, t, if $DIVS_{t-1}$ is high (+1) and the index is not fully invested in the short-term portfolio, we roll the entire mid-term portfolio into the short-term portfolio. Twenty percent (20%) of the portfolio will be rolled into the short-term portfolio per business day.

On any business day, t, if $DIVS_{t-1}$ is low (-1) and the index is not fully invested in the mid-term portfolio, we roll the entire short-term portfolio into the mid-term portfolio. Twenty percent (20%) of the portfolio will be rolled into the mid-term portfolio per business day.

Note that:

- The index rolls from one VIX futures portfolio to the other gradually. A 20% portion of the old portfolio is rolled into the new portfolio every day.

- Once $DIVS_{t-1}$ triggers a roll from one VIX futures portfolio to the other, the roll will complete unless the implied volatility signal changes sign during the roll. If the implied volatility signal becomes 0, the roll will continue at 20% per business day. If the implied volatility signal changes sign during the roll, the original roll will stop and roll back 20% per business day.

20% Staged Roll Example #1

If DIVS does not change sign, the roll will complete.

Date	Implied Volatility Signal ($DIVS_t$)	Weight of Short-term Portfolio (w_t^{short})	Weight of Mid-term Portfolio (w_t^{mid})
2/27/2007	1	0%	100%
2/28/2007	1	20%	80%
3/1/2007	0	40%	60%
3/2/2007	1	60%	40%
3/5/2007	1	80%	20%
3/6/2007	0	100%	0%

20% Staged Roll Example #2

If DIVS changes sign during the roll, the roll will stop and reverse.

Date	Implied Volatility Signal ($DIVS_t$)	Weight of Short-term Portfolio (w_t^{short})	Weight of Mid-term Portfolio (w_t^{mid})
2/27/2007	1	0%	100%
2/28/2007	1	20%	80%
3/1/2007	0	40%	60%
3/2/2007	-1	60%	40%
3/5/2007	0	40%	60%
3/6/2007	0	20%	80%
3/7/2007	-1	0%	100%

Excess Return (ER) Calculations

On any business day, *t*, the excess return index level is calculated. The excess return indices assume no accruals from cash.

The S&P 500 VIX Futures Enhanced Roll Index excess return is calculated as follows:

$$IndexER_t = IndexER_{t-1} * \left(1 + w_{t-1}^{short} * ShortEDR_t + w_{t-1}^{mid} * MidEDR_t \right) \tag{8}$$

where:

$IndexER_{t-1}$ = The S&P 500 VIX Futures Enhanced Roll Index Excess Return on the preceding business day, *t-1*

w_{t-1}^{short} = Weight of the S&P 500 VIX Short-Term Futures Index, on the preceding business day, *t-1*

w_{t-1}^{mid} = Weight of the mid-term portfolio in VIX futures on the preceding business day, *t-1*

$ShortEDR_t$ = Excess daily return of the short-term portfolio, as determined by the following formula:

$$ShortEDR_t = \frac{SPVXSP_t}{SPVXSP_{t-1}} - 1 \tag{9}$$

where:

$SPVXSP_t$ = The S&P 500 VIX Short-Term Futures Excess Return Index closing level on the current business day, t.

$MidEDR_t$ = Excess daily return of the mid-term portfolio, as determined by the following formula:

$$MidEDR_t = \frac{MidER_t}{MidER_{t-1}} - 1 \tag{10}$$

where:

$MidER_t$ = The excess return of the mid-term portfolio on the current business day, t, as calculated in formula (1).

Total Return (TR) Calculations

A total return index is calculated for the S&P 500 VIX Futures Enhanced Roll Index, which includes interest based on the three-month U.S. Treasury rate.

$$IndexTR_t = IndexTR_{t-1} * \left(1 + w_{t-1}^{short} * ShortEDR_t + w_{t-1}^{mid} * MidEDR_t + TBR_t\right) \tag{11}$$

where:

$IndexTR_{t-1}$ = The S&P 500 VIX Futures Enhanced Roll Index Total Return on the preceding business day, t-1

TBR_t = Treasury Bill Return, as determined by the following formula:

$$TBR_t = \left[\frac{1}{1 - \frac{91}{360} * TBAR_{t-1}}\right]^{\frac{Delta_t}{91}} - 1 \tag{12}$$

$Delta_t$ = the number of calendar days between the current and previous business days.

