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EXTERNAL

Cboe S&P 500 One-Week PutWrite 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 S&P 500 One-Week PutWrite Index ("WPUT Index"), ticker symbol 'WPUT'.

Description of the Market or Economic Reality Measure

The Cboe S&P 500 One-Week PutWrite Index (WPUT) is designed to track the performance of a hypothetical passive investment strategy that collects option premiums from writing an At-the-Money (ATM) SPX Put option on a weekly basis and holds a Treasury bill account invested in one-month Treasury bills to cover the liability from the short SPX Put option position. The WPUT Index does not use contributed input data, and all of the input data is readily available via public sources. The WPUT 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 WPUT Index, including applicable formulas and input data. Under the WPUT Index methodology, roll date is every Friday. Should an exchange holiday fall on a Friday, the roll date is the preceding day.

On January 13, 2006, the initial roll date of the WPUT Index, an ATM one week SPX Put option is written after the market opens (9:30 a.m. ET). The first available SPX Put option strike below the Special Opening Quotation (SOQ) of the S&P 500 Index (SPX Index) is selected. The first bid quote after the market opens is the option premium collected from the written SPX Put option. At the same time, $K cash is invested in a Treasury bill account to cover the liability of the short SPX Put option position, where K is the strike price of the new SPX Put option.

Typically, on every Friday (Roll Day) since the initial roll date, the SPX Put option settles and the Treasury bill account is liquidated simultaneously. Concurrently, a new ATM SPX Put option (to expire in one week) is written, and a new Treasury bill account ($$K_{new}$) is set aside as collateral for the new short ATM SPX Put option. The Treasury bill account will accumulate interest at the one-month Treasury bill rate.

As the expiring SPX Put Option can be either an AM-settlement or PM-settlement on the Roll Date, this would affect the settlement procedure of the expiring SPX Put option. If the expiring SPX Put option is AM-settlement on the Roll Date, the expiring SPX Put option settles against the SOQ. If the expiring SPX Put option is PM-settlement on the Roll Date, the expiring SPX Put option is purchased back at the last ask price of the SPX Put option before 4:00 p.m. ET.

For AM-settlement, the first available SPX Put option strike below the SOQ is selected, and the option premium collected is the first bid quote of the SPX Put option after 9:30 a.m. ET. For PM-settlement, the

first available SPX Put option strike below the last disseminated value of the SPX Index before 4:00 p.m. ET is selected, and the option premium collected is the last bid quote of the SPX Put option before 4:00 p.m. ET. In either case, a Treasury bill account with initial cash $K, where K is the strike price of the new SPX Put option, is set up simultaneously to cover the potential liability of the short SPX Put option position.

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

$$Index_t = Index_{t-1} * (1 + R_t) \qquad (1)$$

where:
- $Index_t$ is the level of the WPUT Index;
- $Index_{t-1}$ is the level of the WPUT Index on the previous day; and
- R_t is the return of the WPUT Index.

Non-Roll Date Calculations

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

$$(1 + R_t) = \frac{(M_t - Put_t)}{(M_{t-1} - Put_{t-1})} \qquad (2)$$

$$M_t = R_f * M_{t-1} \qquad (3)$$

where:
- M_t and M_{t-1} are the values of the Treasury bill account on day *t* and *t-1,* respectively;
- R_f is the one-month Treasury bill rate de-annualized to the daily rate;
- Put_t is the average of the last bid-ask quote of the SPX Put option before 4:00 p.m. ET for the closing value. For intraday calculations, the average of the current reported bid and ask prices of the put option is used; and
- Put_{t-1} is the average of the last bid-ask quote of the SPX Put option before 4:00 p.m. ET on the previous day.

Roll Date Calculations

The roll date return of the index is calculated in two steps using formulas (4) and (5) or formulas (6) and (7).

AM-settlement roll days

For AM-settlement roll days, formula (4) is used to calculate the return from the previous day's market close to present day's morning settlement:

$$(1 + R_1) = \frac{(M_old_{t-1} - Put_old_{settle})}{(M_old_{t-1} - Put_old_{t-1})} \qquad (4)$$

where:

- M_old_{t-1} is the value of the Treasury bill account on the previous day;
- $Put_old_{settle} = Max(0, K_{old} - SOQ_t)$ is the settlement value of the expiring SPX Put option;
- Put_old_{t-1} is the average of the last bid-ask quote of the expiring SPX Put option before 4:00 p.m. ET on the previous day.

Note: interest is not accumulated in the Treasury bill account on roll day.

Formula (5) is used to calculate the return from the moment the new SPX Put option is deemed sold to market close:

$$(1 + R_2) = \frac{(M_new_t - Put_new_t)}{(M_new_t - Put_new_{bid\ 930})} \qquad (5)$$

where:

- M_new_t is the cash allocated to cover the potential loss of the new SPX Put option on the roll day;
- Put_new_t is the average of the last bid-ask quote of the new SPX Put option before 4:00 p.m. ET; and
- $Put_new_{bid\ 930}$ is the first bid quote of the new SPX Put option after 9:30 a.m. ET.

Note: interest is not accumulated in the Treasury bill account on roll day.

PM-settlement roll days

For PM-settlement roll days, formula (6) is used to calculate the return from the previous day's market close to 4:00 p.m. ET:

$$(1 + R_1) = \frac{(M_old_{t-1} - Put_old_{ask\ 4pm})}{(M_old_{t-1} - Put_old_{t-1})} \qquad (6)$$

where:

- M_old_{t-1} is the value of the Treasury bill account on the previous day;
- $Put_old_{ask\ 4pm}$ is the last ask quote of the expiring SPX Put option before 4:00 p.m. ET;
- Put_old_{t-1} is the average of the last bid-ask quote of the expiring SPX Put option before 4:00 p.m. ET on the previous day.

Note: interest is not accumulated in the Treasury bill account on roll day.

Formula (7) is used to calculate the return from 4:00 p.m. ET to market close (4:15 p.m. ET):

$$(1 + R_2) = \frac{(M_new_t - Put_new_t)}{(M_new_t - Put_new_{bid\ 4pm})} \qquad (7)$$

where:

- M_new_t is the cash allocated to cover the potential loss of the new SPX Put option on the roll day;
- Put_new_t is the average of the last bid-ask quote of the new SPX Put option before 4:00 p.m. ET; and
- $Put_new_{bid\ 4pm}$ is the last bid quote of the new SPX Put option before 4:00 p.m. ET.

Note: interest is not accumulated in the Treasury bill account on roll day.

The product of the two parts is the total return of the Roll Day:

$$(1 + R_t) = (1 + R_1) * (1 + R_2) \qquad (8)$$

Calculation and Dissemination

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

On standard expiration dates (generally the third Friday), as defined above, the WPUT Index will not be disseminated intraday until the SOQ is determined.

Judgement and Potential Limitations in Calculation

No expert judgement or discretion is used by Cboe in performing the calculation of the WPUT 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 WPUT Index value will not be able to be calculated, and
- where the underlying option contract data is not available, the WPUT Index value will not be able to be calculated.

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