

Index Methodology

As of December/2016

CBOE Strategy Benchmark Indexes

➤ The CBOE S&P 500 Buffer Protect Index Series



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Introduction

The CBOE S&P 500 Buffer Protect Index Series (the “Indices”) are part of a family of Target Outcome Indices. The Indices are designed to provide target outcome returns to the US domestic stock market.

The Indices measures the performance of a portfolio of hypothetical exchange traded Flexible Exchange® Options (“FLEX® Options”) that are based on the S&P 500® Index. Each series in the index is designed to track the returns of a hypothetical investment that over a period of approximately one year seeks to “buffer protect” against the first 10% of losses due to a decline in the S&P 500 Index while providing participation up to a capped level. The capped level is determined on each annual roll date such that there is no premium or discount to enter into the hypothetical investment compared to an investment in the Index.

The Index Series comprises 13 series.

There are 12 monthly series that roll on the third Wednesday of each month:

- CBOE S&P 500 Buffer Protect Index January Series (Ticker: SPRO01)
- CBOE S&P 500 Buffer Protect Index February Series (Ticker: SPRO02)
- CBOE S&P 500 Buffer Protect Index March Series (Ticker: SPRO03)
- CBOE S&P 500 Buffer Protect Index April Series (Ticker: SPRO04)
- CBOE S&P 500 Buffer Protect Index May Series (Ticker: SPRO05)
- CBOE S&P 500 Buffer Protect Index June Series (Ticker: SPRO06)
- CBOE S&P 500 Buffer Protect Index July Series (Ticker: SPRO07)
- CBOE S&P 500 Buffer Protect Index August Series (Ticker: SPRO08)
- CBOE S&P 500 Buffer Protect Index September Series (Ticker: SPRO09)
- CBOE S&P 500 Buffer Protect Index October Series (Ticker: SPRO10)
- CBOE S&P 500 Buffer Protect Index November Series (Ticker: SPRO11)
- CBOE S&P 500 Buffer Protect Index December Series (Ticker: SPRO12)

In addition, there is one balanced index that is a composite of the 12 monthly series, where each monthly series is allocated an equal weight at each monthly roll date:

- CBOE S&P 500 Buffer Protect Index Balanced Series (Ticker: SPRO)

Highlights

A Buffer Protection Option Strategy is a protection strategy that is generally used in a bear, range-bound or modest bull market environment. It seeks to provide a buffer of protection against downside losses over a set period of time, while still providing the opportunity for growth to a maximum pre-determined level.

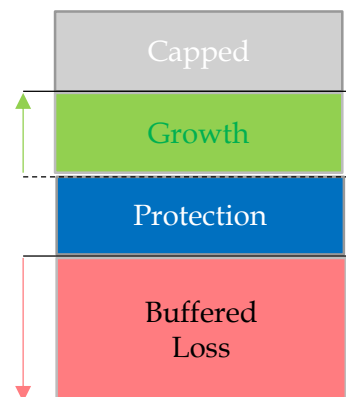
The Indices are part of the outcome based approach to investing. Most investments today target speculative returns, with uncertain levels of risk, over an uncertain period of time. While opportunistic, this approach to investing brings a high degree of uncertainty. Outcome based investing encourages targeting a specific defined return or “payoff”, with an allowance for a specific defined risk, at a specific point in time in the future.

The strategy seeks to provide similar returns to the S&P500 Index, with lower volatility and downside risks, in most market environments with the exception of when the stock market is rallying rapidly.

Index Series Value and Return

First Roll Date and Starting Values

Each Monthly Index series will have an annual Roll Date(i) on the third Wednesday of the month of that index series (i.e. third Wednesday of January for the January series, third Wednesday of February for the February series and so on) and have a value that was set as of the following dates:



- CBOE S&P 500 Buffer Protect Index January Series (Index¹)
Set as of Roll Date(0) January 19, 2005 at a value of 1000
- CBOE S&P 500 Buffer Protect Index February Series (Index²)
Set as of Roll Date(0) February 16, 2005 at a value of 1000
- CBOE S&P 500 Buffer Protect Index March Series (Index³)
Set as of Roll Date(0) March 16, 2005 at a value of 1000
- CBOE S&P 500 Buffer Protect Index April Series (Index⁴)
Set as of Roll Date(0) April 20, 2005 at a value of 1000
- CBOE S&P 500 Buffer Protect Index May Series (Index⁵)
Set as of Roll Date(0) May 18, 2005 at a value of 1000
- CBOE S&P 500 Buffer Protect Index June Series (Index⁶)
Set as of Roll Date(0) June 15, 2005 at a value of 1000
- CBOE S&P 500 Buffer Protect Index July Series (Index⁷)
Set as of Roll Date(0) July 20, 2005 at a value of 1000
- CBOE S&P 500 Buffer Protect Index August Series (Index⁸)
Set as of Roll Date(0) August 17, 2005 at a value of 1000
- CBOE S&P 500 Buffer Protect Index September Series (Index⁹)
Set as of Roll Date(0) September 21, 2005 at a value of 1000
- CBOE S&P 500 Buffer Protect Index October Series (Index¹⁰)
Set as of Roll Date(0) October 19, 2005 at a value of 1000
- CBOE S&P 500 Buffer Protect Index November Series (Index¹¹)
Set as of Roll Date(0) November 16, 2005 at a value of 1000
- CBOE S&P 500 Buffer Protect Index December Series (Index¹²)
Set as of Roll Date(0) December 21, 2005 at a value of 1000
- CBOE S&P Buffer Protect Index Balanced Series (Balanced Index)
Set as of Roll Date(0) December 21, 2005 at a value of 1000

On the subsequent Roll Date of each monthly series, the FLEX Option components expire and the index series simultaneously rolls to a new set of FLEX Options with the expiration of the Options as of the close on the next Roll Date.

The Balanced Index is a composite of the 12 monthly series, where each monthly series is allocated an equal weight at each monthly roll date.

Components

Each Monthly Index series will consist of six FLEX Option components whose strike price and expiration date will be set on the Roll Date(i) relative to the closing level of the S&P 500 Index on the Roll Date:

- Purchased Call Option with strike = 50% of S&P 500 Index closing price
- Written Type A Put Option with strike = 50% of S&P 500 Index closing price
- Written Type B Put Option with strike = 90% of S&P 500 Index closing price
- Purchased Put Option with strike = 100% of S&P 500 Index closing price
- Written Type A Call Option with strike = 100% of S&P 500 Index closing price
- Written Type B Call Option with strike = CapRollDate(i)

All FLEX Options are European-Style Options based on the S&P 500 Index and have an expiration date that is the next Roll Date for the respective Monthly series

Non-Roll Date Calculations

The value of the monthly index series will be calculated as follows for $t = 1$ (i.e. one day after the Roll Date) until $t =$ Roll Date $(i+1)$ (i.e. until the next Roll Date):

$$\text{Index}_t = \text{Index}_{\text{RollDate}(i)} \times \left[\frac{\text{OptionPortfolioValue}_t}{\text{OptionPortfolioValue}_{\text{RollDate}(i)}} \right]$$

The value of the Balanced Index will be a composite of each monthly index series, Index_m ($m = 1$ for January series, $m = 2$ for February series, ... $m = 12$ for December series) and will be calculated as follows for $t = 1$ and until $t =$ Roll Date $(i+1)$ (i.e. until the next Roll Date):

$$\text{BalancedIndex}_t = \text{BalancedIndex}_{\text{RollDate}(i)} \times \sum_{m=1}^{m=12} \left[\frac{1}{12} \times \frac{\text{Index}_t^m}{\text{Index}_{\text{RollDate}(i)}^m} \right]$$

Where:

$$\begin{aligned} \text{OptionPortfolioValue}_{\text{RollDate}(i)} &= 2 \times \text{PurchasedCallOption}_{\text{RollDate}(i)} \\ &\quad - 2 \times \text{WrittenTypeAPutOption}_{\text{RollDate}(i)} \\ &\quad - \text{WrittenTypeBPutOption}_{\text{RollDate}(i)} + 2 \times \text{PurchasedPutOption}_{\text{RollDate}(i)} \\ &\quad - \text{WrittenTypeACallOption}_{\text{RollDate}(i)} - \text{WrittenTypeBCallOption}_{\text{RollDate}(i)} \end{aligned}$$

$$\begin{aligned} \text{OptionPortfolioValue}_t &= 2 \times \text{PurchasedCallOption}_t - 2 \times \text{WrittenTypeAPutOption}_t \\ &\quad - \text{WrittenTypeBPutOption}_t + 2 \times \text{PurchasedPutOption}_t \\ &\quad - \text{WrittenTypeACallOption}_t - \text{WrittenTypeBCallOption}_t \end{aligned}$$

$\langle \rangle_{\text{RollDate}(i)}$ = Value on the last Roll Date

$\text{PurchasedCallOption}_t$ = Closing value of the *Purchased Call Option* on day t

$\text{WrittenTypeAPutOption}_t$ = Closing value of the *Written Type A Put Option* on day t

$\text{WrittenTypeBPutOption}_t$ = Closing value of the *Written Type B Put Option* on day t

$\text{PurchasedPutOption}_t$ = Closing value of the *Purchased Put Option* on day t

$\text{WrittenTypeACallOption}_t$ = Closing value of the *Written Type A Call Option* on day t

$\text{WrittenTypeBCallOption}_t$ = Closing value of the *Written Type B Call Option* on day t

Roll Date Calculations:

On the subsequent Roll Date of each monthly series, the FLEX Option components expire and the index series simultaneously rolls to a new set of FLEX Options with the expiration of the Options as of the close on the next Roll Date.