$TBAR_{t-1}$ = the most recent weekly high discount rate for 91-day US Treasury bills effective on the preceding business day. Generally the rates are announced by the US Treasury on each Monday. On Mondays that are bank holidays, Friday's rates will apply.

w_{t-1}^{short} = Weight of the S&P 500 VIX Short-Term Futures Index, on the preceding business day, t-1

w_{t-1}^{mid} = Weight of the mid-term portfolio in VIX futures on the preceding business day, t-1

$ShortEDR_t$ = Excess daily return of the short-term portfolio, as defined in (9).

$MidEDR_t$ = Excess daily return of the mid-term portfolio, defined in (10).

Base Date and Base Value

The base date for the index is October 23, 2006 and the base value is 100.

S&P 500 VIX Futures Long/Short Strategy Indices

The S&P 500 VIX Futures Long/Short Strategy Index family has six indices:

- The S&P 500 VIX Futures Tail Risk Index – Short Term
- The S&P 500 VIX Futures Tail Risk Index – Mid Term
- The S&P 500 VIX Futures Variable Long/Short Index – Short Term
- The S&P 500 VIX Futures Variable Long/Short Index – Mid Term
- The S&P 500 VIX Futures Short Volatility Hedged Index – Short Term
- The S&P 500 VIX Futures Short Volatility Hedged Index – Mid Term

Each index is equally invested in 13 sub-portfolios, P_1, P_2,…, P_{13}. The indices are rebalanced quarterly.

Each sub-portfolio has a leveraged leg and an inverse leg, both rebalanced daily. They are also rebalanced every 13 weeks to their target weights.

Index Calculations

Step 1: Calculating the Leveraged and Inverse Underlying Indices

The underlying indices of the leveraged and inverse legs are calculated based on the excess return of the S&P 500 VIX Short-Term Futures and Mid-Term Futures indices. The return and the index value are calculated as follows:

$$LER_t = 2*\left(\frac{LVF_t}{LVF_{t-1}} - 1\right) \tag{1}$$

$$IER_t = -1*\left(\frac{IVF_t}{IVF_{t-1}} - 1\right)$$

$$L_t = (1 + LER_t)*L_{t-1}$$

$$I_t = (1 + IER_t)*I_{t-1}$$

where:

LER_t = Daily excess return of the leveraged leg on business day t.

IER_t = Daily excess return of the inverse leg on business day t.

LVF_t = Excess return of the base index in the leveraged leg on business day t. The underlying index is specified in Table 2.

IVF_t = Excess return of the base index in the inverse leg on business day t. The underlying index is specified in Table 2.

L_t = Daily leveraged excess return index value on business day t.

I_t = Daily inverse excess return index value on business day t.

Step 2: Calculating the Sub Portfolio Values

Each sub-portfolio is rebalanced every 13 weeks to its target weight. The portfolio value is calculated based on the return of the two legs since the last rebalancing day as follows:

$$PER_{i,t} = w_L * \left(\frac{L_t}{L_{i,lr}} - 1 \right) + w_I * \left(\frac{I_t}{I_{i,lr}} - 1 \right)$$

(2)

$$P_{i,t} = (1 + PER_{i,t}) * P_{i,lr}$$

where:

$PER_{i,t}$ = Excess return of portfolio i since the last rebalancing day on business day t.

w_L = Target weight of the leveraged leg.

L_t = Leveraged excess return index value on business day t.

$L_{i,lr}$ = Leveraged excess return index value on the last rebalancing day of portfolio i.

w_I = 1- w_L = Target weight of the inverse leg.

I_t = Inverse excess return index value on business day t.

