Cboe Global Indices

Cboe S&P Select Sector Half BuyWrite Indices

METHODOLOGY

Contents

1 Introduction

This document provides a transparent and easily accessible view of the methodology used to calculate the Cboe S&P Financial Select Sector Half BuyWrite Index (BXLFH), the Cboe S&P Health Care Select Sector Half BuyWrite Index (BXLVH), and the Cboe S&P Technology Select Sector Half BuyWrite Index (BXLKH), collectively referred to in this document as "the Indices".

1.1 Index Objective

The Cboe S&P Select Sector Half BuyWrite Indices follow an identical half-covered call strategy except they utilize different underlying Select Sector Indices and corresponding ETF call options in their calculations. The indices are half-covered meaning that the amount of written theoretical call options have a notional value of half the notional value of the long Select Sector Index position.

- The **Cboe S&P Financial Select Sector Half BuyWrite Index (BXLFH)** is designed to track the performance of a half-covered call strategy with long exposure to the S&P Financial Select Sector index (IXM) and a short Financial Select Sector SPDR ETF (XLF) Call option expiring monthly.
- The **Cboe S&P Health Care Select Sector Half BuyWrite Index (BXLVH)** is designed to track the performance of a half-covered call strategy with long exposure to the S&P Health Care Select Sector index (IXV) and a short Healthcare Select Sector SPDR ETF (XLV) Call option expiring monthly.
- The **Cboe S&P Technology Select Sector Half BuyWrite Index (BXLKH)** is designed to track the performance of a half-covered call strategy with long exposure to the S&P Technology Select Sector index (IXT) and a short Information Technology Select Sector SPDR ETF (XLK) Call option expiring monthly.

1.2 Supporting Documentation

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

Cboe_Index_Policies_Practices

Cboe_American_Style_Options_Implied_Volatility_Calculations_Methodology.pdf

2 Index Construction

BXLFH, BXLVH, and BXLKH are each total return indices that are rebalanced monthly, and the methodology is a unit-based calculation. Dividends paid on the component stocks underlying the relevant S&P 500 Select Sector Index and the dollar value of option premium deemed received from the sold call options are re-invested in the relevant half covered S&P 500 Select Sector Index portfolio.

2.1 Index Constituents

The Cboe S&P Select Sector Half BuyWrite Indices track a long position in the relevant underlying index and short position in a call option on the associated ETF. On the initial roll date of each Index, the long S&P 500 Sector Index position and the short at the money XLF, XLV, or XLK Call option position are entered simultaneously. The Indices are half-covered meaning that the amount of written theoretical call options have a notional value of half the notional value of the long Select Sector Index position.

The components of the Indices are listed below.

Index	Type	Position	Underlying Ticker	Underlying Name	Option Expiration	Option Type
Cboe S&P Financial Select Sector Half BuyWrite Index (BXLFH)	Index	Long	IXM	Financial Select Sector Index	n/a	n/a
	Option	Short	XLF	Financial Select Sector SPDR ETF	1 month	Call
Cboe S&P Technology Select Sector Half BuyWrite Index (BXLVH)	Index	Long	IXV	Health Care Select Sector Index	n/a	n/a
	Option	Short	XLV	Health Care Select Sector SPDR ETF	1 month	Call
Cboe S&P Health Care Select Sector Half BuyWrite Index (BXLKH)	Index	Long	IXT	Technology Select Sector Index	n/a	n/a
	Option	Short	XLK	Technology Select Sector SPDR ETF	1 month	Call

2.2 Index Rebalance

Rebalance timelines are performed according to the following table.

Index Name	Index Ticker	Roll Date	Strike Determination	Unit Determination
Cboe S&P Financial Select Sector Half BuyWrite Index	BXLFH	Business day prior to the standard monthly listed option expiry date occurs	Roll Date	Roll Date
Cboe S&P Health Care Select Sector Half BuyWrite Index	BXLVH	Business day prior to the standard monthly listed option expiry date occurs	Roll Date	Roll Date
Cboe S&P Technology Select Sector Half BuyWrite Index	BXLKH	Business day prior to the standard monthly listed option expiry date occurs	Roll Date	Roll Date

The expiring theoretical Call option is European-Style held until the day before its date of maturity and is liquidated at a price determined at 2:00 p.m. ET on the Roll Date (refer to section 3.2). The strike of the new theoretical Call option is the listed option strike closest to the VWAP of the corresponding ETF trade prices from 12:59 p.m. ET to 1:00 p.m. ET on the Roll Date. If no trades occur during this period, then the last mid-price (based on NBBO) of the ETF before 1:00 p.m. ET will be used. The option premium collected should be the theoretical value of the relevant Call option at 2:00 p.m. ET on the Roll Date. If the strikes have the same numerical difference from the VWAP of the ETF, the strike of the new call option with the higher strike is chosen.

