



Index Methodology

As of July/2015

CBOE Strategy Benchmark Indexes

➤ The CBOE VIX Strangle Index (VSTG)



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Introduction:

The CBOE VIX Strangle Index (VSTG Index) was designed as a benchmark for the CBOE Volatility Index (VIX Index) premium capture strategies. The VSTG Index tracks the cumulative return of a hypothetical portfolio (“VSTG portfolio”) that overlays short one-month VIX strangles on an investment in one-month T-bills. The risk of the strangles is capped by long VIX Index calls and the portfolio is collateralized by selecting the number of capped strangles that preserves 80% of the value of the portfolio. The VSTG portfolio is rebalanced on VIX Index expiration dates, the “roll dates.” After the capped VIX strangles expire, new capped strangles are sold. The strikes of the new put and call legs of the VIX strangles are the 5% and 95% percentile values, respectively, of the probability distribution of the VIX Index at the subsequent roll date, conditional on the current settlement value of the VIX Index. The strike of the long VIX Index calls is the 99% percentile value of the conditional distribution.

Index Design:

The initial roll date of the VSTG Index is March 22, 2006, a VIX Index expiration date. At 11:00 am ET on this date, \$100 is invested in one-month T-bills, a number N_0 of VIX strangles is sold, and N_0 long VIX Index calls are purchased.

Selection of VIX Option Strikes

On the initial roll date, as on all subsequent roll dates, the strikes of the short put and short call of the VIX strangle, and long VIX Index call options are the closest¹ listed strikes to the 40%, 95% and 99% percentile values, respectively, of the distribution of the VIX Index at the next expiration conditional on the Special Opening Quotation (SOQ) of the VIX Index used to settle expiring VIX options. Figure 1 shows the initial conditional distribution used to calculate historical values of the VSTG Index. The conditional distribution is revised on the last business date of the year.

Figure 1. Conditional Distribution of the VIX Index

VIX SOQ	40% put strike	95% call strike	99% call strike
to 12.50	12	16	18
to 15	13	18	21
to 17.5	16	26	33
to 20	18	26	36
to 22.5	20	32	44
to 25	22	33	59
to 30	23	34	63
to 60	29	50	69
above	46	69	71

Number of Capped Short Strangles

At the monthly expiration of VIX Index options, the capped VIX strangles are settled and N new strangles are sold such that the portfolio preserves 80% of its value should the “worst loss” occur at the next settlement. The worst loss (WL) is defined as

$$WL = -100 * \text{Max}[K_{\text{put}} - 9, K_{\text{long call}} - K_{\text{short call}}]$$

where 100 is the multiplier of VIX Index options. Note that the definition of the worst loss assumes that the VIX Index never falls below .9.

Based on this criterion, the number of strangles sold on a roll date is:

$$N = \frac{(.20 + R)M_{\text{postsettle}}}{100 * (WL + \Pi(1 + R))}, \quad \Pi = 100 * (Bid_{\text{put}} + Bid_{\text{shortcall}} - Ask_{\text{longcall}})$$

¹ If there are two listed strikes equidistant to the target strike, choose the greater put strike, the smaller short call strike, and the greater long call strike.

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$M_{\text{post settle}}$ is the value of the portfolio after settlement of the options, R is the effective one-month T-bill rate to the next roll date, and $[\]$ equals the total proceeds from sale of the capped strangles.

Calculation of VSTG

Daily Mark of VSTG at Close of Non-Roll Dates

$$\text{STRGL}_t = M_{t-1} * (1+r_{t-1}) - 100 * N_t * (P_{\text{short put},t} + C_{\text{short call},t} - C_{\text{long call},t})$$

M_t = value of Money account at close of date t , and r_{t-1} daily T-Bill rate. Compounding the daily rate from roll date to roll date results in the effective one-month T-Bill rate R used to determine the number of strangles to sell.

$P_{\text{put},t}$, $C_{\text{short call},t}$ and $C_{\text{long call},t}$ = closing mid-quotes of VIX Index puts and calls in the VSTG Index

Calculation of the VSTG Index at Close of Roll Date

$$M_0 = \$100$$

$$M_{\text{post settle},t} = (1+R_{t-1}) * M_{\text{close},t-1} - 100 * N_{t-1} * \max[0, K_{\text{put},t-1} - \text{SOQ}_t] - 100 * N_{t-1} * \max[0, \text{SOQ}_t - K_{\text{short call},t-1}] \\ + 100 * N_{t-1} * \max[0, \text{SOQ}_t - K_{\text{long call},t-1}]$$

$$\text{VSTG}_t = M_{\text{close},t} = M_{\text{post settle},t} + 100 * N_t * [[\]_t - (P_{\text{short put},t} + C_{\text{short call},t} - C_{\text{long call},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, by calling 1-888-OPTIONS, or from The Options Clearing Corporation, One North Wacker Drive, Suite 500, Chicago, Illinois 60606 or www.theocc.com. The CBOE VIX Strangle Index (VSTG) is designed to represent a proposed hypothetical premium capture strategy. Like many passive indexes, the VSTG 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 VSTG index, the VSTG 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 VSTG Index should discuss with their brokers possible timing and liquidity issues. Transaction costs and taxes for a strategy such as the VSTG 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 VSTG index.

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