FIXING THE VIX: AN INDICATOR TO BEAT FEAR
By: Amber Hestla-Barnhart
Volatility is widely considered to be a category of technical indicators with a simple interpretation - no matter how it is measured, volatility is widely believed to rise in a market downturn. This approach is applied to indicators such as the Average True Range (ATR), Bollinger Bands® BandWidth or the most widely followed volatility indicator, VIX, which is formally known as the CBOE Volatility Index®.

VIX is widely known as the “Fear Index” because it often increases when the stock market drops and the fear of further price declines increases. While this concept sounds useful, there are significant limitations to executing trading strategies based on VIX and these limitations make VIX virtually useless for the average investor.

Although it is not widely followed, there is a simple volatility indicator available in the public domain that can be used to implement trading strategies based on the concept of VIX. This indicator, the VIX Fix developed by Larry Williams, overcomes the limitations of VIX. This paper will explain the VIX Fix and introduce a quantitative trading strategy to profit from rising fear.

In this paper, I will briefly review what VIX is, highlight some of the limitations of VIX, describe an alternative to VIX and then provide test results demonstrating how well the VIX Fix works. The main focus of the paper is on the test results.

AN OVERVIEW OF VIX

VIX is intended to quantify the market expectations of near-term volatility included in S&P 500 stock index option prices. The idea of a tradable volatility index dates back to at least 1986¹ and the VIX was developed in 1993.² The Chicago Board Options Exchange notes that “Since its introduction in 1993, VIX has been considered by many to be the world’s premier barometer of investor sentiment and market volatility. For investors who wish to trade an instrument related to the market’s expectation of future volatility, VIX futures were introduced in 2004, and VIX options were introduced in 2006.”³

The calculation of VIX is complex and requires using market prices of S&P 500 options contracts to derive the size of the expected price move in the S&P 500 index over the next 30 days.⁴ From a trading perspective, it is more important to focus on how VIX can be applied to market analysis than it is to understand the calculation of VIX.

Most analysts consider high levels of VIX to be associated with market bottoms. A chart showing both the S&P 500 index and the VIX index demonstrates that this is true. Figure 1 shows that VIX spikes are seen at significant bottoms. Vertical lines have been added to the figure to highlight times when there was both a VIX spike and an important market low.
Visually, it does appear that VIX consistently tops near important market bottoms. Although Figure 1 uses monthly data, the same behavior can be seen in weekly, daily and intraday charts.

**LIMITATIONS OF VIX**

Figure 1 seems to demonstrate the reliable relationship between a high VIX and market bottoms, but there is no tradable information present. Tops in the VIX index are confirmed only in hindsight. Tops in VIX are only loosely associated with bottoms in the S&P 500 with the actual low in price occurring days, weeks or months after the peak in VIX. The time between VIX peaks and market lows is variable and unpredictable in real time.

As one example, VIX set a multi-year high in October 2008, more than four months before the S&P 500 bottomed in March 2009. The top in VIX is only apparent with the benefit of hindsight and traders could have believed the multi-year high in VIX reached in October 2008 was important at that time. There was no way to predict that VIX would continue rising based on the information available at that time.

It will never be possible to know when VIX is peaking in real-time. Because VIX is unbounded by its calculations it is always possible that VIX can move higher. To derive trading signals from VIX, it might be possible to apply traditional tools of technical analysis such as moving averages (MAs) or Bollinger Bands to place the current level
of VIX in context. This is a testable concept but is limited in value due to the fact that the VIX applies only to the S&P 500. In practice, many analysts ignore this limitation since there is generally a high, positive correlation between the price moves of broad market indexes and individual stocks.

However when applying VIX as part of a trading strategy, it is important to remember that VIX is calculated from the premiums traders pay on S&P 500 index options contracts and its value is specific to the S&P 500 index. Recognizing this limitation, the CBOE provides calculations of volatility indexes for the NASDAQ 100, the Dow Jones Industrial Average, the Russell 2000, gold, oil, and euro futures. In addition, the CBOE publishes volatility indexes for several individual stocks including Amazon (AMZN), Google (GOOG), Goldman Sachs (GS), IBM (IBM) and Apple (AAPL). These newer indexes acknowledge the limitation of VIX and highlight the value of calculating volatility for different securities.