$I_{i,lr}$ = Inverse excess return index value on the last rebalancing day of portfolio i.

$P_{i,t}$ = Value of portfolio i on business day t.

$P_{i,lr}$ = Value of portfolio i on its last rebalancing day.

Step 3: Calculating the Excess Return Indices

Each index holds 13 portfolios, P_1, P_2,…, P_{13}. It is rebalanced quarterly to equal weight. The excess return index value is calculated based on the return of the portfolios since the last rebalancing day as follows:

$$ER_t = \frac{1}{13} * \sum_{i=1}^{13} \left(\frac{P_{i,t}}{P_{i,lR}} - 1 \right)$$

(3)

$$IndexER_t = (1 + ER_t) * IndexER_{lR}$$

where:

ER_t = Index excess return since last rebalancing day on business day, t.

$P_{i,t}$ = Value of portfolio i on business day t.

$P_{i,IR}$ = Value of portfolio i on the last rebalancing day of The Excess Return Index.

$IndexER_t$ = The Excess Return Index value on business day t.

$IndexER_{IR}$ = The Excess Return Index value on its last rebalancing day.

Step 4: Calculating the Total Return Indices

The total return index value includes interest based on the three-month U.S. Treasury rate:

$$IndexTR_t = (1 + DER_t + TBR_t) * IndexTR_{t-1}$$ (4)

$$DER_t = \frac{IndexER_t}{IndexER_{t-1}} - 1$$

$$TBR_t = \left[\frac{1}{1 - \frac{91}{360} * TBAR_{t-1}} \right]^{\frac{Delta_t}{91}} - 1$$

where:

$IndexTR_t$	= The Total Return Index value on business day t.
DER_t	= Index daily excess return on business day t.
TBR_t	= Treasury bill return on business day t.
$Delta_t$	= The number of calendar days between the current and previous business days.
$TBAR_{t-1}$	= The most recent weekly high discount rate for 91-day US Treasury bills effective on the preceding business day. Generally the rates are announced by the US Treasury on each Monday. On Mondays that are bank holidays, Friday's rates will apply.

Rebalancing

The Indices are rebalanced on the last business day of every quarter. The index positions are rebalanced to an equal weight holding of each of the 13 sub-portfolios.

The 13 sub-portfolios are rebalanced on Wednesdays. Each sub-portfolio is rebalanced every 13 weeks. If that date is not a business day, the roll date is the next business date. The positions are rebalanced to the target weights specified in Table 2.

Base Date and Base Value

The indices' base dates are December 20, 2005 with base values of 100.

S&P 500 VIX Futures Long/Short Switch Indices

The S&P 500 VIX Futures Long/Short Switch Index seeks to simulate a dynamic portfolio that allocates between cash and one-month VIX futures with the aim of capturing VIX futures roll yield and volatility drops ("short") when volatility declines and VIX futures upside when volatility spikes ("long").

When the futures term structure is convex, the index takes a long position in VIX one-month futures; when the futures term structure is concave, the index takes a short position in VIX one-month futures. The index calculates the curvature of the VIX futures term structure on daily basis. If the curvature signal flips and remains constant for three continuous business days, the index switches its position accordingly.

The index has a constant scale factor of 1/3 on the VIX futures position.

Excess Return Index Calculations

On any business day t when the index is calculated, the excess return index value is calculated as:

$$IndexER_t = IndexER_{t-1} * (1 + ER_t) \qquad (1)$$

where:

$IndexER_t$ = Excess return index level on day t.

ER_t = Excess return on day t, calculated as:

$$ER_t = (W_{L,t-1} * LER_t + W_{S,t-1} * SER_t) * SF \qquad (2)$$

where:

LER_t = Excess return of the S&P 500 VIX Short-Term Futures Spread Adjusted Index on day t.

SER_t = Excess return of the S&P 500 VIX Short-Term Futures Inverse Daily Spread Adjusted Index on day t.

$W_{L,t-1}$ = Weight of the S&P 500 VIX Short-Term Futures Spread Adjusted Index on day t-1.

