SPIKES™ Volatility Index Options

MIAX Options and T3 Index to Launch Options on the SPIKES™ Volatility Index

Overview

MIAX Options and T3 Index are launching options on the SPIKES™ Volatility Index (index symbol: SPIKE), a measure of the expected 30-day volatility in the SPDR S&P 500 ETF (SPY). SPY is the largest exchange traded fund in the world and tracks the most watched stock index in the United States.
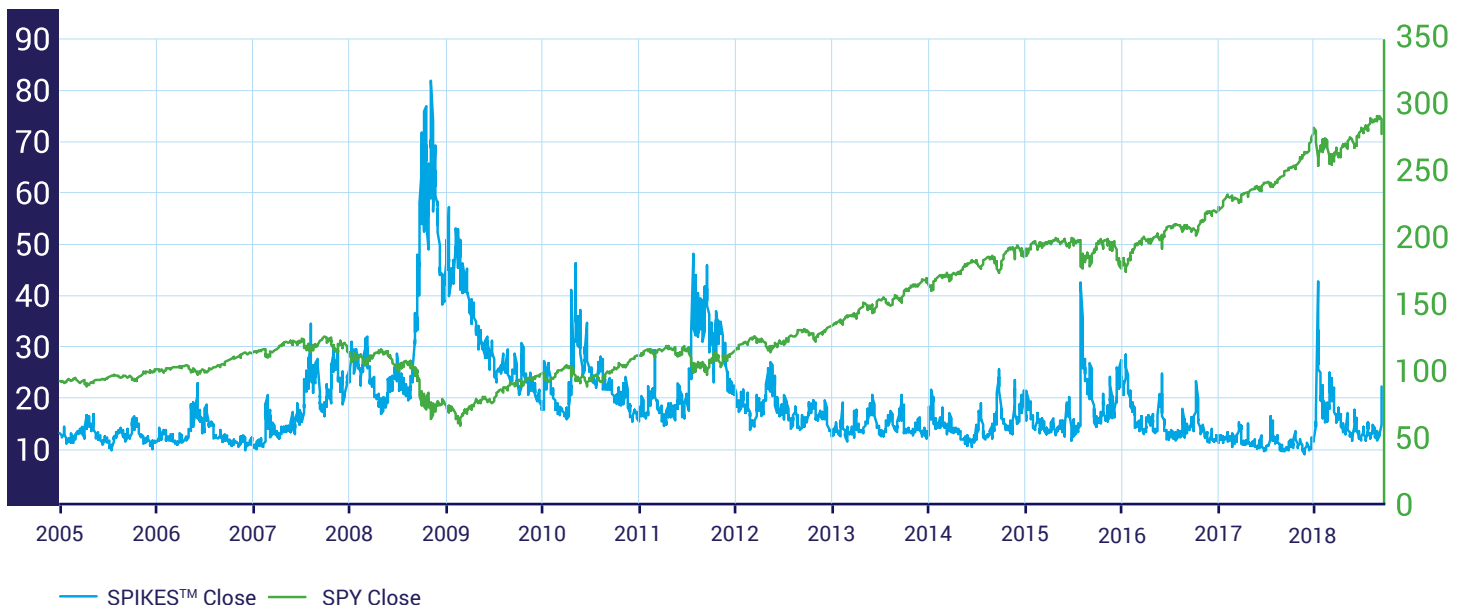
SPIKES™ is built using the popular variance swap methodology and uses live SPY option prices to calculate volatility. This is consistent with the way the trading community is used to modelling risk and hedging exposure.

In addition, the SPIKES™ Index and volatility products offer a number of unique features designed to produce highly accurate, robust data and create a transparent and open auction settlement process.

SPIKES™ is traded on MIAX – one of the fastest and most efficient options platforms in the world, offering fully electronic execution.

MIAX Options is proud to partner with T3 Index to offer SPIKES™ - for more confident volatility trading.

SPIKES™ and SPY Levels

— SPIKES™ Close — SPY Close

The SPIKES™ Formula

SPIKES™ has a defined rules-based approach to selecting components—a series of options on the SPY—and weighting them to derive a single price for the index. The general formula for the SPIKES Index is as follows:

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$$SPIKES = 100 \times \sqrt{\left(\frac{t_1}{t_M} \frac{t_2 - t_M}{t_2 - t_1} \sigma_1^2 + \frac{t_2}{t_M} \frac{t_M - t_1}{t_2 - t_1} \sigma_2^2 \right)}$$

t_1	Time (in seconds) to near-term expiration
σ_1	Estimated volatility computed by variance swap formula, near-term
t_2	Time (in seconds) to next-term expiration
σ_2	Estimated volatility computed by variance swap formula, next-term
t_M	Number of seconds in 30 days (30 x 86,400 = 2,592,000)

The formula for expected T-term variance is as follows:

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$$\sigma^2 = \frac{1}{T} \left[2e^{RT} \sum_i \frac{\Delta K_i p_i}{K_i^2} - \left(\frac{e^{RT}(p^c_{ATM} - p^p_{ATM})}{K_{ATM}} \right)^2 \right]$$

p^c_{ATM} Price of the at-the-money (ATM) SPY call option

p^p_{ATM} Price of the ATM SPY put option

K_{ATM} Strike closest to the point where linearly interpolated SPY call and put prices intersect