**THE VIX FIX**

The fact that VIX applies only to the S&P 500 led market analyst Larry Williams to develop an indicator he calls the “VIX Fix” which can be applied to any stock, ETF, tradable security or market-based index. Figure 2 shows SPY with the traditional VIX index in the second pane of the chart and the VIX Fix in the pane below that. The general direction of the trend in both indicators is the same although there are differences in the magnitude and slight differences in the timing of turning points in the two indicators. At the bottom of the chart, both indicators are shown in a single pane to highlight the similarity in price movements between the two. This chart demonstrates that the direction of the trend in the VIX Fix is highly correlated with the trend in VIX.

![Figure 2: VIX and the VIX Fix](image-url)
The VIX Fix applies the same general formula that is used to calculate the stochastic indicator and is fairly simple to calculate. The difference between the highest close in the past 20 days and today’s low is divided by the highest close in the past 20 days. That ratio is multiplied by 100 to scale the indicator from 0 to 100. The formula for the VIX Fix is:

\[
\frac{\text{Highest (Close, 20)} - \text{Low}}{\text{Highest (Close, 20)}} \times 100
\]

Where “Highest (Close, 20)” means the highest closing value in the past 20 periods and the low refers to the current period’s low. The formula can be applied to any timeframe.

In the calculation, Williams used 20 days to include approximately one month of trading history. With weekly or monthly data, 20 is used as the default parameter.

This indicator extends the powerful concept behind the VIX to any stock or ETF. With a simple calculation method and broad applicability, VIX Fix addresses the two limitations of VIX identified above.

The VIX Fix can be applied in a number of ways. For example, it can be used to identify volatile stocks during periods of relative calm in the broad market. Figure 3 shows the traditional VIX index based on data for the S&P 500 index along with the VIX Fix indicator for Monster Beverage (MNST). VIX Fix fluctuates wildly for MNST during most of the time period shown in the chart, indicating the stock was highly volatile even when the broad market was experiencing low volatility as indicated by the relatively low and flat values of VIX.

Figure 3: VIX Fix identifies trading signals VIX misses.
By identifying the volatility of individual stocks in any market environment, traders can identify stocks with current volatility profiles that are best suited to their trading style.

There are other tools available to determine the volatility of an individual stock but none is as simple as the VIX Fix. One alternative is implied volatility which can be calculated for many individual stocks. The VIX Fix however does not require access to options price data like implied volatility does and is more applicable since the VIX Fix can be calculated for any stock, security or index, even those without actively traded options.

A mechanical trading strategy is based on rules that dictate buy and sell decisions. One advantage of a mechanical strategy is that it is objective. All traders applying the strategy exactly as written will obtain similar results. Any difference in results should be attributable to slippage and commissions which are unavoidable and vary from trader to trader. Another advantage of mechanical trading strategies is that they are useful for evaluating the effectiveness of technical indicators. In a backtest, slippage and commission costs can be controlled, allowing the results of a backtest can be used to assess how well selected indicators work.

To develop a test of the effectiveness of the VIX Fix, an MA can be added to the indicator. For an initial test, a 20-day MA will be applied to daily data. All stocks in the S&P 500 and several other indexes will be tested using data from November 1, 1999 through October 31, 2014, a 15-year test period. If the total history available for any stock covers less than fifteen years as of October 31, 2014, all available history is used. This test does not correct for survivorship bias because it uses the stocks that were in the index on October 31, 2014. To partially offset the impact of survivorship bias, tests are run using several indexes that include nearly 3,000 separate stocks and a long timeframe is used. The period used in the test includes two bear markets and three bull markets to capture the performance of the VIX Fix under a variety of market conditions.

A buy will be triggered when the VIX Fix falls below the MA and a sell will be generated when the VIX Fix rises above the MA. Trading costs of $5 per trade were deducted from each trade to simulate the impact of slippage and commissions.