2.3 Options Pricing

To value the component options that comprise the index, a model-based valuation is used. The model is constructed using an implied volatility surface from listed Select Sector SPDR ETF (XLF, XLV, or XLK) option prices by applying the spline method for interpolation and the SABR model for extrapolation. The model uses the mid prices of the listed Select Sector SPDR ETF options based on NBBO as inputs for the model. 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 dynamic behavior of the smile. Valuations are then calculated for the options on the roll dates and at 4:00 p.m. ET[1] each trading date. The option prices used in the calculation of this index are theoretical values generated using a volatility surface constructed in accordance with the Cboe_American_Style_Options_Implied_Volatility_Calculations_Methodology. And finally, Black-Scholes model is used to price the options as European-Style.

3 Index Calculations

Each Index is calculated according to the following formula:

$$Index_t = Equity_t + Option_t$$

where:

- $Index_t$ is the level of the Index on day t;
- $Equity_t$ is the equity part of the Index on day t; and
- $Option_t$ is Option and Cash part of the index.

3.1 Non-Roll Date Calculations

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

$$Equity_t = EqUnit_{t-1} * Equity_{t-1} * (Idx_t + Div_t)/Idx_{t-1}$$

$$Option_t = Option_{t-1} + Unit_{t-1} * (C_{t-1} - C_t)$$

where:

- $Equity_{t-1}$ is the equity part of the Index on date t-1;
- $EqUnit_{t-1}$ is the adjustment factor for Equity notional on date t-1, equal to 1;
- $Option_{t-1}$ is Option and Cash part of the index on date t-1;
- C_t is the theoretical price of the written call option on date t at 4:00 p.m. ET. For intraday calculations, the current theoretical price of the call option is used;
- C_{t-1} is the theoretical price of the written call option on date t-1 at 4:00 p.m. ET;

[1] *From the launch date up until January 5, 2024, valuations for the options were calculated using the mid prices of the listed Select Sector SPDR ETF options based on the National Bid and Best Offer (NBBO) as of 4:15 p.m. ET.*

- Idx_t is the closing value of the corresponding S&P 500 Select Sector Index on date t. For intraday calculations, the current reported value of the S&P 500 Select Sector Index is used;
- Idx_{t-1} is the closing value of the S&P 500 Select Sector Index on date t-1.
- $Unit_{t-1}$ is the adjustment factor for notional on date t-1;
- Div_t represents the ordinary cash dividends payable on the component stocks underlying the S&P 500 Select Sector Index that trade "ex-dividend" at date t

3.2 Roll Date Calculations

The intraday calculations on the roll date from the market open until 2:00 p.m. ET are calculated as:

$$Equity_t = EqUnit_{t-1} * Equity_{t-1} * (Idx_t + Div_t)/Idx_{t-1}$$

$$Option_t = Unit_{t-1} * (-C_{t\ old})$$

The $Unit_t$ calculation on the roll date is calculated at 1:00 p.m. ET as:

$$Unit_{t\ roll} = 0.5 * \frac{Equity_{t-1}}{ETF_{t-1}}$$

The intraday and closing calculations on the roll date from 2 p.m. ET to the market close are calculated as:

$$Equity_{t\ roll} = EqUnit_{t-1} * Equity_{t-1} * (Idx_t + Div_t)/Idx_{t-1}$$

$$Option_t = Unit_{t-1} * (-C_{t\ old}) + Unit_{t\ roll} * (-C_t)$$

$$Factor = (1 + \frac{Unit_{t\ roll} * C_{new} - Unit_{t-1} * C_{liq}}{Equity_{t\ roll} - Unit_{t\ roll} * C_t})$$

$$Equity_t = EqUnit_{t-1} * Equity_{t\ roll} * Factor$$

$$Unit_t = Unit_{t\ roll} * Factor$$

$$Option_{t\ close} = Unit_t * (-C_t)$$

$$Equity_{t\ close} = EqUnit_{t-1} * Equity_{t\ roll} * Factor$$

where:

- ETF_{t-1} is the primary listing exchange's closing value of the ETF at date t-1;
- $EqUnit_{t-1}$ is the adjustment factor for Equity notional on date t-1, equal to 1;

