



TRADING VOLATILITY

Fundamental Concepts And Strategies For Trading Volatility ETPs

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Summary

Volatility ETPs are an extremely useful yet complex class of securities. An investor's long-term success in trading these products depends on understanding exactly how they work and following a disciplined execution strategy. This document introduces the core concepts of VIX and VIX-related products. It also identifies the primary price drivers of our favorite volatility ETPs and outlines how we can use these concepts to generate forecasts for future price movements.

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1 Introduction

Volatility has recently become a very popular asset class among major investment banks and sophisticated investment funds because it is able to generate large returns as well as hedge risk. The unique mean-reverting property of volatility makes it possible to generate forecasts that can be used to take advantage of spikes and declines in volatility. By tracking and analyzing a variety of volatility-related indices and metrics, the direction of future moves in volatility funds can be made with reasonable accuracy. These forecasts provide us with an edge in the stock market and we use them as the foundation of our trading strategy.

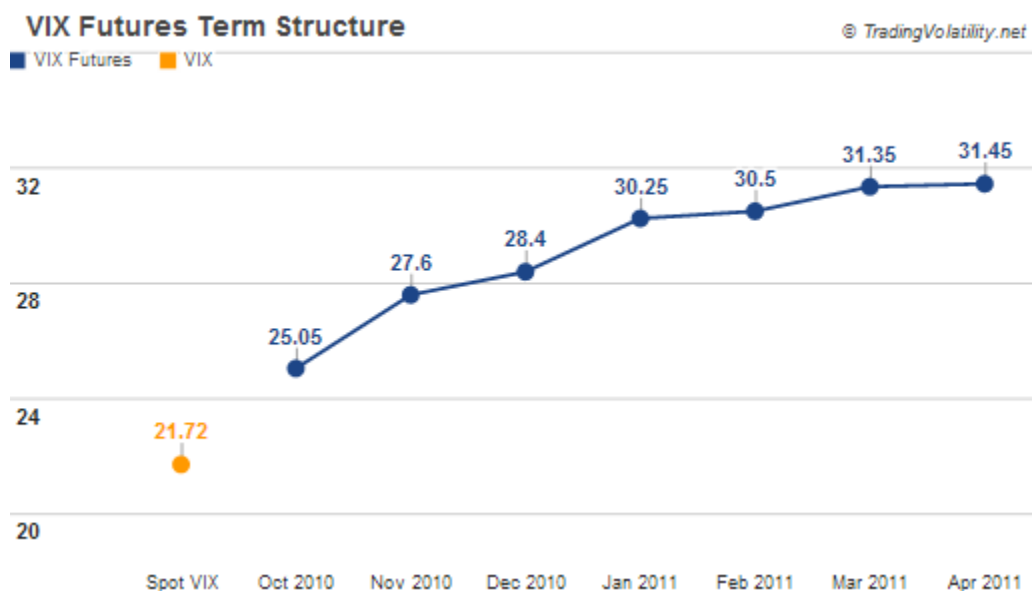
2 The VIX

In order to understand our approach to trading volatility exchange traded products (ETPs) it is important to understand what the VIX tracks and the concept of VIX futures. Most simply stated, the VIX measures the expected volatility of the S&P 500 Index (SPX). By taking a weighted average of a range of put and call options for the SPX, the VIX obtains a value that provides the market's expectations for the dispersion of the S&P 500 (up or down) for the next 30 days. Because the VIX is a weighted average calculation of options, it is not directly tradable. Note that the VIX is also sometimes referred to as "spot VIX" or "30 day implied volatility."

The value of the VIX is often quoted as a price but actually represents a percentage on an annualized basis. For example, a VIX of 16 means that market participants expect the SPX to move at an annualized rate of 16% over the next 30 days. Sometimes it is easier to think about the VIX on a shorter timeframe to help put it in context of daily market moves. To express VIX in a monthly rate you can divide its value by $\sqrt{12}$, which equals 4.6% for a VIX of 16. To express the value in a daily rate you can divide the VIX by $\sqrt{252}$, which equals 1% for a VIX of 16. Note that when talking about the VIX, the phrase "market participants expect" means that movement occurs with a 68% probability (one standard deviation). While it is not necessary for the purpose of trading to go into more details of the calculation, you can check out CBOE's [white paper on VIX](#) if you are interested in the math behind it all.