The buy rule is designed to identify periods of time when volatility has become unusually high (periods of time when it is greater than the MA) and takes action (buys) when volatility is returning to normal (falling below the MA). These rules assume that volatility is mean reverting, a widely accepted assumption among market analysts. After a stock is bought, the position will be held while volatility (VIX Fix) remains low (below its MA)
and sold when the volatility (VIX Fix) becomes higher than average (crosses above the MA). When a sell signal is given, the strategy will move to cash and assumes a 0% return on cash. The results of this test are shown in Table 1. The same tests were also completed using weekly data and the results are presented in Table 2. The same 20-period MA was used so the strategy rules were exactly the same.

<table>
<thead>
<tr>
<th>DAILY DATA</th>
<th>Annual rate of return</th>
<th>% wins</th>
<th>Maximum drawdown</th>
<th>Percent of time invested</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIX Fix Strategy on S&amp;P 500 components (large cap stocks)</td>
<td>7.0%</td>
<td>41.3%</td>
<td>84%</td>
<td>26%</td>
</tr>
<tr>
<td>VIX Fix Strategy on S&amp;P 400 components (mid cap stocks)</td>
<td>9.1%</td>
<td>41.4%</td>
<td>60%</td>
<td>31%</td>
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<tr>
<td>VIX Fix Strategy on Russell 2000 components (small cap stocks)</td>
<td>8.1%</td>
<td>40.0%</td>
<td>70%</td>
<td>36%</td>
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<tr>
<td>VIX Fix Strategy on NASDAQ 100 components (volatile stocks)</td>
<td>10.4%</td>
<td>41.2%</td>
<td>46%</td>
<td>33%</td>
</tr>
<tr>
<td>Buy &amp; Hold (S&amp;P 500 index)</td>
<td>4.6%</td>
<td>100%</td>
<td>55%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 1: VIX Fix strategy test with daily data.

The same tests were also completed using weekly data and the results are presented in Table 2. The same 20-period MA was used so the strategy rules were exactly the same.

<table>
<thead>
<tr>
<th>WEEKLY DATA</th>
<th>Annual rate of return</th>
<th>% wins</th>
<th>Maximum drawdown</th>
<th>Percent of time invested</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIX Fix Strategy on S&amp;P 500 components (large cap stocks)</td>
<td>15.5%</td>
<td>46.1%</td>
<td>28%</td>
<td>27%</td>
</tr>
<tr>
<td>VIX Fix Strategy on S&amp;P 400 components (mid cap stocks)</td>
<td>14.5%</td>
<td>45.7%</td>
<td>31%</td>
<td>31%</td>
</tr>
<tr>
<td>VIX Fix Strategy on Russell 2000 components (small cap stocks)</td>
<td>12.7%</td>
<td>42.9%</td>
<td>40%</td>
<td>43%</td>
</tr>
<tr>
<td>VIX Fix Strategy on NASDAQ 100 components (volatile stocks)</td>
<td>16.6%</td>
<td>45.6%</td>
<td>81%</td>
<td>34%</td>
</tr>
<tr>
<td>Buy &amp; Hold (S&amp;P 500 index)</td>
<td>4.6%</td>
<td>100%</td>
<td>55%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 2: VIX Fix strategy test with weekly data.

The results show that buying stocks after a peak in volatility can be rewarding. The highly liquid stocks in major market averages all provide double digit average annual returns that are 2.8 to 3.6 times higher than the gains.
of the S&P 500 index. Of the stocks included in the test on the S&P 500 index, 391 (78.2%) were profitable in standalone testing.

All except the NASDAQ 100 delivered higher gains with less risk, defining risk as the largest maximum drawdown. Although the NASDAQ 100 test showed those stocks outperformed a buy and hold strategy, the risk was higher.

The VIX Fix strategy is invested a relatively small percentage of the time which would allow investors to pursue alternative investment strategies instead of retreating to cash.

One question that must be addressed is whether traders can obtain superior results using the VIX itself rather than the VIX Fix for trading signals. The VIX Fix varies the degree of exposure to the market based on current volatility levels of individual stocks. The VIX will supply a buy or sell signal for all stocks at the same time, whereas the VIX Fix provides signals that are staggered through time. Using VIX would lead to an “all or nothing” investment position. The VIX Fix provides a higher degree of specificity and therefore improved performance over time.