- $C_{t\ old}$ is the theoretical settlement value of the expiring call option on roll date. For intraday calculations, the current theoretical price of the call option is used;
- C_{new} is the theoretical price of the new Call option on the roll date at 2:00pm ET;
- C_{liq} is the theoretical price of the liquidated Call option on the roll date at a price determined at 2:00 p.m. ET;
- $Unit_{t\ roll}$ is the adjustment factor for notional calculated at 1:00pm ET on roll date;
- $Equity_{t\ roll}$ is the equity part of the Index calculated on roll date before adjusting for the "re-investment" of C_{vwap};
- $Option_{t\ close}$ is the theoretical price of the new written call option at the close of date t;
- $Equity_{t\ close}$ is the equity part of the Index at the close of date t;
- $Factor$ is the scaling factor that reflects the "re-investment" in the half covered S&P 500 Select Sector Index portfolio of the option premium deemed received from the sold call options;

4 Calculation and Dissemination

The Indices are calculated and disseminated as follows on each business day.

Index Name	Index Ticker	Dissemination Frequency	Dissemination Hours
Cboe S&P Financial Select Sector Half BuyWrite Index	BXLFH	10 Minutes	Between 9.30 a.m. and 5.30 p.m. ET
Cboe S&P Health Care Select Sector Half BuyWrite Index	BXLVH	10 Minutes	Between 9.30 a.m. and 5.30 p.m. ET
Cboe S&P Technology Select Sector Half BuyWrite Index	BXLKH	10 Minutes	Between 9.30 a.m. and 5.30 p.m. ET

A Business Day is defined as a day when the Cboe Exchanges are open for the Cboe Regular Trading Hours (RTH) session.

The Index follows the Cboe Options Exchange holiday schedule.

5 Index Information

Index Name	Index Ticker	Base Date	Launch Date	Base Value	Currency
Cboe S&P Financial Select Sector Half BuyWrite Index	BXLFH	January 20, 2005	September 28, 2022	1000	USD
Cboe S&P Health Care Select Sector Half BuyWrite Index	BXLVH	January 20, 2005	September 28, 2022	1000	USD
Cboe S&P Technology Select Sector Half BuyWrite Index	BXLKH	January 20, 2005	September 28, 2022	1000	USD

6 Appendix 1 – Material Changes

Material changes described in this document since September 28, 2022 are as follows:

Change Summary	Effective Date	Previous	Updated
Clarification on the snapshot timing for the underlying ETF prices used in the theoretical options pricing model	January 8, 2024	Valuations are then calculated for the options on the roll dates and at 4:00 p.m. ET each trading date. The option prices used in the calculation of this index are theoretical values generated using a volatility surface constructed in accordance with the Cboe American-Style Options Implied Volatility Calculation Methodology, which is available on Cboe's Governance website. And finally, Black-Scholes model is used to price the options as European-Style.	Valuations are then calculated for the options on the roll dates and at 4:00 p.m. ET[1] each trading date. The option prices used in the calculation of this index are theoretical values generated using a volatility surface constructed in accordance with the Cboe American-Style Options Implied Volatility Calculation Methodology, which is available on Cboe's Governance website. And finally, Black-Scholes model is used to price the options as European-Style. *[1] From the launch date up until January 5, 2024, valuations for the options were calculated using the mid prices of the listed Select Sector SPDR ETF options based on the National Bid and Best Offer (NBBO) as of 4:15 p.m. ET.*
Modification to the time the theoretical price of the liquidated call option is determined	May 18, 2023	The expiring theoretical Call option is European-Style held until the day before its date of maturity and is liquidated at a price determined at 4:00 p.m. ET on the Roll Date. **3.1.2 Roll Date Calculations** C_{liq} is the theoretical price of the liquidated Call option on the roll date at a price determined at 4:00 p.m. ET;	The expiring theoretical Call option is European-Style held until the day before its date of maturity and is liquidated at a price determined at 2:00 p.m. ET on the Roll Date. **3.1.2 Roll Date Calculations** C_{liq} is the theoretical price of the liquidated Call option on the roll date at a price determined at 2:00 p.m. ET;
Modification to the roll date	November 17, 2022	*"The Roll Date is the same business as the standard monthly listed option expiry date."* The roll-date calculation reflected that the price of the Call option was removed at the difference between the price of the ETF and the strike of the expiring call option or 0, whichever was greater.	*"The Roll Date is the business day preceding the standard monthly listed option expiry date."* The roll-date calculation has been updated to reflect that the theoretical price of the liquidated Call option will be determined at 4:00 p.m. ET.

7 Appendix 2 – Document Information

Version Number	4.0
Last Revised Date	December 22, 2023

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