Cboe Global Indices

Cboe S&P 500 15% WHT Buffer Protect Indices

METHODOLOGY

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1 Introduction

This document provides a transparent and easily accessible view of the methodology used to calculate the Cboe S&P 500 Annual 15% Buffer Protect Index (SPBFA), the Cboe S&P 500 15% WHT Annual 30% (-5% to -35%) Buffer Protect Index (SPBSA), the Cboe S&P 500 15% WHT Quarterly 5% Buffer Protect Index (SPBFQ) and the Cboe S&P 500 15% WHT Quarterly 9% (-3% to -12%) Buffer Protect Index (SPBNQ), collectively referred to in this document as "the Cboe S&P 500 15% WHT Buffer Protect Indices" or "the Indices".

1.1 Index Objective

The index objectives of the Indices covered by this document are as follows:

- The **Cboe S&P 500 Annual 15% Buffer Protect Index (SPBFA)** is designed to track the performance of a long exposure to the S&P 500 Index ("SPX Index") and a long S&P 500 Option ("SPX Option") put spread vs. short call expiring annually on the last business day of December. The strike prices of the put spread are 100% and 85% of the closing SPX price. The Index aims to provide protection against up to a 15% decline in the S&P 500 Index while providing participation up to a capped level.

  The **Cboe S&P 500 15% WHT Annual 30% (-5% to -35%) Buffer Protect Index (SPBSA)** is designed to track the performance of a long exposure to the S&P 500 Index ("SPX Index") and a long S&P 500 Option ("SPX Option") put spread vs. short call expiring annually on the last business day of December. The strike prices of the put spread are 95% and 65% of the closing SPX price. The Index aims to provide protection against a 5% to 35% decline in the S&P 500 Index while providing participation up to a capped level.

- The **Cboe S&P 500 15% WHT Quarterly 5% Buffer Protect Index (SPBFQ)** is designed to track the performance of a long exposure to the S&P 500 NTR (15%) (SPX15UN) and a long S&P 500 Index (SPX) put spread vs. short call expiring quarterly on the last business day of March, June, September, and December. The strategy aims to provide protection against losses in the long exposure to the S&P 500 NTR (15%) while providing participation up to a capped level. The strike prices of the put spread are 100% and 95% of the closing SPX price, targeting protection against up to a 5% decline in the S&P 500 Index.

- The **Cboe S&P 500 15% WHT Quarterly 9% (-3% to -12%) Buffer Protect Index (SPBNQ)** is designed to track the performance of a long exposure to the S&P 500 NTR (15%) (SPX15UN) and a long S&P 500 Index (SPX) put spread vs. short call expiring quarterly on the last business day of March, June, September, and December. The strategy aims to provide protection against losses in the long exposure to the S&P 500 NTR (15%) while providing participation up to a capped level. The strike prices of the put spread are 97% and 88% of the closing SPX price, targeting protection against a 3% to 12% decline in the S&P 500 Index.

1.2 Supporting Documentation

This Methodology should be read in conjunction with the following documents:

Cboe_Index_Policies_Practices

Cboe_TPS_Policies_Practices

2 Index Construction

The Cboe S&P 500 15% WHT Buffer Protect Indices are total return indices and the calculation is unit-based.

2.1 Index Constituents

2.1.1. SPBSA and SPBFA

The Indices consist of a hypothetical portfolio containing a long position in the S&P 500 Index, and three option components whose strike price and expiration date will be set on the roll date relative to the last reported value of the S&P 500 Index prior to 4:00 p.m. ET, as specified in section 2.2. The strike of the call is determined such that the net premium of the long put spread vs. short call is equal to the dividends paid on the component stocks underlying the S&P 500 Index in the preceding year accrued at 85%.

Type	Position	Ticker	Underlying Name	Option Expiration	Option Type
Index	Long	SPX	S&P 500	n/a	n/a
Option	Long	SPX	S&P 500	Annually	Put
Option	Short	SPX	S&P 500	Annually	Put
Option	Short	SPX	S&P 500	Annually	Call

On the initial roll date of each Index, the S&P 500 Index position and the S&P 500 Option positions are entered simultaneously. The options are valued as European-style options that are held to expiration and settled on the last business day of December.
Dividends paid on the component stocks underlying the S&P 500 Index are reflected in a cash account at 85% to reflect withholding tax ("WHT") considerations.