T	Time to options expiration (in years, with 1-second precision)
K_i, p_i	A list of unique SPY options strikes, ordered from lowest to highest, and corresponding SPY options prices; of a call if $K_i > K_{ATM}$; and of a put if $K_i < K_{ATM}$; if $K_i = K_{ATM}$ then an average between the ATM SPY put and call prices
ΔK_i	Half the difference between the strikes on either side of K_i;

$$\Delta K_i = \frac{(K_{i+1} - K_{i-1})}{2}$$

For the last (highest and lowest) selected strikes, ΔK_i is simply the absolute difference between K_i and the nearest selected option's strike

R Risk-free interest rate to option's expiration

Calculation Process

SPIKES™ is calculated using only standard options on the SPY that expire on the third Friday of each calendar month. Although weekly options on SPY are available, these are **not** used in the calculation of SPIKES™.

The following process is used to calculate SPIKES™:

STEP 1 Select two SPY expirations	STEP 2 Apply "Price Dragging" technique	STEP 3 Select option inputs	STEP 4 Apply variance swap formula	STEP 5 Calculate SPIKES™
Select the two SPY expiration months. The SPIKES™ calculation begins with the universe of regular monthly SPY options and selects the first monthly expiration with more than two full days to expiry and the next monthly expiration.	Apply "Price Dragging" technique to determine option price inputs. Price Dragging uses eligible trades, bids, and offer prices to reduce erratic movements of the index value that could result from illiquid out-of-the-money options.	Select option inputs. For each expiration, choose the at-the-money and all out-of-the-money options, limited by truncation.	Apply variance swap formula. For each expiration, the volatility is estimated using the variance swap formula, with the selected options' prices weighted according to the formula [2] above.	Calculate SPIKES™. Compute the 30-day weighted average of the near- and next-expiration variances, take the square root, and multiply by 100 as illustrated in the formula [1] above.

New MIAX Functionality

SPIKES™ Special Settlement Auction (a modified Opening Process)

The SPIKES™ Special Settlement Auction occurs on MIAX Options in the SPY options that have 30 days to expiration on the Wednesday that is 30 days prior to the third Friday of the calendar month immediately following the month in which the contract expires. If that Wednesday or the expiration Friday that is 30 days following that Wednesday is a holiday, the final settlement date for the contract shall be on the business day immediately preceding that Wednesday.

Before and during the opening process for each relevant SPY option, MIAX Options will disseminate robust imbalance information over its AIS feed. Anyone (members and non-members) may subscribe to the AIS feed.

New liquidity types called Settlement Auction Only (SAO) orders and SAO eQuotes were created for this process.

Contract Specifications of SPIKES™ Options

Description	SPIKES™ measures changes in expected volatility of the SPDR S&P ETF (commonly known and referred to by its ticker symbol, SPY)
Symbol	SPIKE
CUSIP	84851L107
Multiplier	$100
Strike Interval	Minimum strike price intervals are set at $0.50 where the strike price is less than $15, $1 or greater where the strike price is between $15 and $200, and $5 or greater where the strike price is greater than $200
Minimum Trading Increment	$0.05 for series trading below $3 and $0.10 for series trading at or above $3 Complex Orders and PRIME Price Improvement Auctions are in $0.01 increments
Expiration Date	The Wednesday that is thirty days prior to the third Friday of the calendar month immediately following the expiring month
Expiration Month	Up to twelve expiration months. Short-term, quarterly and LEAPS may also be available
Exercise Style	European
Last Trading Day	Trading will ordinarily cease at 4:15 p.m. (New York Time) on the Tuesday preceding an expiration Wednesday
Settlement Type	Cash
Settlement Value Symbol	SPKCS
Settlement Value*	The exercise and settlement value will be calculated on Wednesday at 9:30 a.m. (New York time) using opening prices, and if no trade has occurred, the mid-point of the opening market for the SPY options used in the calculation of the Index at that time. The exercise-settlement amount will be equal to the difference between the settlement value and the exercise price of the option, multiplied by $100. Exercise will result in the delivery of cash on the business day following expiration.
Settlement of Exercise	Next business day following expiration
Position and Exercise Limits	No position and exercise limits
Trading Hours	9:30 a.m. - 4:15 p.m. Eastern Time (New York time)

* For more information refer to Settlement Process for SPIKES™ Derivatives document.

About MIAX Options and MIH

Miami International Securities Exchange, LLC (MIAX Options) is a fully electronic options trading exchange and wholly-owned subsidiary of Miami International Holdings, Inc. (MIH). MIAX Options currently lists and trades options on approximately 2,800 multi-listed classes. MIAX Options' unparalleled system throughput is approximately 38 million quotes per second. The average latency for a single quote on MIAX Options is approximately 17.56 microseconds for a full round trip. At the 99th and 99.9th percentiles, the latency on MIAX Options is approximately 25.69 and 57.67 microseconds, respectively. MIAX Options is part of the MIAX Exchange Group along with MIAX PEARL, LLC (MIAX PEARL), MIH's second options exchange.

About T3 Index

T3 Index is a research-driven financial indexing firm, specializing in volatility and option benchmarking. T3 Index is dedicated to developing investible, proprietary indices that track related strategies across a range of asset classes to transform the way people invest and manage risk.

Further information on T3Index can be found at **www.t3index.com**.

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