Adaptive VIX Bands

Frederic Palmliden, CFA, CMT

Senior Quantitative Analyst

BACKGROUND

The Adaptive VIX Bands strategy builds on the ideas in the Normalized VIX strategy published in the August 2015 issue of Strategy Concepts Club. This strategy also utilizes the VIX index as a gauge of stock market volatility, but with different characteristics. Instead of comparing the normalized volatility to firm levels and holding positions for only one trading session, this strategy compares the current volatility reading to adaptive bands and holds positions for a much longer period on average. The main benefit of adaptive bands is the continuous flexibility to acclimate to the current environment. The custom bands will widen when the volatility of the volatility increases and narrow when it decreases. A contrarian perspective is still employed, with long positions taken with relatively high volatility readings, while short positions are taken with relatively low volatility readings.

The custom strategy is outlined and analyzed in detail below and provides another perspective on applying the VIX index in strategy trading. A custom indicator with vibrant graphics is also included in order to help visualize trading signals.

STRATEGY ELEMENTS

The TSL:Adaptive VIX Bands strategy requires a secondary data series (i.e., VIX data) to function properly. The necessary VIX data can be inserted in a TradeStation chart using the symbol $VIX.X. The data series is purposely hidden in the screenshots throughout this article to emphasize the strategy signals and improve their visibility.
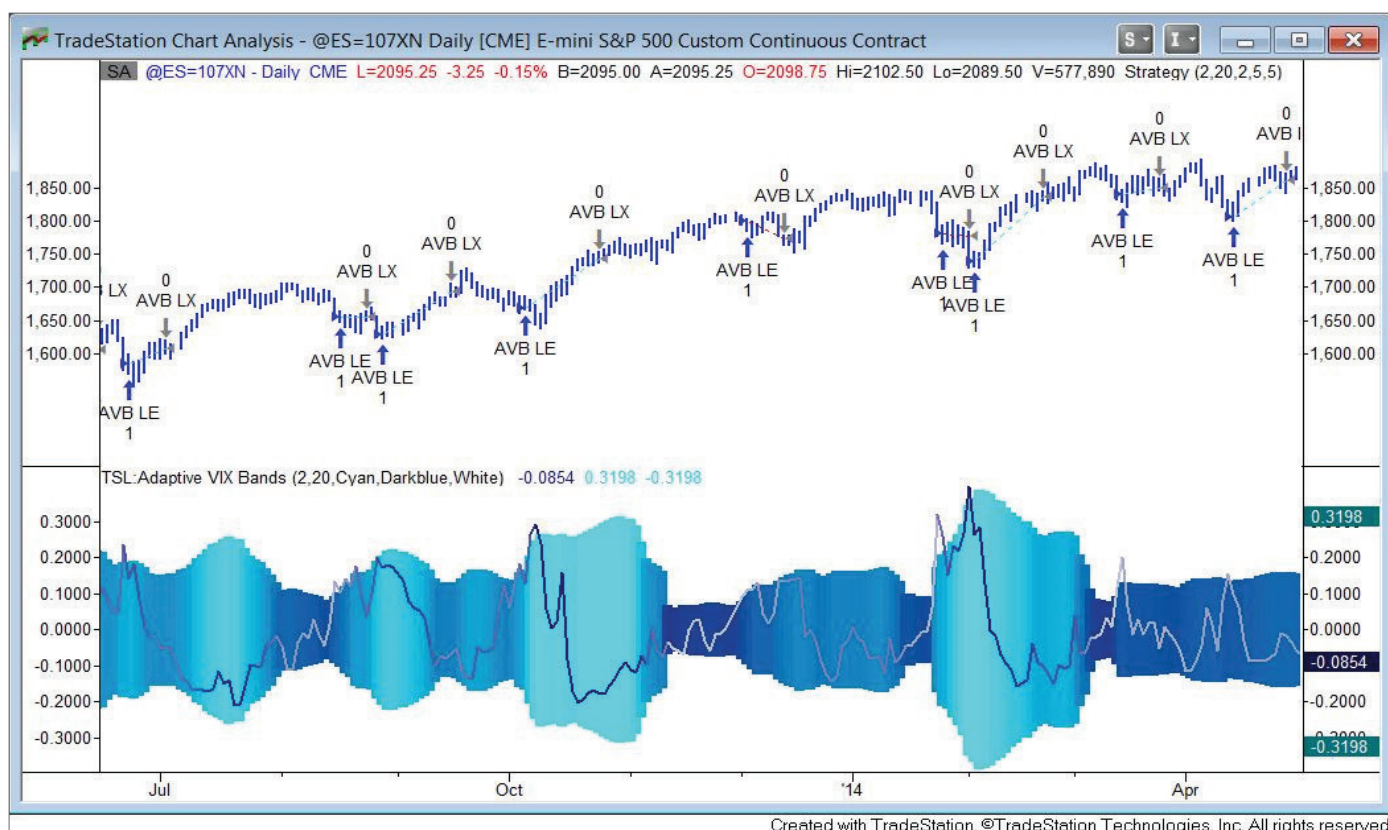
Figure 1: E-mini S&P 500 Continuous Contract (@ES=107XN) with the TSL:Adaptive VIX Bands Strategy