2.1.2. SPBFQ and SPBNQ

The Indices consist of a hypothetical portfolio containing a long position in the S&P 500 NTR (15%) (SPX15UN), and three option components. The strikes of the put spread are determined by percent difference from the closing price of the S&P 500 Index (see section 2.2). For both Indices, the strike of the call is determined such that the net premium of the long put spread vs. short call combo is equal to zero.

Type	Position	Ticker	Underlying Name	Option Expiration	Option Type
Index	Long	SPX15UN	S&P 500 NTR (15%)	n/a	n/a
Option	Long	SPX	S&P 500	Quarterly	Put
Option	Short	SPX	S&P 500	Quarterly	Put
Option	Short	SPX	S&P 500	Quarterly	Call

On the initial roll date of each Index, the long S&P 500 NTR (15%) position and the S&P 500 Option positions are entered simultaneously. The options are valued as European-style options that are held to expiration and settled on the last business day of each quarter.
Dividends paid on the component stocks underlying the S&P 500 NTR (15%) are re-invested into the S&P 500 NTR (15%) at 85% for withholding tax considerations.

2.2 Index Rebalance

Rebalances are performed according to the following table.

Index Name	Index Ticker	Roll Date	Strike Determination	Strike Price Selection	Unit Determination
Cboe S&P 500 Annual 15% Buffer Protect Index	SPBFA	Business day when the end of month option expiry date occurs in December	Roll Date	Long put: 100% * 4:00pm ET S&P 500 Short put: 85% * 4:00pm ET S&P 500 Short call: Determined on roll date (refer to section 3.1.2)	Roll Date
Cboe S&P 500 Annual 30% (-5% to -35%) Buffer Protect Index	SPBSA	Business day when the end of month option expiry date occurs in December	Roll Date	Long put: 95% * 4:00pm ET S&P 500 Short put: 65% * 4:00pm ET S&P 500 Short call: Determined on roll date (refer to section 3.1.2)	Roll Date
Cboe S&P 500 15% WHT Quarterly 5% Buffer Protect Index	SPBFQ	Business day when the end of month option expiry date occurs in March, June, September, and December	Roll Date	Long put: 100% * 4:00pm ET S&P 500 value Short put: 95% * closing price S&P 500 Short call: Determined on roll date (refer to section 3.2.2)	Roll Date
Cboe S&P 500 15% WHT Quarterly 9% (-3% to -12%) Buffer Protect Index	SPBNQ	Business day when the end of month option expiry date occurs in March, June, September, and December	Roll Date	Long put: 97% * 4:00pm ET S&P 500 value Short put: 88% * closing price S&P 500 Short call: Determined on roll date (refer to section 3.2.2)	Roll Date

2.3 Options Pricing

2.3.1. Options Pricing in SPBFA and SPBSA

The option prices used in the calculation of the Indices are theoretical values generated using Cboe Hanweck Options Analytics theoretical prices as a primary source as described in the Cboe_TPS_Policies_Practices[1].

The option premiums used to calculate the call strike and value the Indices on roll days are the theoretical values of the selected options based on the last value of the underlying index prior to 4:00 p.m. ET and an implied volatility surface from listed SPX options prices. Valuations are then calculated for the theoretical options at 4:00 p.m. ET.

The option premiums used to value the Indices on non-roll days are the theoretical values of the selected options based on the last value of the underlying index prior to 4:00 p.m. ET. Valuations are then calculated for the theoretical options at 4:00 p.m. ET.

CGI applies transaction costs to the option prices used in the call strike calculation based on the Vega of the options. The value of the Vega charges per option will be calculated as the Black's Vega of each option multiplied

[1] *For the backtest, Cboe's legacy Theoretical Options Pricing Model was used for the valuation of theoretical options.*

by the determined Volatility Spread. The Vega charges are added to any purchased option price and subtracted from any written option price. No Vega adjustments to the option prices are made on non-roll dates.

2.3.2. Options Pricing in SPBFQ and SPBNQ

The option prices used in the calculation of the Indices are theoretical values generated using Cboe Hanweck Options Analytics theoretical prices as a primary source as described in the Cboe_TPS_Policies_Practices[2].

The option premiums used to calculate the call strike and value the Indices on roll days are the theoretical values of the selected options based on the last value of the S&P 500 prior to 4:00 p.m. ET and an implied volatility surface from listed SPX options prices. Valuations are then calculated for the theoretical options at 4:00 p.m. ET.

