



Index Methodology

As of July/2015

## CBOE Strategy Benchmark Indexes

➤ The CBOE S&P 500 RXM Index (RXM)



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### Introduction:

The CBOE S&P 500 RXM Index (RXM) is a benchmark index designed to track the performance of a hypothetical risk reversal strategy that: (1) Buys a rolling Out-of-the-Money (Delta = 0.25) monthly SPX Call option, (2) writes a rolling Out-of-the-Money (Delta = -0.25) monthly SPX Put option, 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 RXM Index, one unit of an Out-of-the-Money monthly SPX Call option is purchased. The Call option selected is the one with a delta closest to 0.25. Simultaneously, one unit of an Out-of-the-Money monthly SPX Put option (the one with a delta closest to -0.25) is written with a money market account invested in one-month Treasury bills held to cover its liability. All inputs used in the delta calculation using the Black formula should be the last available values before 11:00 am ET. The premiums collected from writing the SPX Put option or paid out for the call option are the volume weighted average trade price 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 option 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 option 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 Put option during the VWAP period, the last bid quote for the SPX Put option before 12:00 pm ET is used. If there is no trade in the SPX Call option during the VWAP period, the last ask quote for the SPX Call option 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 just written. 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 25-delta monthly SPX Call option and a new 25-negative-delta monthly SPX Put option will be selected at 11:00 am ET. The selecting of strikes follows the same rule as the initial roll date. The premiums of the SPX Call and Put options are the VWAP between 11:30 am and 12:00 pm ET, or the last bid (ask) quote of the applicable option before 12:00 pm ET if there are no trades in the SPX Put (Call) 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 RXM 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:

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

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

Where  $Put_t$  is the average of the last bid-ask quote of the SPX Put option before 4:00 pm ET,  $Call_t$  is the average of the last bid-ask quote of the SPX Call 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.

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

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

$$R_1 = \frac{(M_{old_{t-1}} - Put_{old_{settle}} + Call_{old_{settle}})}{(M_{old_{t-1}} - Put_{old_{t-1}} - Call_{old_{t-1}})}$$

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 the moment the new SPX Call and Put options are deemed sold to the market close:

$$R_2 = \frac{(M_{new_t} - Put_{new_t} - Call_{new_t})}{(M_{new_t} - Put_{new_{vwap}} - Call_{new_{vwap}})}$$

Where  $Call_{new_{vwap}}$  is the VWAP of the new 25-delta 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 25-negative-delta 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:

$$R_t = R_1 * R_2$$

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

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

Options involve risk and are not suitable for all investors. Prior to buying or selling an option, a person must receive a copy of Characteristics and Risks of Standardized Options. Copies are available from your broker or from The Options Clearing Corporation, One North Wacker Drive, Suite 500, Chicago, Illinois 60606 or [www.theocc.com](http://www.theocc.com). The CBOE S&P 500 RXM Index (RXM) is designed to represent a proposed hypothetical risk reversal strategy. Like many passive indexes, the RXM Index does not take into account significant factors such as transaction costs and taxes and, because of factors such as these, many or most investors should be expected to underperform passive indexes. In the construction of the hypothetical RXM Index, the RXM options are assumed to be sold at a certain price on the third Friday of the month. However, there is no guarantee that all investors will be able to sell at this price, and investors attempting to replicate the RXM Index should discuss with their brokers possible timing and liquidity issues. Transaction costs and taxes for a strategy such as the RXM could be significantly higher than transaction costs for a passive strategy of buying-and-holding stocks. Investors should consult their tax advisor as to how taxes affect the outcome of contemplated options transactions. Past performance does not guarantee future results. This paper contains index performance data based on back-testing, i.e., calculations of how the index might have performed prior to launch. Back-tested performance information is purely hypothetical and is provided in this document solely for information purposes. Back-tested performance does not represent actual performance and should not be interpreted as an indication of actual performance. It is not possible to invest directly in an index. Chicago Board Options Exchange, Incorporated (CBOE) calculates and disseminates the RXM Index.

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