The strategy's core element is the adaptive bands that hug the modified VIX data. Since the VIX data follows more of a log-normal distribution as opposed to a normal distribution, the VIX data is first modified in this application using the natural logarithm of the data. The arithmetic mean of the natural log values (i.e., geometric mean at a log scale) is then subtracted from it to generate the current volatility reading used in this strategy. The adaptive bands use a rolling approach: the top band is constructed using a specified positive multiple of the rolling geometric standard deviation, while the lower band uses the same deviation but on the negative side.

The current volatility reading (i.e., the natural logarithm of the VIX minus the arithmetic mean of the natural logarithm values of the VIX data) can then be compared to the adaptive bands. By default, the bands encompass about 95% of the volatility readings on a rolling basis. This is to say that if the current reading is beyond one of the two bands, it is considered a significant reading and a strategy signal is generated. If the current volatility reading crosses over the top band, a long entry is taken on the following bar, while a short entry is taken if the current volatility reading crosses below the lower band. This again is in accord with typical contrarian interpretation of the VIX.

The **TSL:Adaptive VIX Bands** indicator is provided to help visualize the trade signals. The indicator is used with inputs set as listed below.

Input	Default	Description
GSD_Num	2	Number of geometric standard deviations to use for the Adaptive VIX Bands.
Sample_Size	20	Sample size length for the geometric mean and the standard deviation calculation.
Wide_Band_Color	Cyan	Color used when the Adaptive VIX Bands are the widest in a rolling look-back period of 100 bars.
Narrow_Band_Color	Darkblue	Color used when the Adaptive VIX Bands are the narrowest in a rolling look-back period of 100 bars.
Base_Vol_Color	White	Color used for the current volatility reading when the Adaptive VIX Bands are narrow.