The option premiums used to value the Indices on non-roll days are the theoretical values of the selected options based on the last value of the S&P 500 and other model parameters prior to 4:00 p.m. ET. Valuations are then calculated for the theoretical options at 4:00 p.m. ET.

CGI applies transaction costs to the option prices used in the call strike calculation based on the Vega of the options. The value of the Vega charges per option will be calculated as the Black's Vega of each option multiplied by the determined Volatility Spread. The Vega charges are added to any purchased option price and subtracted from any written option price. No Vega adjustments to the option prices are made on non-roll dates.

[2] *End-of-day back-tested index levels prior to the launch date utilized theoretical option prices created with a volatility surface constructed in accordance with the Cboe_European-Style_Option_ Implied_Volatility_Calculation_ Methodology.pdf. From the launch date until December 13, 2024, option prices used in the end-of-day calculations were using Cboe Hanweck Options Analytics theoretical prices as primary source, and option prices used in the intraday calculations were generated using a volatility surface constructed in accordance with the Cboe_European-Style_Option_ Implied_Volatility_Calculation_ Methodology.pdf.*

3 Index Calculations

3.1 Index Calculations SPBSA and SPBFA

The Indices are calculated according to the following formula:

$$Index_t = Equity_t + (Option_t + Cash_t - Cost_t) * Unit_{t-1}$$

where:

- $Index_t$ is the level of the Index on day t;
- $Equity_t$ is the equity part of the Index on day t;
- $Option_t$ is the Option part of the Index on day t;
- $Cash_t$ is the Cash part of the Index on day t;
- $Cost_t$ is the value of any Index costs on day t; and
- $Unit_{t-1}$ is the unit amount on date t-1 determined on the previous roll date.

3.1.1 Non-Roll Date Calculations

The non-roll date value of the $Equity_t$, $Option_t$ and $Cash_t$ are calculated as:

$$Equity_t = Unit_{t-1} * S_t$$

$$Option_t = OptPortfolioVal_t$$

$$Cash_t = Cash_{t-1} * (1 + r_{t-1} * \frac{Ndays}{360}) + Unit_{t-1} * Div_t * 0.85$$

$$Cost_t = 0$$

$$OptPortfolioVal_t = PchsdPutOpt_t - WrtnPutOpt_t - WrtnCallOpt_t$$

where:

- S_t is the value of the S&P 500 Index on date t, prior 4:00pm ET. For intraday calculations, the current reported value of the S&P 500 Index is used;
- $Cash_{t-1}$ is the value of the cash account on day t-1;
- r_{t-1} is the 1 year maturity of a Secured Overnight Financing Rate (SOFR) based curve[3] on day t-1;
- *Ndays* is the number of calendar days between day t and the previous trading day;
- Div_t represents the ordinary cash dividends payable on the component stocks underlying the S&P 500 Index that trade "ex-dividend" at date t expressed in S&P 500 Index points;
- $OptPortfolioVal_t$ is the net value of the option component on day t;
- $PchsdPutOpt_t$ is the closing value of the purchased put option on day t;

[3] *The Secured Overnight Financing Rate (SOFR) based curve is sourced from Eris Innovations, LLC.*

- $WrtnPutOpt_t$ is the closing value of the written put option on day t; and
- $WrtnCallOpt_t$ is the closing value of the written call option on day t.

3.1.2. Roll Date Calculations

On the roll date the cash account is used to partially offset the cost of the put spread. The roll date value of the $Equity_t$, $Option_t$ and $Cash_t$ are calculated as:

$$Equity_t = Unit_{t-1} * S_t + OptPortfolioVal_{settle} * Unit_{t-1}$$

$$Option_t = OptPortfolioVal_{roll} + NewOptionPortfolioCost_{roll}$$

$$Cash_t = 0$$

$$Cost_t = NewOptionPortfolioCost_{roll}$$

$$Unit_t = \frac{Index_t}{S_t}$$

$$OptPortfolioVal_{settle} = PchsdPutOpt_{expy} - WrtnPutOpt_{expy} - WrtnCallOpt_{expy}$$

$$OptPortfolioVal_{roll} = PchsdPutOpt_{roll} - WrtnPutOpt_{roll} - WrtnCallOpt_{roll}$$

where:

- $OptPortfolioVal_{settle}$ is the net value of the option component expiring on the roll date;
- $PchsdPutOpt_{expy}$ is calculated as the greater of 0 or the expiring purchased put strike minus S_t;
- $WrtnPutOpt_{expy}$ is calculated as the greater of 0 or the expiring written put strike minus S_t;
- $WrtnCallOpt_{expy}$ is calculated as the greater of 0 or S_t minus the expiring written call strike;
- $OptPortfolioVal_{roll}$ is the net value of the new option components entered on the roll date;
- $PchsdPutOpt_{roll}$ is the value of the new purchased put with strike equal to 100% of S_t for the 15% Buffer Index (SPBFA), and 95% of S_t for the 30% (-5% to -35%) Buffer Index (SPBSA);
- $WrtnPutOpt_{roll}$ is the value of the new written put with strike equal to 85% of S_t for the 15% Buffer Index (SPBFA), and 65% of S_t for the 30% (-5% to -35%) Buffer Index (SPBSA); and
- $WrtnCallOpt_{roll}$ is the value of the new written call option with strike determined by the below method.

The strike of the Written Call Option is calculated such that the following holds true on the roll date[4]:

$$VegaAdjWrtnCallOpt_{roll} = PchsdPutOpt_{roll} - WrtnPutOpt_{roll} - \frac{Cash_{t_4pm}}{Unit_{t-1}} + VegaChgPutSpr$$

$$Cash_{t_4pm} = Cash_{t-1} * (1 + r_{t-1} * \frac{Ndays}{360}) + Unit_{t-1} * Div_t * 0.85$$

[4] *The Vega and Implied Volatility values are sourced from Cboe Hanweck Options Analytics.*

$$WrtnCallOpt_{roll} = VegaAdjWrtnCallOpt_{roll} + VegaChgWrtnCall$$

$$VegaChgPutSpr = VolSpread_{Put} * (VegaPchsdPut - VegaWrtnPut);$$

$$VegaChgWrtnCall = VolSpread_{Call} * VegaWrtnCall$$

$$VolSpread_{Put} = Min(2, Max\left(0.5 + (IV_{PutSpread} - 0.1) * \frac{(2 - 0.5)}{(0.45 - 0.1)}, 0.5\right))$$

$$VolSpread_{Call} = Min(2, Max\left(0.5 + (IV_{Call} - 0.1) * \frac{(2 - 0.5)}{(0.45 - 0.1)}, 0.5\right))$$

$$NewOptionPortfolioCost_{roll} = VegaChgWrtnCall + VegaChgPutSpr$$

where:

- $IV_{PutSpread}$ is the average of the implied volatilities of the purchased put and written put;
- IV_{Call} is the implied volatility of the written call;
- $VegaAdjWrtnCallOpt_{roll}$ is the value of the new written call option after applying Vega charges;
- $VegaPchsdPut$ is the Black-Scholes Vega of the purchased put;
- $VegaWrtnPut$ is the Black-Scholes Vega of the written put; and
- $VegaWrtnCall$ is the Black-Scholes Vega of the written call.

The value of Vega charges per option will be calculated as the Black-Scholes Vega of each option multiplied by the $VolSpread$. The Volatility Spread for the put spread is determined using the average of the implied volatilities of the purchased put and written put.

To determine the strike of the Written Call Option, Cboe Global Indices uses the Cboe_TPS_Policies_Practices. The strike level is calculated by equating the Model Price adjusted for the Vega charges to the calculated VegaAdjWrtnCallOpt price in the section above. For each strike,

$$|(Model\ Price_i - VegaChgWrtnCallModel_i) - VegaAdjWrtnCallOpt_{roll}| < Tolerance$$

where:

- $Tolerance$ = 0.01;
- $Model\ Price$ is the theoretical value of the option calculated as noted in Section 2.3;
- $VegaChgWrtnCallModel$ is the vega charge calculated using Black-Scholes Vega of the call option and the $VolSpread_{Call}$ formula.

3.1.3 Intraday Calculations

Intraday calculations proceed identically to non-roll date calculations using the last traded price of the S&P 500 Index and the model prices of the options given the updated SPX Index level and volatility surface.

3.2 Index Calculations SPBFQ and SPBNQ

The Indices are calculated according to the following formula:

$$Index_t = Equity_t + (Option_t - Cost_t) * Unit_{t-1}$$

where:

- $Index_t$ is the level of the Index on day t;
- $Equity_t$ is the equity part of the Index on day t;
- $Option_t$ is the Option part of the index;
- $Cost_t$ is the value of any index costs on day t; and
- $Unit_{t-1}$ is the unit amount on date t-1 determined on the previous roll date.

