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EXTERNAL

Cboe NASDAQ-100 BuyWrite Index

This document details the calculation methodology of the titled index/benchmark. This document, in conjunction with the Cboe Index Rules and Governance document (available on Cboe's Governance website), provides a transparent and easily accessible view of the methodology used to calculate the Cboe NASDAQ-100 BuyWrite Index ("BXN Index"), ticker symbol 'BXN'.

Description of the Market or Economic Reality Measure

The Cboe NASDAQ-100 BuyWrite Index (BXN) measures the total rate of return of a NASDAQ-100 covered call strategy. This strategy ("BXN covered call strategy") consists of holding a portfolio indexed to the NASDAQ-100 and selling a succession of one-month at-the-money NASDAQ-100 (NDX) call options. The BXN index is based on the cumulative gross rate of return of this strategy since the inception of the index, December 30, 1994, when it was set to an initial value of 100.00. The BXN Index does not use contributed input data, and all of the input data is readily available via public sources. The BXN Index is non-significant, as defined by EU Regulation 2016/1011 ("EU Benchmark Regulation" or "EU BMR").

Index Calculations

The following describes the methodology for calculating the BXN Index, including applicable formulas and input data. Under the BXN Index methodology, roll date is the third Friday of each month. Should the third Friday fall on an exchange holiday, the roll date is the preceding day.

BXN is a total return index that is rebalanced monthly. Dividends paid on the component stocks underlying the NASDAQ-100 Index and the dollar value of option premium deemed received from the sold call options are functionally "re-invested" in the covered NASDAQ-100 Index portfolio.

The BXN covered call strategy requires that each NASDAQ-100 call option be held to its date of maturity, generally the third Friday of the month. The call option is settled against the Special Opening Quotation (SOQ, ticker "XQO") of the NASDAQ-100 used as the final settlement price of NASDAQ-100 options. The SOQ is a special calculation of the NASDAQ-100 that is compiled from the opening prices of NASDAQ-100 stocks. The SOQ calculation is performed when all the constituents in the index have opened for trading, and is usually determined before 11:00 a.m. ET. The final settlement price of the call option at maturity is the difference between the SOQ and the strike price of the expiring option, or 0, whichever is greater.

Subsequent to the settlement of the expiring call option, a new at-the-money call option expiring in the next month is then written, a transaction commonly referred to as the "roll." The strike price of the new call is the NDX call option with the closest listed strike price at or above the last value of the NASDAQ-100 Index reported before 11:00 a.m. ET. For example, if the last NASDAQ-100 price reported before 11:00 a.m. is 1600.65 and the closest listed option strike price at or above 1600.65 is 1605, then the NASDAQ-100 1605 call is selected as the new call to sell.

Once the strike price has been identified, the new call option is deemed sold at a price equal to the volume-weighted average price (VWAP) of the call during a two-hour period beginning at 11:30 a.m. ET. Cboe calculates the VWAP in two steps: first, Cboe excludes trades in the new Call option between 11:30 a.m. and 1:30 p.m. ET that are identified as uppercase A – H and lowercase f – t. This will remove all forms of late, cancel and spread orders; and second, Cboe calculates the weighted average of all remaining transaction prices of the new Call option between 11:30 a.m. and 1:30 p.m. ET, with weights equal to the fraction of total remaining volume transacted at each price during this period. The source of the transaction prices used in the calculation of the VWAP is OPRA. If no transactions occur between 11:30 a.m. and 1:30 p.m. ET, then the new call option is deemed sold at the last NBBO bid price reported before 1:30 p.m. ET.

The BXN Index is calculated every 15 seconds according to the following formula:

$$BXN_t = BXN_{t-1}\,(1+R_t) \qquad (1)$$

where:

- BXN_t is the level of the BXN Index;
- BXN_{t-1} is the level of the BXN Index on the previous day; and
- R_t is the return of the BXN Index.

<u>Non-Roll Date Calculations</u>

The non-roll date return of the index is calculated as:

$$1 + R_t = (S_t + Div_t - C_t)/(S_{t-1} - C_{t-1}) \quad (2)$$

where:

- S_t is the closing value of the NASDAQ-100 Index on date t. For intraday calculations, the current reported value of the NASDAQ-100 Index is used;
- S_{t-1} is the closing value of the NASDAQ-100 Index at date t-1;
- C_t is the arithmetic average of the last NBBO quote of the call option reported before 4:00 p.m. ET on date t for the closing value. For intraday calculations, the average of the current reported NBBO quote of the call option is used;
- C_{t-1} is the arithmetic average of the last NBBO quote of the call option reported before 4:00 p.m. ET at date t-1; and
- Div_t represents the ordinary cash dividends payable on the component stocks underlying the NASDAQ-100 Index that trade “ex-dividend” at date t expressed in NASDAQ-100 Index points.

<u>Roll Date Calculations</u>

On roll dates, the gross rate of return is compounded from three gross rates of return: the gross rate of return from the previous close to the SOQ is determined and the expiring call is settled, the gross rate of return from the SOQ to the initiation of the new call position, and the gross rate of return from the time the new call option is deemed sold to the close of trading on the roll date. It can be expressed as follows:

$1 + R_t = (1 + R_a) \times (1 + R_b) \times (1 + R_c)$ (3
where:

$1 + R_a = (S^{SOQ} + Div_t - C_{Settle})/(S_{t-1} - C_{t-1})$;

$1 + R_b = (S^{VWAV})/(S^{SOQ})$; AND

$1 + R_c = (S_t - C_t)/(\,(S^{VWAV} - C_{VWAP})$;

where:

- R_a is the rate of return of the covered portfolio from the previous close of trading through the settlement of the expiring call option;
- S^{SOQ} is the Special Opening Quotation used in determining the settlement price of the expiring call option;
- C_{settle} = Max $(0, SOQ_t - K\_old)$ is the final settlement price of the expiring call option, where K_old is the strike of the expiring option;
- R_b is the rate of return of the un-covered NASDAQ-100 Index portfolio from the settlement of the expiring option to the time the new call option is deemed sold;
- S^{VWAV} is the volume-weighted average value of the NASDAQ-100 Index based on the same time and weights used to calculate the VWAP in the new call option;
- R_c is the rate of return of the covered NASDAQ-100 Index portfolio from the time the new call option is deemed sold to the close of trading on the roll date;
- C_{VWAP} is the volume-weighted average trading price of the new call option between 11:30 a.m. and 1:30 p.m. ET; and
- C_t refers to the average of the last NBBO quote of the new call option reported before 4:00 p.m. ET on the roll date.

Calculation and Dissemination

Cboe compiles, calculates, maintains, and disseminates all BXN Index values. The BXN Index is calculated and disseminated every 15 seconds during U.S. trading hours.

On roll dates, as defined above, the BXN Index will not be disseminated intraday until the SOQ and VWAP are determined.

Judgement and Potential Limitations in Calculation

No expert judgement or discretion is used by Cboe in performing the calculation of the BXN Index. Potential limitations for this index (i.e., situations where the index may not reflect the above described market or economic reality) include:

- where underlying index input data is unavailable, the BXN Index value will not be able to be calculated, and

- where the underlying option contract data is not available, the BXN Index value will not be able to be calculated.

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