3 VIX Futures

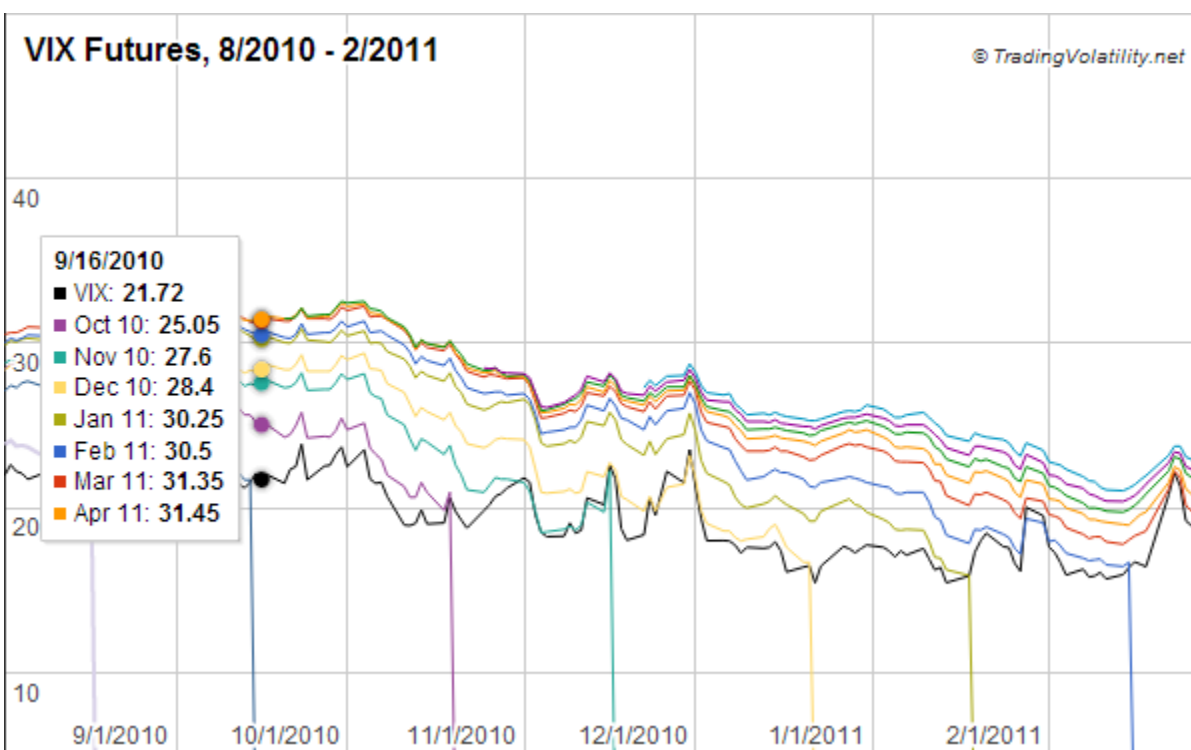
In addition to the VIX there are also VIX futures. While spot VIX is a calculation of the current 30-day implied volatility of SPX, VIX futures are the expected value of the VIX on the expiration date for a given month. VIX futures are contracts that can be bought or sold directly. Each month has its own VIX futures contracts and when we look at the group of VIX futures together we get something called the term structure. In the term structure graph below we can see the price of VIX as well as the price of each month of VIX futures for the next seven months.



Normally the term structure is shaped such that VIX futures that have a longer time to expiration are more expensive than nearer months, a condition known as contango. The reason for this pricing structure is that a longer timeframe translates into greater uncertainty of what price VIX might be on those expiration dates.

A term structure that has near term months that are more expensive than more distant months is in backwardation. This condition happens when market participants believe that the current levels of volatility are excessively high based on historical norms and they anticipate that VIX will revert to a value closer to long term averages.