$W_{S,t-1}$ = Weight of the S&P 500 VIX Short-Term Futures Inverse Daily Spread Adjusted Index on day t-1.

SF = Scale factor = 1/3.

Total Return Index Calculations

On any business day t when the index is calculated, the total return index value is calculated as:

$$IndexTR_t = IndexTR_{t-1} * (1 + ER_t + CashDR_t) \qquad (3)$$

where:

$IndexER_t$ = Excess return index level on day t.

ER_t = Excess return on day t, calculated as in formula (2).

$CashDR_t$ = Cash daily return on day t, calculated as:

$$CashDR_t = \frac{Date_t - Date_{t-1}}{360} * Rate_{t-1}$$ (4)

where:

$Date_t$ = The valuation date.

$Date_{t-1}$ = The previous valuation date.

$Rate_{t-1}$ = The previous day value of overnight LIBOR, expressed as a percentage.

Curvature and Weights

On any business day t when the index is calculated, the index calculates the curvature of the VIX futures term structure as follows:

$$Curvature_t = \frac{VX(c2)_t - VX(c1)_t}{VX(c2)_t} - \frac{VX(c7)_t - VX(c4)_t}{3*VX(c7)_t}$$ (5)

where:

$VX(c1)_t$ = The mid price of the first month VIX futures on day t.

$VX(c2)_t$ = The mid price of the second month VIX futures on day t.

$VX(c4)_t$ = The mid price of the fourth month VIX futures on day t.

$VX(c7)_t$ = The mid price of the seventh month VIX futures on day t.

Define the direction of curvature as follows:

$$C_t = \begin{cases} +1 ... if ... Curvature_t \geq 0 \\ -1 ... if ... Curvature_t < 0 \end{cases}$$ (6)

On the first day of index calculation, the index consists of cash only and has no allocation to either long or short volatility positions. The index does not allocate to volatility until it observes three consistent signals.

$$W_{L,0} = W_{S,0} = 0$$ (7a)

On all other business days when the index is calculated, the index maintains its previous allocation to the long and short VIX futures position until the curvature flips and remains constant for three continuous business days. The weights of the long and short VIX futures at the end of day t are determined as follows:

$$W_{L,t} = \begin{cases} 1 ... if ... C_{t-1} = C_{t-2} = C_{t-3} = -1*C_{t-4} = -1 \\ 0 ... if ... C_{t-1} = C_{t-2} = C_{t-3} = -1*C_{t-4} = +1 \\ W_{L,t-1} ... otherwise \end{cases}$$

$$W_{S,t} = \begin{cases} 0 ... if ... C_{t-1} = C_{t-2} = C_{t-3} = -1*C_{t-4} = -1 \\ 1 ... if ... C_{t-1} = C_{t-2} = C_{t-3} = -1*C_{t-4} = +1 \\ W_{S,t-1} ... otherwise \end{cases}$$ (7b)

where:

$W_{L.t}$ = Weight of the S&P 500 VIX Short-Term Futures Spread Adjusted Index on day t.

$W_{S,t}$ = Weight of the S&P 500 VIX Short-Term Futures Inverse Daily Spread Adjusted Index on day t.

The mid price is calculated as the average of the bid and ask prices.

$$mid = \frac{bid + ask}{2} \qquad (8)$$

The bid and ask prices of the VIX futures contracts used in this calculation are captured at 04:15 PM ET. If the price of any contract is not observed at 04:15 PM, the latest available price is used.

The index processes the real-time bid and ask prices as follows:

- If a quote only has a bid price, default ask to the bid price. If a quote only has an ask price, default bid to the ask price. In other words, if the index receives a one-sided quote, it assumes bid = ask = mid.

- Valid bid/ask quotes must satisfy the following criteria:

  o The bid must be greater than 0.

  o The ask must be greater than or equal to the bid.

  o The bid/ask spread, calculated as per below, must be less than or equal to 5%.

$$spread = \frac{ask - bid}{ask} \qquad (9)$$

Base Date and Base Value

The base date for the index is January 19, 2006. The base value on that date is 100 for both the excess return and total return versions of the index.