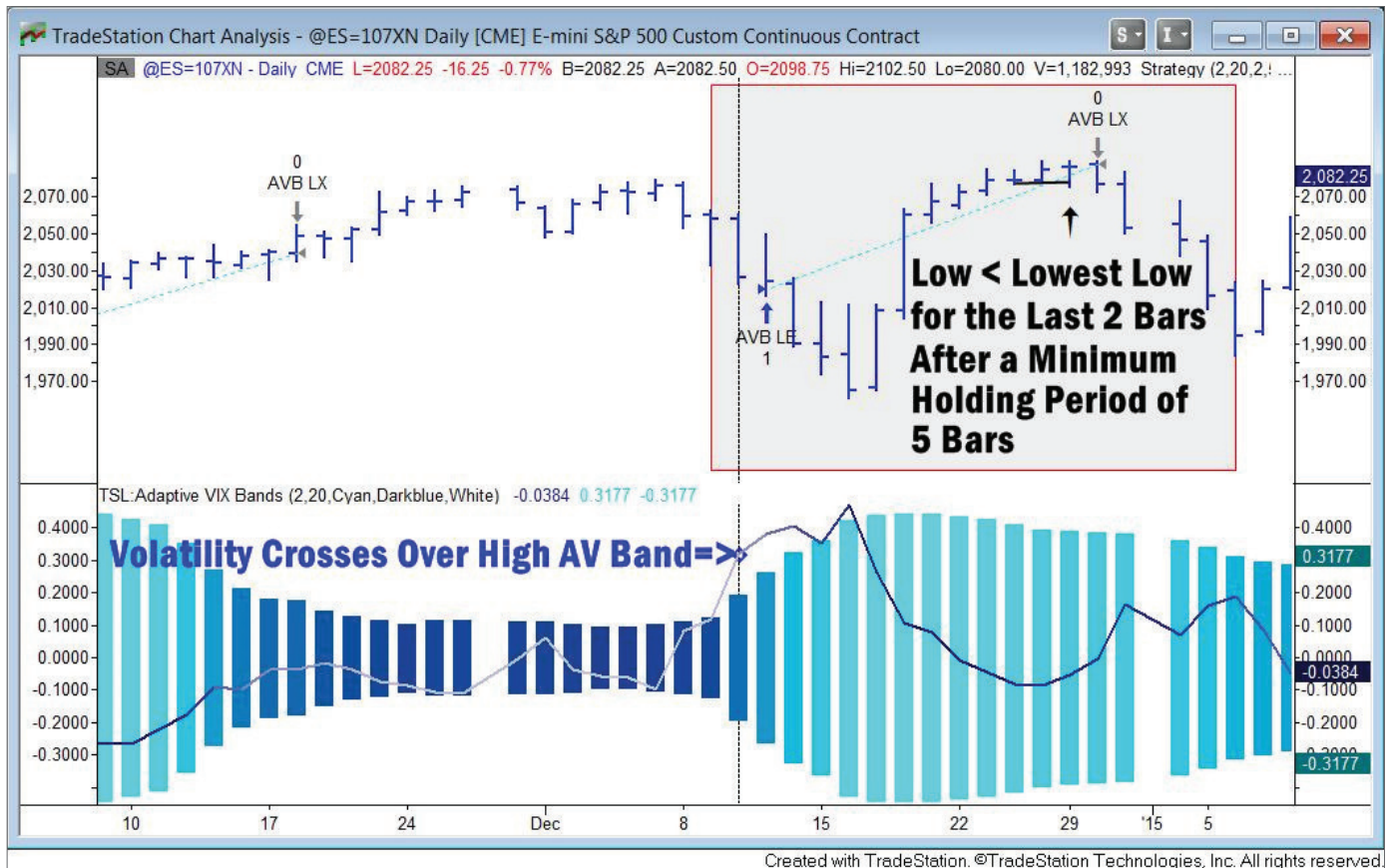| Plot	Description
Adaptive VIX	Plots the current volatility reading.
High AV Band	Plots the rolling high adaptive VIX band.
Low AV Band	Plots the rolling low adaptive VIX band.

Figure 2: TSL:Adaptive VIX Bands Strategy Order Generation Example

To help visualize the current volatility reading contextually, gradient colors are used both for the bands and for the volatility reading itself. The typical colors will fluctuate between the extreme colors specified as indicator inputs. The colors used for the current volatility reading are reversed from the colors used by the bands in order to see the plot more easily. The wide band color is an exception, as it is replaced by a base color. Otherwise, the volatility reading would be hard to see when it is halfway between narrow and wide.

Positions are held for a minimum number of bars, which is specified as a strategy input. Then, long trades are closed when the low is less than the lowest low in a specified look-back period. In a similar fashion, short trades are closed when the high is greater than the highest high in a specified look-back period. There is therefore open exposure (with long and short trades) at least up to the specified minimum holding period.

Figure 2 illustrates an example of a long entry. In this case, the current volatility reading crossed the top band and a long signal was generated at the open of the next bar. The position is then closed after 12 bars when the low broke the lowest low for the last two bars with a minimum holding period of five bars. Again, notice that the VIX data series is hidden in order to highlight only the trades.

Input	Default	Description
GSD_Num	2	Number of geometric standard deviations to use for the Adaptive VIX Bands.
Sample_Size	20	Sample size length for the geometric mean and the geometric standard deviation calculation.
Trail_Stop_Length	2	Look-back period for the lowest low and the highest high.
Min_Long_Hold	5	Minimum holding period, in bars, for long trades.
Min_Short_Hold	5	Minimum holding period, in bars, for short trades.

The default input values were found, in part, by strategy optimization and sensitivity analysis. (See the sensitivity analysis comments in the Strategy Performance Report Highlights section.) Applying the strategy to other securities would likely require adjustments to the input values.