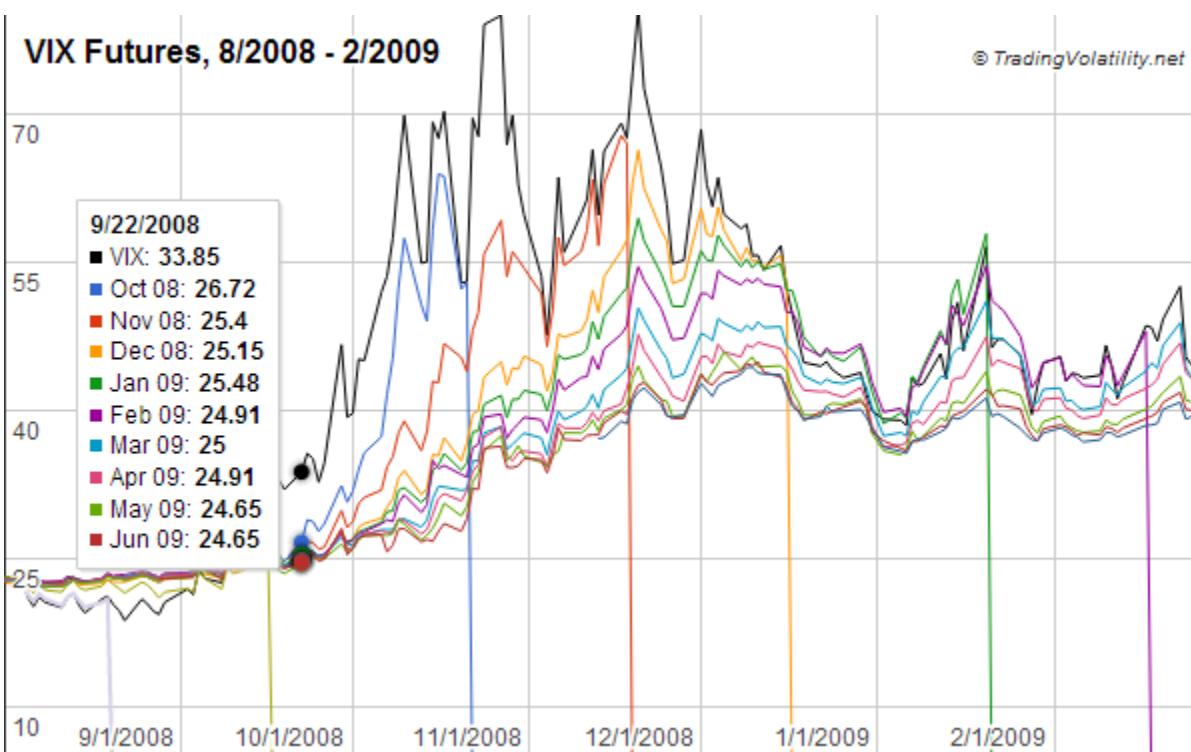
The exact shape of the term structure changes daily. In order to monitor how the term structure changes over time I like to look at a chart showing the daily closing values of VIX and each month of VIX futures over a multi-month timeframe. Below is a chart of VIX and VIX futures plotted daily between August 1, 2010 and Feb 28, 2011.



By viewing the VIX futures term structure in this manner we can see a few things more clearly.

- Contango, the condition in which contracts for near term months are less expensive than contracts further out in the future, is clearly visible at most points. The VIX futures values from our term structure chart are now highlighted on September 16th. At this point, October contracts are cheaper than November, which are cheaper than December, which are cheaper than January 2011, and so on.
- VIX futures expiration dates are represented by the colored vertical lines near the middle of each month. At this point, all months advance forward one month (second month becomes the first month, third becomes the second month, etc.) and a new seventh month is added into the mix.
- As time progresses the values of more distant VIX futures months approach spot VIX. Try following the blue line representing February 2011 VIX futures and see how the difference between it and spot VIX (the black line) gradually decreases as it approaches its expiration date in mid-February.

While the term structure is in contango most of the time there are also times of backwardation, which is visible in the chart of VIX futures between August 2008 and February 2009, below. Here we see VIX is greater than Oct, which is greater than Nov, which is greater than Dec, etc.



If you would like to view the current term structure, historical VIX futures prices and related data you can do so on our [VIX Futures Data page](#).