Index Governance

Index Committee

The Commodities Index Committee maintains the families of S&P VIX Futures Indices. All members of the Committee are full-time professionals at S&P Dow Jones Indices. The Committee meets quarterly. At each meeting, the Committee reviews any significant market events. In addition, the Committee may revise index policy for timing of rebalancings 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' Commodities Indices Policies & Practices document.

Index Policy

Announcements

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

Holiday Schedule

The indices are calculated daily from 7:00 PM (day before) to 4:28 PM New York Time, excluding holidays and weekends.

A complete holiday schedule for the year is available at *www.spdji.com*.

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 and New Holidays

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 Dow Jones Indices calculates the value of the index based on the most recent prior closing futures price published by the Cboe Futures Exchange and the roll for that day is carried to the next Cboe business day as described in the Contract Rebalancing section. If an exchange fails to open due to unforeseen circumstances, S&P Dow Jones Indices may determine not to publish the index for that day. The daily roll percentage is determined on the day when the index is fully rolled from the first month contract to the second month contract, and stays constant throughout the month. If the index is not calculated or published due to unforeseen circumstances during the month, the unrolled potion for that day is carried to the next Cboe business day. It does not change the daily roll percentage on the remaining days of the month.

In situations where an exchange introduces a holiday during the month of the index calculation the index is not be published and the roll for that day is carried to the next Cboe business day as described in the Contract Rebalancing section.

Please see the example provided below:

Normal Roll Schedule	ER Calculated Weights	
	% Current	% Next
10/25/2012	0.76	0.24
10/26/2012	0.72	0.28
10/29/2012	0.68	0.32
10/30/2012	0.64	0.36
10/31/2012	0.60	0.40
11/01/2012	0.56	0.44
11/02/2012	0.52	0.48

Unscheduled Market Closure	ER Calculated Weights	
	% Current	% Next
10/25/2012	0.76	0.24
10/26/2012	0.72	0.28
10/29/2012	**Unscheduled Market Closure**	
10/30/2012	**Unscheduled Market Closure**	
10/31/2012	0.68	0.32
11/01/2012	0.56	0.44
11/02/2012	0.52	0.48

For more information on Unexpected Exchange Closures, please refer to S&P Dow Jones Indices' Commodities Indices Policies & Practices Methodology.

Delisting of Futures Contracts

If one or more futures contracts included in one of the indices is no longer listed, S&P Dow Jones Indices may choose to cease publication of the effected index at that time.

For information on Calculations and Pricing Disruptions, Expert Judgment, Data Hierarchy and Error Corrections, please refer to S&P Dow Jones Indices' 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.spdji.com,* 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 *S&P DJI's All Indices by Methodology Report* for a complete list of indices covered by this document.