STRATEGY RULES

The TSL:Normalized VIX strategy was applied to the E-mini S&P 500 Continuous Contract (@ES=107XN) using daily bars. However, the strategy could be modified to be used on other securities (e.g., SPY) and bar intervals using the same basic principles. The detailed strategy rules are listed below.

Long Entries

▶ If the current volatility reading crosses over the high adaptive VIX band, buy on a market order on the next bar.

Short Entries

▶ If the current volatility reading crosses under the low adaptive VIX band, sell short on a market order on the next bar.

Exits

▶ Exit any long on a market order on the open of the next bar when the low is below the lowest low of the last 2 bars following a minimum holding period of 5 bars.

▶ Exit any short on a market order on the open of the next bar when the high is above the highest high of the last 2 bars following a minimum holding period of 5 bars.

Note: Please keep in mind that for the ES, entries and exits occur at 6 p.m. ET, which is the opening time of the daily session for the futures contract.

STRATEGY PERFORMANCE REPORT HIGHLIGHTS

The strategy was tested on the ES using the custom continuous futures contract (@ ES=107XN), which is the closest replication to the CME roll. The custom continuous contract utilizes no back adjustment and the rollover trigger is seven trading days prior to the expiration date. The problem when using the @ES adjusted continuous contract is that some theoretical trades would not have occurred at the prices listed in the back-test. As a reminder, the main purpose behind any continuous contract is to create a longer history than is possible using data from just one delivery month; however, the method of construction of the continuous contract series should be considered when back-testing.

Total Number of Trades = 102

▶ The total trades are unevenly split between long trades (67) and short trades (35). Testing revealed that, overall, the strategy worked better on the long side versus the short side. This is also highlighted by a profit factor that is considerably higher for long trades (2.74) than for short trades (1.87).

Figure 3: Strategy Performance Report – Performance Summary Tab

All performance results are hypothetical. Past performance, actual or hypothetical, is not necessarily indicative of future results.

BACK-TESTING SETTINGS

Initial Capital	$20,000
Trade Size	1 Contract
Commissions	$2.36 per side per contract
History	10 years ending 6/30/15
Bar Interval	Daily

Average Bars in Winning/Losing Trades

▶ The average holding period in a winning trade was about two weeks, while the average holding period for a losing trade was just over one week. The largest winning trade was $7,832.78, while the largest losing trade was $3,217.22.

Percent of Time in the Market = 31.66%

▶ The time in the market is substantial and the RINA index is reasonable at 149.17. The Sharpe ratio registered 0.25 and the K-Ratio came out at 3.16, which are quite good.

The equity curve is linear overall for the back-tested period. Relatively small drawdowns were experienced in the tested period, which is quite good considering the average holding period and the amount of history included in the back-test. Keep in mind that the overall market experienced much turmoil in the analyzed period (e.g., 2008) when the VIX index experienced dramatic fluctuations. The back-tested period also includes different types of markets (i.e., bull and bear markets as well as low- and high-volatility markets). The experienced volatility of the equity curve translated to a maximum weekly drawdown of about 19%.

The most negative aspect of the equity curve may be the extended sideways performance, especially in 2010-2012. This would have been challenging to navigate before the strategy's performance picked back up in 2013. Understanding a strategy fully and having confidence that the premise behind a strategy will prevail in the long term may help keep a trader from throwing in the towel at the point of maximum financial opportunity. Of course, that is the strategy trader's challenge and the reason for back-testing with a solid understanding of the strategy's characteristics.

