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# Description of the CBOE NASDAQ-100® BuyWrite Index (BXN℠ Index)

***Index Design.*** 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 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 "NDS") of the NASDAQ-100 used as the final settlement price of NASDAQ-100 options.[1] 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 100 stocks in the index have opened for trading, and is usually determined before 11:00 a.m. ET.[2] 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.

Soon after 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 closest listed strike price 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 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 half-hour period beginning at 11:30 a.m. ET. The Chicago Board Options Exchange (CBOE) calculates the VWAP by first, excluding trades identified as having been executed as part of a "spread", and then taking a weighted average of all remaining transaction prices of the call option between 11:30 a.m. and 12:00 p.m., with weights equal to the fraction of total non-spread volume transacted at each price during this period. Equivalently, the VWAP is the average traded price of the call. The source of the transaction prices used in the calculation of the VWAP is CBOE's Market Data Retrieval (MDR) System.[3] If no transactions occur between 11:30 a.m. and 12:00 p.m., then the new call option is deemed sold at the last bid price reported before 12:00 p.m.

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[1] If the third Friday is an exchange holiday, the call option will be settled against the SOQ on the previous business day and the new call option will be selected on that day as well.

[2] If one or more stocks in the NASDAQ-100 Index do not open on the day the SOQ is calculated, the final settlement price for NDX options is determined in accordance with the Rules and By-Laws of the Options Clearing Corporation.

[3] Time & Sales information from CBOE's MDR System is disseminated through the Options Price Reporting Authority (OPRA) and is publicly available through most price quote vendors.

***Index Calculation.*** The BXN Index is calculated in real-time by the CBOE every fifteen seconds during each trading day excluding roll dates [for the respective components of the covered NASDAQ-100 Index portfolio]. It is a chained index, i.e., its value is equal to 100 times the cumulative product of gross daily rates of return of the BXN covered call strategy since the inception date of the index. On any given day, BXN is calculated as follows:

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

where $R_t$ is the daily rate of return of the portfolio. This rate includes dividends paid by stocks comprising the NASDAQ-100 Index.

On all but the roll dates, the daily gross rate of return of the BXN is calculated from the close-to-close change in the value of the covered NASDAQ-100 portfolio and the value of dividends distributed by NASDAQ-100 stocks trading "ex-dividend" on that date. The gross daily rate of return is equal to:

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

In this equation, $S_t$ is the closing value of the NASDAQ-100 at date t, $Div_t$ represents the cash dividends, expressed in NASDAQ-100 Index points, distributed by NASDAQ-100 stocks trading "ex-dividend" at date t, and $C_t$ is the arithmetic average of the last bid and ask prices of the call option reported before 4:00 p.m. ET at date t. $S_{t-1}$ is the previous close of the NASDAQ-100 Index and $C_{t-1}$ is the previous average of the last bid and ask prices of the call option reported before 4:00 p.m. ET.

On roll dates, the gross daily rate of return is compounded from three gross rates of return, the gross rate of return from the previous close to the time 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, expressed as follows:

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

where:

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

$$1 + R_b = (S^{VWAV})/(S^{SOQ}); \text{ and}$$

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

In this equation, $R_a$ 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. $Div_t$ represents NASDAQ-100 dividends as on non-roll dates, and $C_{Settle}$ is the final settlement price of the expiring call option. $S_{t-1}$ and $C_{t-1}$ are defined on non-roll days.

$R_b$ is the rate of return of the un-covered 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 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 12:00 p.m. ET and $C_t$ refers to the average bid/ask quote of the new call option reported before 4:00 p.m. ET on the roll date.

SUPPLEMENTAL INFORMATION (added June 18, 2015)

**CBOE NASDAQ-100 BuyWrite V2 Index (BXNT)**

CBOE introduced the CBOE NASDAQ-100 Buywrite V2 Index (BXNT[SM]) on June 22, 2015. The BXNT Index replicates the methodology used to calculate the BXN Index, with one exception. That is, the written NDX call options are held until one day prior to the expiration date (i.e., generally the Thursday preceding the Third Friday of the month) and is liquidated at a VWAP price determined at the close, $C_{old\_option\_vwap}$. $C_{old\_option\_vwap}$ is the volume-weighted average trading price between 3:30 p.m. and 4:00 p.m. ET.

Accordingly, the roll date for BXNT is rolled over a two day period and is calculated as follows:

One day prior to the expiration date (generally the Thursday preceding the Third Friday of the month):

$$1 + R_t = (1 + R_a) \times (1 + R_b)$$

$$1 + R_a = (\ S^{new\_vwav} + Div_t - C_{old\_option\_vwap})/(\ S_{t-1} - C_{t-1})$$

$$1 + R_b = (S_t)/(\ S^{new\_vwav})$$

Where, $S^{new\_vwav}$ is the volume-weighted average value of the NASDAQ-100 Index based on the same time and weights used to calculate the VWAP of the old call option between 3:30 p.m. and 4:00 p.m. ET.

On the expiration date:

$$1 + R_t = (1 + R_a) \times (1 + R_b)$$

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

$$1 + R_b = (S_t - C_t) / (S^{vwav} - C_{vwap})$$

CBOE has not calculated a separate series of historical values for the BXNT Index prior to June 18, 2015. Rather, historical values for the BXNT Index prior to June 18, 2015, may be considered the same as BXN Index values.

January 25, 2007

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