Index	Bloomberg	Reuters
S&P 500 VIX Short-Term Futures Index ER (Real-Time)	SPVXSPID	.SPVXSPID
S&P 500 VIX Short-Term Futures Index ER (End-of-Day)	SPVXSP	--
S&P 500 VIX Short-Term Futures Index ER (Asian End-of-Day)	SPVSTFAP	--
S&P 500 VIX Short-Term Futures Index TR (Real-Time)	SPVIXSTR	.SPVIXSTR
S&P 500 VIX Short-Term Futures Index TR (End-of-Day)	SPVXSTR	--
S&P 500 VIX Mid-Term Futures Index ER	SPVXMP	.SPVXMP
S&P 500 VIX Mid-Term Futures Index TR (Real-Time)	SPVIXMTR	.SPVIXMTR
S&P 500 VIX Mid-Term Futures Index TR (End-of-Day)	SPVXMTR	--
S&P 500 VIX Futures Term-Structure Index ER	SPVXTSER	.SPVXTSER
S&P 500 VIX Futures Term-Structure Index TR	SPVXTSTR	--
S&P 500 VIX 2M Futures Index ER	SPVIX2ME	.SPVIX2ME
S&P 500 VIX 2M Futures Index TR	SPVIX2MT	.SPVIX2MT
S&P 500 VIX 3M Futures Index ER	SPVIX3ME	.SPVIX3ME
S&P 500 VIX 3M Futures Index TR	SPVIX3MT	.SPVIX3MT
S&P 500 VIX 4M Futures Index ER	SPVIX4ME	.SPVIX4ME
S&P 500 VIX 4M Futures Index TR	SPVIX4MT	.SPVIX4MT
S&P 500 VIX 6M Futures Index ER	SPVIX6ME	.SPVIX6ME
S&P 500 VIX 6M Futures Index TR	SPVIX6MT	.SPVIX6MT
S&P 500 VIX Short Term Futures Daily Inverse Index ER	SPVXSPI	.SPVXSIER
S&P 500 VIX Short Term Futures Daily Inverse Index TR	SPVXSPIT	.SPVXSITR
S&P 500 VIX Short Term Futures Inverse Index ER (Asian End-of-Day)	SPVSTIAP	--
S&P 500 VIX Mid Term Futures Daily Inverse Index ER	SPVXMPI	.SPVXMPI
S&P 500 VIX Mid Term Futures Daily Inverse Index TR	SPVXMPIT	.SPVXMPIT
S&P 500 VIX Front Month Futures Index ER	SPVXFME	.SPVXFME
S&P 500 VIX Front Month Futures Index TR	SPVXFMT	.SPVXFMT
S&P 500 VIX Front Month Futures Index ER (Asian End-of-Day)	SPVFMFAP	--
S&P 500 VIX Front Month Futures Inverse Index ER (Asian End of Day)	SPVFMIAP	--
S&P 500 Constant Vega (3%) VIX Short Term Futures Index ER	SPVXSV3P	.SPVXSV3P
S&P 500 Constant Vega (6%) VIX Short Term Futures Index ER	SPVXSV6P	.SPVXSV6P
S&P 500 Dynamic VIX Futures Index ER	SPDVIXE	
S&P 500 Dynamic VIX Futures Index TR	SPDVIXT	
S&P 500 Dynamic VIX Futures Index ER (Official Close)	SPDVIXP	
S&P 500 Dynamic VIX Futures Index TR (Official Close)	SPDVIXTR	
S&P 500 VIX Futures Enhanced Roll Index ER	SPVIXEP	.SPVIXEP
S&P 500 VIX Futures Enhanced Roll Index TR	SPVIXETR	.SPVIXETR
S&P 500 VIX Futures Tail Risk Index ER– Short Term	SPVXTRSP	
S&P 500 VIX Futures Tail Risk Index TR – Short Term	SPVXTRST	
S&P 500 VIX Futures Tail Risk Index ER – Mid Term	SPVXTRMP	
S&P 500 VIX Futures Tail Risk Index TR – Mid Term	SPVXTRMT	
S&P 500 VIX Futures Variable Long/Short Index ER – Short Term	SPVXVSP	
S&P 500 VIX Futures Variable Long/Short Index TR – Short Term	SPVXVST	
S&P 500 VIX Futures Variable Long/Short Index ER – Mid Term	SPVXVMP	
S&P 500 VIX Futures Variable Long/Short Index TR – Mid Term	SPVXVMT	
S&P 500 VIX Futures Short Volatility Hedged Index ER – Short Term	SPVXVHSP	
S&P 500 VIX Futures Short Volatility Hedged Index TR – Short Term	SPVXVHST	
S&P 500 VIX Futures Short Volatility Hedged Index ER – Mid Term	SPVXVHMP	
S&P 500 VIX Futures Short Volatility Hedged Index TR – Mid Term	SPVXVHMT	
S&P 500 VIX Futures Long/Short Switch Index ER	SPVXLSP	.SPVXLSP
S&P 500 VIX Futures Long/Short Switch Index TR	SPVXLST	.SPVXLST
S&P 500 VIX Short-Term Futures Spread Adjusted Index ER	SPVXFSAI	.SPVXFSAI
S&P 500 VIX Short-Term Futures Inverse Daily Spread Adjusted Index ER	SPVXSFID	.SPVXSFID

Index Data

Index level data is available via subscription.