3.2.1 Non-Roll Date Calculations

The non-roll date value of the $Equity_t$ and $Option_t$ are calculated as:

$$Equity_t = EqUnit_{t-1} * Idx_t$$

$$Option_t = OptPortfolioVal_t$$

$$OptPortfolioVal_t = PchsdPutOpt_t - WrtnPutOpt_t - WrtnCallOpt_t$$

$$Cost_t = 0$$

where:

- $EqUnit_{t-1}$ is the adjustment factor for Equity notional on date t-1, equal to the ratio between the Buffer Protect Index and the underlying S&P 500 15% NTR Index on the previous roll;
- Idx_t is the closing value of the corresponding S&P 500 15% NTR Index on date t. For intraday calculations, the current reported value of the S&P 500 15% NTR Index is used;
- $Unit_{t-1}$ is the adjustment factor for notional on date t-1 determined on the previous roll date;
- $OptPortfolioVal_t$ is the net value of the option component on day t;
- $PchsdPutOpt_t$ is the closing value of the purchased put option on day t;
- $WrtnPutOpt_t$ is the closing value of the written put option on day t; and
- $WrtnCallOpt_t$ is the closing value of the written call option on day t.

3.2.2 Roll Date Calculations

The roll date value of the $Equity_t$ and $Option_t$ are calculated as:

$$Equity_t = EqUnit_{t-1} * Idx_t + OptPortfolioVal_{settle} * Unit_{t-1}$$

$$Option_t = OptPortfolioVal_{roll} + Cost_t$$

$$Cost_t = NewOptionPortfolioCost_{roll}$$

$$Unit_t = \frac{Index_t}{SPX_t}$$

$$EqUnit_t = \frac{Index_t}{Idx_t}$$

$$OptPortfolioVal_{settle} = PchsdPutOpt_{expy} - WrtnPutOpt_{expy} - WrtnCallOpt_{expy}$$

$$OptPortfolioVal_{roll} = PchsdPutOpt_{roll} - WrtnPutOpt_{roll} - WrtnCallOpt_{roll}$$

where:

- $Index_t$ is the last calculated value of the Index prior to 4:00 p.m. ET on day t;
- SPX_t is the last reported value of the S&P 500 Index prior to 4:00 p.m. ET on day t;
- Idx_t is the last reported value of the S&P 500 15% NTR Index prior to 4:00 p.m. ET on date t;
- $OptPortfolioVal_{settle}$ is the net value of the option component expiring on the roll date;
- $PchsdPutOpt_{expy}$ is calculated as the greater of 0 or the expiring purchased put strike minus SPX_t;
- $WrtnPutOpt_{expy}$ is calculated as the greater of 0 or the expiring written put strike minus SPX_t;
- $WrtnCallOpt_{expy}$ is calculated as the greater of 0 or SPX_t minus the expiring written call strike;
- $OptPortfolioVal_{roll}$ is the net value of the new option components entered on the roll date;
- $PchsdPutOpt_{roll}$ is the value of the new purchased put with strike equal to 100% of SPX_t for the 5% Buffer Index (SPBFQ), and 97% of SPX_t for the 9% (-3% to -12%) Buffer Index (SPBNQ);
- $WrtnPutOpt_{roll}$ is the value of the new written put with strike equal to 95% of SPX_t for the 5% Buffer Index (SPBFQ), and 88% of SPX_t for the 9% (-3% to -12%) Buffer Index (SPBNQ);
- $WrtnCallOpt_{roll}$ is the value of the new written call option with strike determined by the below method.

The strike of the Written Call Option is calculated such that the following holds true on the roll date:

$$VegaAdjWrtnCallOpt_{roll} = PchsdPutOpt_{roll} - WrtnPutOpt_{roll} + VegaChgPutSpr$$

$$WrtnCallOpt_{roll} = VegaAdjWrtnCallOpt_{roll} + VegaChgWrtnCall$$

$$VegaChgPutSpr = VolSpread_{Put} * (VegaPchsdPut - VegaWrtnPut)$$

$$VegaChgWrtnCall = VolSpread_{Call} * VegaWrtnCall$$

$$VolSpread_{Put} = Min\left(2, Max\left(0.5 + (IV_{PutSpread} - 0.1) * \frac{(2 - 0.5)}{(0.45 - 0.1)}, 0.5\right)\right)$$

$$VolSpread_{Call} = Min\left(2, Max\left(0.5 + (IV_{Call} - 0.1) * \frac{(2 - 0.5)}{(0.45 - 0.1)}, 0.5\right)\right)$$

$$NewOptionPortfolioCost_{roll} = VegaChgWrtnCall + VegaChgPutSpr$$

where:

- $IV_{PutSpread}$ is the average of the implied volatilities of the purchased put and written put;
- IV_{Call} is the implied volatility of the written call;
- $VegaAdjWrtnCallOpt_{roll}$ is the value of the new written call option after applying Vega charges;
- $VegaPchsdPut$ is the Black-Scholes Vega of the purchased put;
- $VegaWrtnPut$ is the Black-Scholes Vega of the written put;
- $VegaWrtnCall$ is the Black-Scholes Vega of the written call.

The value of Vega charges per option will be calculated as the Black-Scholes Vega of each option multiplied by the $VolSpread$. The Volatility Spread for the put spread is determined using the average of the implied volatilities of the purchased put and written put.

To determine the strike of the Written Call Option, Cboe Global Indices uses the Cboe_TPS_Policies_Practices. The strike level is calculated by equating the Model Price adjusted for the Vega charges to the calculated VegaAdjWrtnCallOpt price in the section above. For each strike,

$$|(Model\ Price_i - VegaChgWrtnCallModel_i) - VegaAdjWrtnCallOpt_{roll}\ | < Tolerance$$

where:

- $Tolerance$ = 0.01;
- $Model\ Price$ is the theoretical value of the option calculated as noted in Section 2.1;
- $VegaChgWrtnCallModel$ is the vega charge calculated using Black-Scholes Vega of the call option.

3.2.3 Intraday Calculations

Intraday calculations proceed identically to non-roll date calculations using the last traded price of the SPX15UN Index and the model prices of the options given the updated SPX underlying price level and volatility surface.

4 Calculation and Dissemination

The Cboe S&P 500 15% WHT Buffer Protect Indices are calculated and disseminated as follows on each Business Day during Cboe RTH.

Index Name	Index Ticker	Dissemination Frequency	Dissemination Hours
Cboe S&P 500 Annual 15% Buffer Protect Index	SPBFA	15 Seconds	Between 9:31 a.m. and 4:00 p.m. ET
Cboe S&P 500 Annual 30% (-5% to -35%) Buffer Protect Index	SPBSA	15 Seconds	Between 9:31 a.m. and 4:00 p.m. ET

Cboe S&P 500 Quarterly 5% Buffer Protect Index	SPBFQ	15 seconds	Between 9:31 a.m. and 4:15 p.m. ET
Cboe S&P 500 Quarterly 9% (-3% to -12%) Buffer Protect Index	SPBNQ	15 seconds	Between 9:31 a.m. and 4:15 p.m. ET

A Business Day is defined as a day when the Cboe Options Exchanges are open for the Cboe Regular Trading Hours (RTH) session. The Indices follow the Cboe Options Exchange holiday schedule.

5 Index Information

Index Name	Index Ticker	Base Date	Launch Date	Base Value	Currency
Cboe S&P 500 Annual 15% Buffer Protect Index[5]	SPBFA	December 29, 2006	October 16, 2023	1000	USD
Cboe S&P 500 Annual 30% (-5% to -35%) Buffer Protect Index[5]	SPBSA	December 29, 2006	October 16, 2023	1000	USD
Cboe S&P 500 Quarterly 5% Buffer Protect Index	SPBFQ	June 29, 2006	December 29, 2022	1000	USD
Cboe S&P 500 Quarterly 9% (-3% to -12%) Buffer Protect Index	SPBNQ	June 29, 2006	December 29, 2022	1000	USD

6 Appendix 1 – Changes

Major changes described in this document since December 29, 2022 are as follows:

Change Summary	Effective Date	Previous Language	Updated Language
Modification to the Theoretical Options Pricing Source for SPBFQ and SPBNQ	December 13, 2024	The option prices used in the end-of-day[1] calculation of the Indices are theoretical values generated using Cboe Hanweck Options Analytics theoretical prices as a primary source as described in the Cboe TPS Policies & Practices Methodology. The option prices used in the intraday calculation of the Indices are theoretical values generated using a volatility surface constructed in accordance with the Cboe European-Style Options Implied Volatility Calculation Methodology. The option premiums used to calculate the call strike and value the Indices on roll days are the theoretical values of the selected options based on the last value of the underlying index prior to 4:00 p.m. ET and an	The option prices used in the calculation of the Indices are theoretical values generated using Cboe Hanweck Options Analytics theoretical prices as a primary source as described in the Cboe_TPS_Policies_Practices[1]. The option premiums used to calculate the call strike and value the Indices on roll days are the theoretical values of the selected options based on the last value of the S&P 500 prior to 4:00 p.m. ET and an implied volatility surface from listed SPX options prices. Valuations are then calculated for the theoretical options at 4:00 p.m. ET. The option premiums used to value the Indices on non-roll days are the theoretical values of the selected options based on the last value of the

[5] *End-of-day back-tested index levels prior to the launch date is based on closing data of the underlying components as of 4:15pm ET.*

Change Summary	Effective Date	Previous Language	Updated Language
		implied volatility surface from listed SPX options prices. Valuations are then calculated for the theoretical options at 4:00 p.m. ET. The option premiums used to value the Indices on non-roll days are the theoretical values of the selected options based on the last value of the underlying index prior to 4:00 p.m. ET. Valuations are then calculated for the theoretical options at 4:00 p.m. ET. [1] *End-of-day back-tested index levels prior to the launch date utilized theoretical option prices created with a volatility surface constructed in accordance with the Cboe_European-Style_Option_Implied_Volatility_Calculation_Methodology.pdf.*	S&P 500 and other model parameters prior to 4:00 p.m. ET. Valuations are then calculated for the theoretical options at 4:00 p.m. ET. [1] *End-of-day back-tested index levels prior to the launch date utilized theoretical option prices created with a volatility surface constructed in accordance with the Cboe_European-Style_Option_Implied_Volatility_Calculation_Methodology.pdf. From the launch date until <effective date>, option prices used in the end-of-day calculations were using Cboe Hanweck Options Analytics theoretical prices as primary source, and option prices used in the intraday calculations were generated using a volatility surface constructed in accordance with the Cboe_European-Style_Option_Implied_Volatility_Calculation_Methodology.pdf.*
Modification to Options Pricing Snap Time on Non-Roll Days for SPBFQ and SPBNQ	May 20, 2024	2.1 Options Pricing The option prices used in the end-of-day* calculation of the Indices are theoretical values generated using Cboe Hanweck Options Analytics theoretical prices as a primary source as described in the Cboe TPS Policies & Practices Methodology. The option prices used in the intraday calculation of the Indices are theoretical values generated using a volatility surface constructed in accordance with the Cboe European-Style Options Implied Volatility Calculation Methodology. **End-of-day back-tested index levels prior to the launch date utilized theoretical option prices created with a volatility surface constructed in accordance with the Cboe European-Style Options Implied Volatility Calculation Methodology.*	2.1 Options Pricing The option prices used in the end-of-day* calculation of the Indices are theoretical values generated using Cboe Hanweck Options Analytics theoretical prices as a primary source as described in the Cboe TPS Policies & Practices Methodology. The option prices used in the intraday calculation of the Indices are theoretical values generated using a volatility surface constructed in accordance with the Cboe European-Style Options Implied Volatility Calculation Methodology. The option premiums used to calculate the call strike and value the Indices on roll days are the theoretical values of the selected options based on the last value of the underlying index prior to 4:00 p.m. ET and an implied volatility surface from listed SPX options prices. Valuations are then calculated for the theoretical options at 4:00 p.m. ET.