Short trades are theoretically possible by flipping the rules. To test this strategy, short trades would be entered when volatility increases (the VIX Fix crosses above its MA) and would be covered (buying to close the position) when the VIX Fix falls below its MA. The results of backtests were not profitable which indicates rising volatility will not always be associated with falling prices.

The 20-period MA was selected solely as a convenient parameter, and was not optimized. Testing of nearby values shows that the parameter is stable as summarized in Table 3.

<table>
<thead>
<tr>
<th>WEEKLY DATA</th>
<th>Annual rate of return</th>
<th>% wins</th>
<th>Maximum drawdown</th>
<th>Percent of time invested</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIX Fix Strategy on S&amp;P 500 components (MA = 18)</td>
<td>14.2%</td>
<td>46.2%</td>
<td>32%</td>
<td>27%</td>
</tr>
<tr>
<td>VIX Fix Strategy on S&amp;P 500 components (MA = 19)</td>
<td>14.9%</td>
<td>46.1%</td>
<td>30%</td>
<td>27%</td>
</tr>
<tr>
<td>VIX Fix Strategy on S&amp;P 500 components (MA = 20)</td>
<td>15.5%</td>
<td>46.1%</td>
<td>28%</td>
<td>27%</td>
</tr>
<tr>
<td>VIX Fix Strategy on S&amp;P 500 components (MA = 21)</td>
<td>16.0%</td>
<td>46.1%</td>
<td>27%</td>
<td>27%</td>
</tr>
<tr>
<td>VIX Fix Strategy on S&amp;P 500 components (MA = 22)</td>
<td>16.2%</td>
<td>46.0%</td>
<td>26%</td>
<td>27%</td>
</tr>
</tbody>
</table>

Table 3: MA parameter variation for the VIX Fix strategy test with weekly data.
Based on this test, the VIX Fix Strategy is robust as defined by Connors and Radtke. They demonstrated that “a sound trading strategy should provide results that vary slightly when the strategy parameters are varied by a small amount.” The results presented in Table 3 show that relatively small changes in the period of the MA result in relatively small changes in performance. There is also a linear trend in the percentage returns and drawdowns. Based on the data, it does appear that an MA with a value greater than 20 would improve the performance of the strategy.

This data increases the confidence level that the parameter has not been curve fit to the past data. It also increases the confidence level that the strategy is likely to perform in a similar manner in the future because it is not based on curve fitted data.

**A REAL TIME TEST**

To supplement the backtesting presented in the previous section, in this section, the results of a real time test will be presented. This test is modeled on the test presented in Stock Selection: A Test of Relative Stock Value Reported over 17 ½ Years, the 2001 Dow Award winning paper presented by Charles D. Kirkpatrick II, CMT. As Kirkpatrick noted, “the best and most convincing test of any theory is to see if it works by itself using completely unknown data.”

Traders can also apply the VIX Fix to benefit from price moves in the options market. Options prices incorporate a number of factors which volatility is one of the important. If volatility is higher than average, traders selling options should be able to generate significant gains as volatility returns to a normal level and the options price declines.

From September 20, 2013 through September 26, 2014, real time trade recommendations were published in a weekly newsletter. Each week, three to five put option selling recommendations were provided to subscribers. The trades were based primarily on the VIX Fix indicator. If a stock chart showed that the VIX Fix had fallen below its 20-week MA in the previous week, a put option meeting a minimum income requirement was identified. To be recommended, the put sale needed to generate a return on investment of at least 3% of the required margin deposit. All of the options recommended expired in less than 90 days. Assuming profits are reinvested, this strategy could produce an annual return on investment of more than 10% a year if the win rate is high.

The results of the test indicate how the trades would have performed if each one was acted on and are summarized in Table 4.
Given the reality of the options market, the VIX Fix performs significantly better than a random entry with 92.6% wins compared to an expected win rate of 5.5% from randomly selling puts and allowing them to expire.