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

Web site

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

Appendix: The S&P 500 VIX Short-Term Futures Spread Adjusted Index Family

The S&P 500 VIX Short-Term Futures Spread Adjusted Index family seeks to simulate a long or short S&P 500 VIX futures position in the first month and second month contracts. It consists of two indices:

- The S&P 500 VIX Short-Term Futures Spread Adjusted Index
- The S&P 500 VIX Short-Term Futures Inverse Daily Spread Adjusted Index

The S&P 500 VIX Short-Term Futures Spread Adjusted Index rolls continuously from the first month to the second month and maintains a constant one-month maturity. The index sells the first month futures at bid and buys the second month futures at ask.

The S&P 500 VIX Short-Term Futures Inverse Daily Spread Adjusted Index assumes an inverse position of the S&P 500 VIX Short-Term Futures Spread Adjusted Index. The index buys the first month futures at ask and sells the second month futures at bid.

For both indices, index values are calculated throughout the day using the mid prices of the first month and second month VIX futures. At the index close (04:00 PM ET), the bid and ask prices of the VIX futures contracts are captured. The indices use the most recent valid bid and ask prices to adjust the index values. If the price of any contract is not observed at the close, the latest available price is used.

Excess Return Index Calculations

On any business day t, the excess return index value is calculated as:

$$IndexER_t = IndexER_{t-1} * (1 + ER_t) \tag{1}$$

   where:

   $IndexER_t$ = Excess return index level on day t.

   ER_t = Excess return on day t.

Day Count and Weights

On any business day t when the index is calculated, the index allocates weights to the first month and second month futures as follows:

$$W_{1,t} = 100 * \frac{dr}{dt} \tag{2}$$

$$W_{2,t} = 100 * \frac{dt - dr}{dt} \tag{3}$$

   where:

   dt = The total number of business days in the current Roll Period beginning with, and including, the starting Cboe VIX Futures Settlement Date and ending with, but excluding, the following Cboe VIX Futures Settlement Date. The number of business days stays constant in cases where a new holiday is introduced intra-month or an unscheduled market closure takes place.

dr = The total number of business days within a Roll Period beginning with, and including, the following business day and ending with, but excluding, the following Cboe VIX Futures Settlement Date. In cases where a new holiday is introduced intra-month, the number of business days includes those business days up to the business day preceding such a holiday.

After the close on the Tuesday corresponding to the start of the Roll Period, the total weight of the index is allocated to the first month contract. On each subsequent business day, a fraction of the first month VIX futures holding is sold and an equal notional amount of the second month VIX futures is bought. The fraction, or quantity, is proportional to the number of first month VIX futures contracts as of the previous index roll day, and inversely proportional to the length of the current Roll Period. In this way, the initial position in the first month contract is progressively moved to the second month contract over the course of the month. This continues until the following Roll Period starts, when the previous second month VIX futures contract becomes the new first month VIX futures contract and then is sold off incrementally following the same process.

Bid, Ask and Mid Prices

The index captures the real-time bid/ask prices of both VIX futures contracts, and calculates mid prices as follows:

$$mid = \frac{bid + ask}{2} \tag{4}$$

The index processes the real-time bid and ask prices as follows:

- If a quote only has a bid price, default ask to the bid price. If a quote only has an ask price, default bid to the ask price. In other words, if the index receives a one-sided quote, it assumes bid = ask = mid.

- Valid bid/ask quotes must satisfy the following criteria:

  o The bid must be greater than 0.

  o The ask must be greater than or equal to the bid.

  o The bid/ask spread, calculated as per below, must be less than or equal to 5%.

$$spread = \frac{ask - bid}{ask} \tag{5}$$

Real Time Excess Return

The excess return is calculated using mid prices throughout the day.