Instead of analyzing one strategy input in isolation, data from TradeStation's Strategy Optimization Reports can be utilized in Microsoft Excel to perform sensitivity analysis between two strategy inputs at the same time by creating a 3-D chart. For instance, an exhaustive Strategy Optimization Report can be run on the Trail_Stop_Length and Min_Long_Hold strategy inputs, and the resulting data can be used to create a surface chart in Excel.
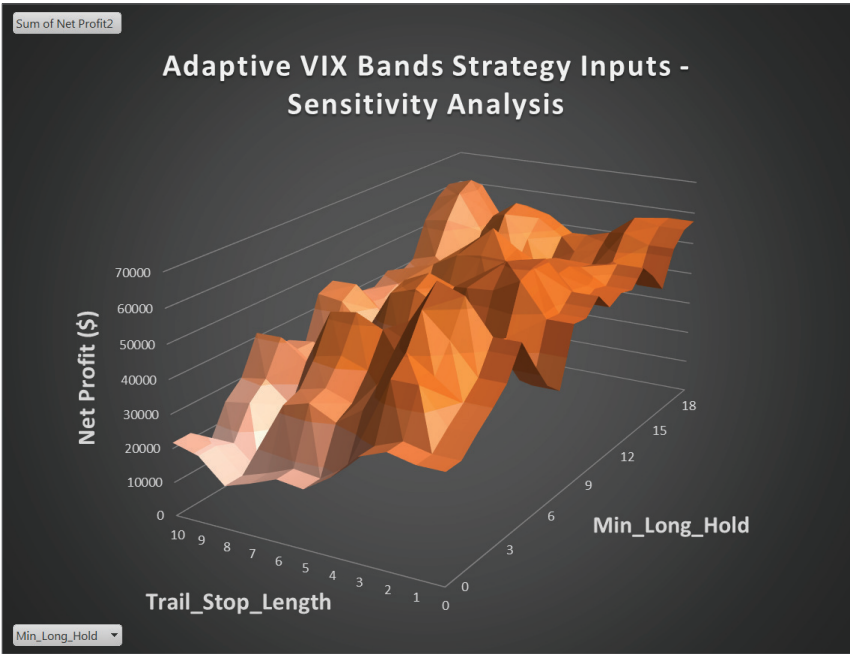
Figure 5 illustrates the impact on the back-tested net profit when the Trail_Stop_Length and Min_Long_Hold input values change. The back-tested net profit is fairly stable for the most part in the surface. The chosen default values for the two inputs happen to be peak values in this case (when the Trail_Stop_Length input is 2 and the Min_Long_Hold is 5).

Figure 4: Strategy Performance Report – Equity Curve Detailed
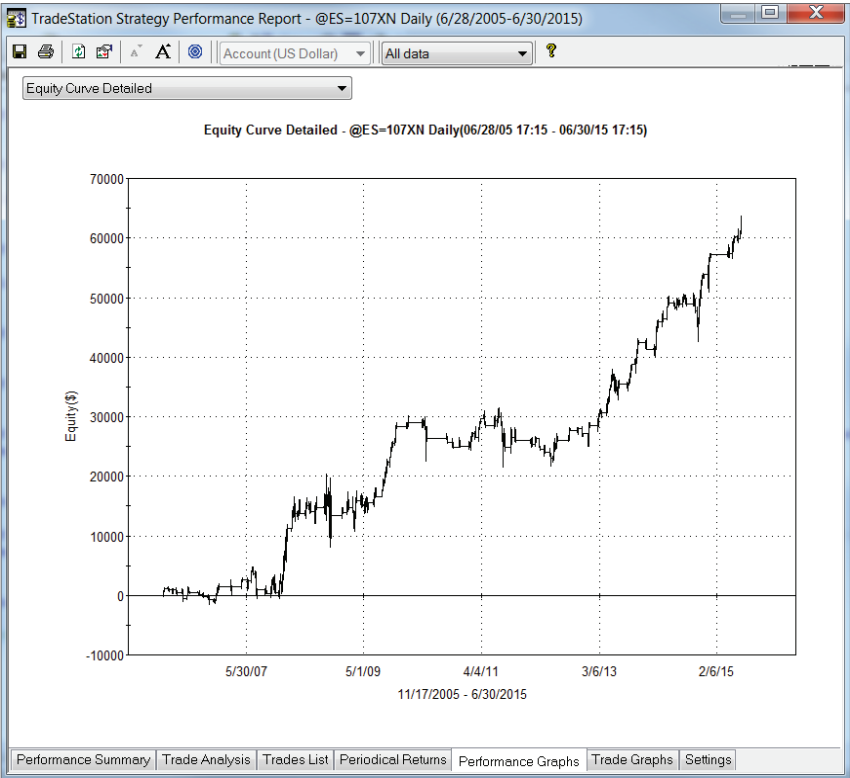
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Figure 5: TSL:Adaptive VIX Bands Strategy Inputs Sensitivity Analysis

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