Change Summary	Effective Date	Previous Language	Updated Language
			The option premiums used to value the Indices on non-roll days are the theoretical values of the selected options based on the last value of the underlying index prior to 4:00 p.m. ET. Valuations are then calculated for the theoretical options at 4:00 p.m. ET. **End-of-day back-tested index levels prior to the launch date utilized theoretical option prices created with a volatility surface constructed in accordance with the Cboe European-Style Options Implied Volatility Calculation Methodology.*
Modification to the Options Pricing section to reflect the pricing methodologies used in the end-of-day and intraday calculations for SPBFQ and SPBNQ	December 20, 2023	2.1 Options Pricing The option prices used in the calculation of the Indices are theoretical values generated using a volatility surface constructed in accordance with the Cboe European-Style Options Implied Volatility Calculation Methodology. The option premiums used to value the Indices and to calculate the call strike on the roll date are the theoretical values of the selected options based on the closing price of the underlying index and an implied volatility surface from listed SPX options prices by applying the spline method for interpolation and the SABR model for extrapolation. The spline interpolation is a form of interpolation where the interpolant is a piecewise-defined function by polynomials. The SABR model is a stochastic volatility model, which attempts to capture the volatility smile in derivatives markets. The name stands for "stochastic alpha, beta, rho", referring to the parameters of the model, introduced by Hagan et al., as an attempt to model the volatility surface and capture the empirically observed	2.1 Options Pricing The option prices used in the end-of-day* calculation of the Indices are theoretical values generated using Cboe Hanweck Options Analytics theoretical prices as a primary source as described in the Cboe TPS Policies & Practices Methodology. The option prices used in the intraday calculation of the Indices are theoretical values generated using a volatility surface constructed in accordance with the Cboe European-Style Options Implied Volatility Calculation Methodology. *End-of-day back-tested index levels prior to the launch date utilized theoretical option prices created with a volatility surface constructed in accordance with the Cboe European-Style Options Implied Volatility Calculation Methodology.

Change Summary	Effective Date	Previous Language	Updated Language
		dynamic behavior of the smile. Valuations are then calculated for the theoretical options on the roll dates and at 4:15 p.m. ET each trading date.	
Changes in Timing for the Unit Determination and in the Calculation of Costs for SPBFQ and SPBNQ	September 29, 2023	• Units are determined based on the levels of the S&P 500 Index and S&P 500 NTR (15%) Index from the day prior to the roll date. • Cost calculation with bucketed approach.	• Units are determined based on the levels of the S&P 500 Index and S&P 500 NTR (15%) Index from the roll date (see section 3). • Cost calculation with linear interpolation (see section 3.2).
Clarification of the language in the Index Objectives for SPBFQ and SPBNQ	April 18, 2023	• The Cboe S&P 500 15% WHT Quarterly 5% Buffer Protect Index (SPBFQ) is designed to track the performance of a "long" exposure to the S&P 500 NTR (15%) (SPX15UN) and a long S&P 500 Index (SPX) put spread vs. short call expiring quarterly on the last business day of March, June, September, and December. The strike prices of the put spread are 100% and 95% of the closing SPX price to provide protection against losses of 5% due to a decline in the S&P 500 NTR (15%) while providing participation up to a capped level. • The Cboe S&P 500 15% WHT Quarterly 9% (-3% to -12%) Buffer Protect Index (SPBNQ) is designed to track the performance of a "long" exposure to the S&P 500 NTR (15%) (SPX15UN) and a long S&P 500 Index (SPX) put spread vs. short call expiring quarterly on the last business day of March, June, September, and December. The strike prices of the put spread are 97% and 88% of the closing SPX price to provide protection against losses of 3% to 12% due to a decline in the S&P 500 NTR (15%) while providing participation up to a capped level.	• The Cboe S&P 500 15% WHT Quarterly 5% Buffer Protect Index (SPBFQ) is designed to track the performance of a "long" exposure to the S&P 500 NTR (15%) (SPX15UN) and a long S&P 500 Index (SPX) put spread vs. short call expiring quarterly on the last business day of March, June, September, and December. The strategy aims to provide protection against losses in the "long" exposure to the S&P 500 NTR (15%) while providing participation up to a capped level. The strike prices of the put spread are 100% and 95% of the closing SPX price, targeting protection against up to a 5% decline in the S&P 500 Index. • The Cboe S&P 500 15% WHT Quarterly 9% (-3% to -12%) Buffer Protect Index (SPBNQ) is designed to track the performance of a "long" exposure to the S&P 500 NTR (15%) (SPX15UN) and a long S&P 500 Index (SPX) put spread vs. short call expiring quarterly on the last business day of March, June, September, and December. The strategy aims to provide protection against losses in the "long" exposure to the S&P 500 NTR (15%) while providing participation up to a capped level. The strike prices of the put spread are 97% and 88% of the closing SPX price, targeting protection against a 3% to 12% decline in the S&P 500 Index.

7 Appendix 2 – Document Information

Version Number[6]	2.1
Last Revised Date	March 14, 2025

[6] *Prior to July 12, 2024, the methodologies for the Cboe S&P 500 15% WHT Quarterly Buffer Protect Indices and Cboe S&P 500 15% WHT Annual Buffer Protect Indices were separately maintained.*

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