For the S&P 500 VIX Short-Term Futures Spread Adjusted Index, the real time excess return is calculated as:

$$ER_t = \frac{\sum_{i=1}^{2} W_{i,t-1} * mid_{i,t}}{\sum_{i=1}^{2} W_{i,t-1} * mid_{i,t-1}} - 1 \tag{6a}$$

where:

$W_{i,t-1}$ = Weight of the ith month futures on day t-1.

$mid_{1,t-1}$, $mid_{1,t}$ = Mid price of the first month futures on day t-1 and t, respectively.

$mid_{2,t-1}$, $mid_{1,t}$ = Mid price of the second month futures on day t-1 and t, respectively.

For the S&P 500 VIX Short-Term Futures Inverse Daily Spread Adjusted Index, the real time excess return is calculated as:

$$ER_t = 1 - \frac{\sum\limits_{i=1}^{2} W_{i,t-1} * mid_{i,t}}{\sum\limits_{i=1}^{2} W_{i,t-1} * mid_{i,t-1}}_{\;2,t-1} \qquad (6b)$$

where:

$W_{i,t-1}$ = Weight of the ith month futures on day t-1.

$mid_{1,t-1}, mid_{1,t}$ = Mid price of the first month futures on day t-1 and t, respectively.

$mid_{2,t-1}, mid_{1,t}$ = Mid price of the second month futures on day t-1 and t, respectively.

At any time during the day when the index does not have valid bid or ask prices on either futures contract, the index value stays unchanged.

End of Day Excess Return

Index calculation stops at 04:00 PM ET on any day the index is calculated. At this time, the index takes the most recent snapshot of the valid bid and ask prices, as described above, and calculates the end-of-day excess return.

For the S&P 500 VIX Short-Term Futures Spread Adjusted Index, the end-of-day excess return is calculated as:

$$ER_t = \frac{\sum\limits_{i=1}^{2} W_{i,t-1} * mid_{i,t} - \Delta W_t * (mid_{1,t} - bid_{1,t}) - \Delta W_t * (ask_{2,t} - mid_{2,t})}{\sum\limits_{i=1}^{2} W_{i,t-1} * mid_{i,t-1}} - 1 \qquad (7a)$$

where:

$W_{i,t-1}$ = Weight of the ith month futures on day t-1.

$mid_{1,t-1}, mid_{1,t}$ = Mid price of the first month futures on day t-1 and t, respectively.

$mid_{2,t-1}, mid_{1,t}$ = Mid price of the second month futures on day t-1 and t, respectively.

$bid_{1,t}$ = Bid price of the first month futures on day t.

$ask_{2,t}$ = Ask price of the second month futures on day t.

For the S&P 500 VIX Short-Term Futures Inverse Daily Spread Adjusted Index, the end-of-day excess return is calculated as:

$$ER_t = 1 - \frac{\sum\limits_{i=1}^{2} W_{i,t-1} * mid_{i,t} + \Delta W_t * (ask_{1,t} - mid_{1,t}) + \Delta W_t * (mid_{2,t} - bid_{2,t})}{\sum\limits_{i=1}^{2} W_{i,t-1} * mid_{i,t-1}} \qquad (7b)$$

where:

$W_{i,t-1}$ = Weight of the ith month futures on day t-1.

$mid_{1,t-1}, mid_{1,t}$ = Mid price of the first month futures on day t-1 and t, respectively.

$mid_{2,t-1}$, $mid_{1,t}$ = Mid price of the second month futures on day t-1 and t, respectively.

$ask_{1,t}$ = Ask price of the first month futures on day t.

$bid_{2,t}$ = Bid price of the second month futures on day t.

ΔW_t = Weight that is rolled on day t, calculated as:

$$\Delta W_t = W_{2,t} - W_{2,t-1}$$ (8)

For the avoidance of doubt, on the business day subsequently following the last trade date of the first month futures:

- subscript 2 and subscript 1 in all the formulas above are re-set, and

ΔW_t equals the weight that is rolled to the new second month futures.

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