<table>
<thead>
<tr>
<th></th>
<th>Recommendations made and closed</th>
<th>% wins</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>62</td>
<td>93.5%</td>
</tr>
<tr>
<td>2014</td>
<td>114</td>
<td>92.1%</td>
</tr>
<tr>
<td>Total</td>
<td>183</td>
<td>92.6%</td>
</tr>
</tbody>
</table>

Table 4: Real time test results.

Many investors erroneously believe that selling puts is a high probability trading strategy with an expected win rate of 75% or more. This perception appears to be based on a study which found that three out of four options held to expiration, on average, expire worthless. That particular study reviewed options on various futures contracts for a three-year period (1997-1999) and found that 76.5% of options contracts held to expiration on the Chicago Mercantile Exchange (CME) expired worthless. This study is misleading because it does not include contracts closed prior to expiration. According to the widely quoted study, 6.3 million option contracts expired worthless in 1999. According to CME data, 115 million options contracts were traded that year. Most options contracts are closed prior to expiration and because there is a buyer and seller for each contract, half of those were closed with a gain and half of the options traders closed positions with a loss. Of all contracts traded, just 5.5% expired worthless that year.

Another reality of the options markets is that a high win rate is not always an indicator of profitability for an options selling strategy. It is possible to win small amounts on a high percentage of trades and suffer extraordinary losses on the remaining trades. This means the risk of ruin is high for options sellers.

This test did not apply any risk management rules to decrease the risk of ruin. In practice, traders could apply a stop-loss rule or some other strategy to close out options positions when they show large losses.

To determine whether or not this test would have resulted in profits over the test period, a simple calculation was made assuming the losing trades were exited at the closing market price on the Friday before the option expired. If that had been done, the profits from winning trades exceeded the expense of closing losing trades cumulatively and in both 2013 and 2014.

Based on the real time test with a provision for including the impact of losses, the VIX Fix strategy can be combined with a minimum income requirement rule to implement a profitable put selling strategy.

Backtesting demonstrates the VIX Fix can be used effectively as part of a trading strategy. This is an indicator that was fully disclosed by its developer, Larry Williams, and is available in the public domain. The tests described in this paper use the VIX Fix exactly as it was described in 2007.
This paper adds an MA to the VIX Fix to develop a complete trading strategy. Applying the VIX Fix with its MA to weekly data seems to be more profitable than using daily data. As demonstrated in this paper, VIX Fix can also be used to trade options. Results of a real time test of the put selling strategy reveal that traders can find high probability trading opportunities with the VIX Fix.

Further research can examine the effectiveness the VIX Fix when combined with other indicators such as Bollinger Bands. The length of the MA used for trading could also be optimized through additional testing, and additional research could be conducted on international markets and other asset classes.
Amber Hestla-Barnhart – 2015 Charles H. Dow Award Winner

The MTA grants the 2015 Charles H. Dow Award in recognition of the research and applications presented in Fixing the VIX: An Indicator to Beat Fear.

Amber Hestla-Barnhart, the winner of the 2015 Charles H. Dow Award which recognizes outstanding research in technical analysis, is Chief Option Strategist at ProfitableTrading.com and editor of the weekly Income Trader and biweekly Maximum Income newsletters. She applies the ideas detailed in the Dow Award paper in these newsletters. Prior to assuming these responsibilities, Amber worked as a trader for a Registered Investment Adviser (RIA) with $200 million in assets under management and as an independent research analyst. Her work has been featured in SFO, Technical Analysis of Stocks & Commodities, and Traders Magazine (UK). She is also a frequent contributor to Technically Speaking, the Market Technicians Association monthly newsletter. Prior to her career in finance, Amber was a member of the Wyoming Army National Guard, where she was assigned to the Counter Drug Support Program/Wyoming Division of Criminal Investigation (DCI) as a Criminal Intelligence Analyst. While in that position, Amber received the Governor’s commendation for her work targeting criminal activity associated with motorcycle gangs and she received the Director’s commendation for work on cold cases dating to the 1970s. In 2009, she left DCI to deploy in support of Operation Iraqi Freedom for which she received the Army Commendation Medal. Upon her return in 2010, she entered the investment industry.