



Index Methodology

As of July/2015

CBOE Strategy Benchmark Indexes

➤ The CBOE S&P 500 Covered Combo Index (CMBO)



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Introduction:

The CBOE S&P 500 Covered Combo Index (CMBO) is a benchmark index designed to track the performance of a hypothetical short strangle strategy that: (1) writes a rolling 2% Out-of-the-Money (OTM) monthly SPX Call option and a rolling At-the-Money (ATM) monthly SPX Put option, (2) establishes a long position indexed to the S&P 500 Index (SPX Index) to cover the liability from the short SPX Call option position, and (3) holds a rolling money market account invested in one-month Treasury bills to cover the liability from the short SPX Put option position.

Index Design:

On June 20, 1986, the initial roll date of the CMBO Index, a unit of a 2% OTM monthly SPX Call option is written and a unit of the SPX Index is purchased to cover the liability from the short SPX Call option position. Simultaneously, a unit of an ATM SPX Put option is written with a money market account invested in one-month Treasury bills held to cover the liability from the short SPX Put option position. The strike of the SPX Call option is the first available strike above 102% of the last disseminated value of the SPX Index before 11:00 am ET. The strike of the SPX Put option is the first available strike below the last disseminated value of the SPX Index before 11:00 am ET. The premiums collected from writing the SPX Call and Put options are the volume weighted average trade prices between 11:30 am and 12:00 pm ET (VWAP). CBOE calculates the VWAP in two steps: first, CBOE excludes trades in the new SPX Call and SPX Put options between 11:30 am and 12:00 pm ET that are identified as having been executed as part of a "spread"; and second, CBOE calculates the weighted average of all remaining transaction prices of the new SPX Call and SPX Put options between 11:30 am and 12:00 pm ET, with weights equal to the fraction of total non-spread volume transacted at each price during this period. If there is no trade in the SPX Call option or the SPX Put option during the VWAP period, the last bid quote of the applicable option before 12:00 pm ET is used. As the long SPX Index position is assumed to be entered simultaneously with the short position of the SPX Call option, the weighted average price of the SPX Index is calculated using the disseminated values of the SPX Index based on the same time and weights used to calculate the SPX Call option VWAP. Similarly, if there is no trade of the SPX Call option during the VWAP period, the last disseminated value of the SPX Index quote before 12:00 pm ET is used. To cover the liability from the short position of the SPX Put option, \$K cash is invested into a money market account, where K is the strike of the Put option. The money market account will accumulate interest at one-month T-bill rate.

Typically, on the third Friday (Roll Day) of every month since the initial roll date, the old options settle at 9:30 am ET against the Special Opening Quotation of the SPX Index (SOQ). The old money market account is liquidated at the same time. A new 2% OTM monthly SPX Call option and a new ATM monthly SPX Put option will be selected at 11:00 am ET. Following the same rule as the initial roll date, the strike of the SPX Call option is the first available strike above 102% of the last disseminated value of the SPX Index before 11:00 am ET. The strike of the SPX Put option is the first available strike below the last disseminated value of the SPX Index before 11:00 am ET. The premiums collected from the SPX Call and Put options are the VWAP between 11:30 am and 12:00 pm ET, or the last bid quote of the applicable option before 12:00 pm ET if there are no trades in the SPX Call option or the SPX Put option during the VWAP period. A money market account is set aside as collateral for the new short SPX Put option position to cover the liability.

Index Calculation:

The CMBO Index value is calculated by CBOE in real-time, every 15 seconds.

On each trading day excluding roll dates, the daily return of the index is calculated as:

$$R_t = (SPX_t + DIV_t + M_t - Call_t - Put_t) / (SPX_{t-1} + M_{t-1} - Call_{t-1} - Put_{t-1})$$

$$M_t = R_f * M_{t-1}$$

Where SPX_t is the last disseminated value of the SPX Index on day t , DIV_t is the SPX dividend on day t , $Call_t$ is the average of the last bid-ask quote of the SPX Call option before 4:00 pm ET, Put_t is the average of the last bid-ask quote of the SPX Put option before 4:00 pm ET, M_t is the value of the money market account on day t , and R_f is the one month T-bill rate de-annualized to the daily rate. The terms with subscript $t-1$ stand for the values on the previous day.

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On Roll Days, the return is calculated in three steps:

First, calculate the return from the previous day market close to morning settlement of the expiring option (9:30 am ET):

$$R_1 = \frac{(SOQ_t + DIV_t + M_{old\ t-1} - Call_{old\ settle} - Put_{old\ settle})}{(SPX_{t-1} + M_{old\ t-1} - Call_{old\ t-1} - Put_{old\ t-1})}$$

Where SOQ_t is the Special Opening Quotation of the SPX Index on the Roll Day, SPX_{t-1} is the last disseminated value of the SPX Index on the previous day, $Call_{old\ settle} = \text{Max}(0, SOQ_t - K_{call})$ is the settlement value of the expiring SPX Call option, in which K_{call} is the strike price of the expiring SPX Call option, $Put_{old\ settle} = \text{Max}(0, K_{put} - SOQ_t)$ is the settlement value of the expiring SPX Put option, in which K_{put} is the strike price of the expiring SPX Put option, $Call_{old\ t-1}$ and $Put_{old\ t-1}$ are the averages of the last bid-ask quotes of the expiring SPX Call option and expiring SPX Put option on the previous day before 4:00 pm ET, and $M_{old\ t-1}$ is the value of the money market account at the market close on the previous day. Note interest is not accumulated in the money market account on the Roll Day.

Second, calculate the return from morning settlement (9:30 am ET) to the moment the new option positions are deemed sold:

$$R_2 = SOQ_t / SPX_{vwap}$$

Where SOQ_t is the Special Opening Quotation of the SPX Index on the Roll Day, SPX_{vwap} is the weighted average value of the SPX index, calculated using disseminated values of the SPX Index based on the same time and weights used to calculate the new SPX Call option VWAP. Note that if there are no trades in the SPX Call option during the VWAP period, the last disseminated value of the SPX Index before 12:00 pm ET is used.

Lastly, calculate the return from the moment the new SPX Call and SPX Put options are deemed sold to the market close:

$$R_3 = \frac{(SPX_t + M_{new\ t} - Call_{new\ t} - Put_{new\ t})}{(SPX_{vwap} + M_{new\ t} - Call_{new\ vwap} - Put_{new\ vwap})}$$

Where SPX_t is the last disseminated value of the SPX Index on day t , SPX_{vwap} is the weighted average value of the SPX Index, calculated using disseminated values of the SPX Index based on the same time and weights used to calculate the new SPX Call option VWAP, $Call_{new\ vwap}$ is the VWAP of the new 102% OTM SPX Call option, $Call_{new\ t}$ is the average of the last bid-ask quotes of the new SPX Call option before 4:00 pm ET, $Put_{new\ vwap}$ is the VWAP of the new ATM SPX Put option, $Put_{new\ t}$ is the average of the last bid-ask quotes of the new SPX Put option before 4:00 pm ET, $M_{new\ t}$ is the value of the new money market account, which equals the strike of the new ATM SPX Put option. Note no interest is accumulated in the money market account on the Roll Day.

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

$$R_t = R_1 * R_2 * R_3$$

Once the daily return is calculated for every trading day, the daily index value is calculated as:

$$INDEX_t = INDEX_{t-1} * R_t$$

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