On the Roll Date the Index value is calculated as follows:

$$\begin{aligned} \text{Index}_{\text{RollDate}(i+1)} &= \\ \text{Index}_{\text{RollDate}(i)} &\times \left[\text{Min} \left(1, \frac{\text{SPX}_{\text{RollDate}(i+1)}}{\text{SPX}_{\text{RollDate}(i)}} + 10\% \right) + \text{Min} \left(\frac{\text{Cap}_{\text{RollDate}(i)}}{\text{SPX}_{\text{RollDate}(i)}} - 1, \text{Max} \left(0, \frac{\text{SPX}_{\text{RollDate}(i+1)}}{\text{SPX}_{\text{RollDate}(i)}} - 1 \right) \right) \right] \end{aligned}$$

On Roll Dates of each monthly series, the Balanced Index will be rebalanced and calculated as a composite of each monthly index series, Index_m (m = 1 for January series, m = 2 for February series, ... m = 12 for December series) as follows:

$$\text{BalancedIndex}_{\text{RollDate}(i+1)} = \text{BalancedIndex}_{\text{RollDate}(i)} \times \sum_{m=1}^{m=12} \left[\frac{1}{12} \times \frac{\text{Index}_{\text{RollDate}(i+1)}^m}{\text{Index}_{\text{RollDate}(i)}^m} \right]$$

Calculation of the Cap

Cap_{RollDate(i)} is the strike of the Written Type B Call Option such that the following holds true on the Roll Date:

$$\begin{aligned} \text{WrittenTypeBCallOption}_{\text{RollDate}(i)} &= 2 \times \text{PurchasedCallOption}_{\text{RollDate}(i)} - 2 \times \text{WrittenTypeAPutOption}_{\text{RollDate}(i)} \\ &\quad - \text{WrittenTypeBPutOption}_{\text{RollDate}(i)} + 2 \times \text{PurchasedPutOption}_{\text{RollDate}(i)} \\ &\quad - \text{WrittenTypeACallOption}_{\text{RollDate}(i)} - \text{SPX}_{\text{RollDate}(i)} \end{aligned}$$

To determine the value and Strike B of the Written Type B Call Option, CBOE uses an interpolation methodology that it deems is most appropriate for the market conditions at the time. To do so, CBOE values at least two written call options. The value of these options is then used to estimate the value and strike of the Written Type B Call Option.

Following is an illustration of the possible methodology that CBOE may use to interpolate using two option prices:

The value of two additional options is determined on the Roll Date:

- Written Type B1 Call Option
- Written Type B2 Call Option

Denote the weights as: W1 and W2 for Written Type B1 Call Option and Written Type B2 Call Option with Strike B1 = 105% of the S&P500 Index closing price and Strike B2 = 115% of the S&P500 Index closing price, respectively. The value and strike of the Written Type B Call Option is interpolated such that the following equalities hold true:

Written Type B Call Option = W1 x Written Type B1 Call Option + W2 x Written Type B2 Call Option

Strike B = W1 x Strike B1 + W2 x Strike B2

W1 + W2 = 1

While CBOE will use at least two options, as a matter of practice it will generally use three option prices, namely, Written Type A Call Option, Written Type B1 Call Option and Written Type B2 Call Option to estimate the value of the Written Type B Call Option. However, to determine the value and Strike B of the Written Type B Call Option, CBOE may use just two or more than two option prices if it deems it appropriate for the market conditions at the time.

Valuation

To value the component Options that comprise the Monthly index series, a model based valuation is used.

Model based valuation is used for valuing the options. CBOE constructs an implied volatility surface from listed S&P 500 option prices by applying the SABR model. 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 calculated for the options on the roll dates and for the official close of CBOE each trading date.

Index Maintenance

Index Construction

CBOE gathers information for the option components and applies the methodology to create individual index series.

Valuation and Equations

CBOE determines an evaluated value for each component option and associated equation in the Indices.

Calculation and Dissemination

CBOE compiles, calculates, maintains and disseminates the values of the Indices. Calculation will occur once a day upon the official close of CBOE trading hours.

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