4 VIX Futures ETPs

The edge in trading VIX futures ETPs comes from the fact that each fund has a daily rolling mechanism to maintain a targeted maturity. In order to accomplish that target the fund will own a blend of two or more months of VIX futures. Each day, the fund sells a portion of its existing holdings of VIX futures and buys a replacement amount of the next month VIX futures. A significant difference between the prices of the two months of futures creates a measurable directional pull, which can be thought of as a headwind or tailwind for the security. Technically known as the roll yield, this headwind can be positive, negative, or neutral. Our goal in trading VIX ETPs is to make the trades which give us the highest probability to make a profitable trade, and a key piece of information is the direction and magnitude of the roll yield.

There are a variety of VIX futures ETPs, each targeting a specific objective. I choose to focus on both long volatility and short volatility funds that have a price replication target of either short-term VIX futures (months one and two) or mid-term VIX futures (months four to seven).

Long Volatility

One of the most popular VIX-related funds is iPath's "VIX Short-term Futures ETN" (ticker symbol: VXX) which tracks the daily movement of the first and second month VIX futures and provides a return of the daily gain or loss of those VIX futures.

Short Volatility

The funds that allow investors to take the opposite side of the trade and "short" volatility to obtain a return which is the daily inverse of VXX are the "VelocityShares Daily Inverse VIX Short-Term ETN" (ticker symbol: XIV) and the "Proshares Short VIX Short-term futures ETP" (ticker symbol: SVXY).

Mid-Term Funds

For some people the daily movements in VXX and XIV create too much volatility in their portfolio. One of my favorite alternatives to XIV is the "VelocityShares Daily Inverse VIX Short-Term ETN" (ticker symbol: ZIV), which allows you to short volatility of months that are 4-7 months in the future. Generally, VIX futures that have a longer time to expiration will move less on a given day than VIX futures that are closer to expiration, making ZIV a less volatile product but still quite profitable as it returned 200% in the first three years since its launch on Nov 30, 2010.

5 Impact Of The Roll Yield

How important is it to know the direction and magnitude of a fund's roll yield? Consider VXX. It launched on Jan 30, 2009 at \$6,693 (adjusted for reverse splits) and has fallen to \$42.55 as of the end of 2013. During this same timeframe VIX has fallen from 44.84 to 13.73, a 69% loss. However, VXX has lost 99.3% of its value -- a result of a persistent contango and negative roll yield.

A negative roll yield for VXX means a positive roll yield for its inverse fund, XIV. From its inception on Nov 30, 2010 through 2013 XIV had a 260% gain, as shown below.



The strong VXX losses and XIV gains are primarily a result of a persistent contango term structure during much of this timeframe. However, a contango term structure and these types of gains should never be taken as a given. What makes this product dangerous to the uninformed investor is that the roll yield can reverse to negative and cause large drawdowns.

Notice in August 2011 as XIV fell from \$19 to \$5, losing nearly 75% of its value. This loss was a direct result of the roll yield changing from negative to positive as the term structure switched to backwardation. Conversely, the roll yield for VXX changed from negative to positive and it became quite profitable to buy VXX during this time.

ZIV is also impacted by a roll yield but by a lesser amount, as seen in the chart of ZIV below. The overall performance of ZIV follows a similar trend as XIV but the magnitude of its moves is smaller.



Clearly these securities provide great opportunities for investors if you know what to look for. They can also be dangerous if used incorrectly or if an investor does not pay attention to the VIX futures term structure. This is why our site is dedicated to tracking and analyzing the term structure data.

6 Value Of The Roll Yield

To understand the roll yield we have to dig into the details of the monthly roll cycle. Summarizing the roll process for VXX:

1. At the beginning of the roll period all the weight is allocated to the first month futures contract.
2. On each subsequent business day a fraction of the first month VIX futures holding is sold and an equal notional amount of the second month VIX futures is bought. The exact quantity bought/sold depends on the number of business days in the roll period (the number of days varies but averages out to about 21).
3. The next roll period starts after all weight from the front month has been sold and the old second month VIX futures contract becomes the new first month VIX futures contract. The process then repeats.

This process generates a roll yield headwind or tailwind depending on the difference in price between the two months of VIX futures.

Roll Yield During Contango

When the term structure is in contango the fund is selling units of first month VIX futures and using the proceeds to purchase a quantity of second month VIX futures at a higher value. The "buy high, sell low" scenario results in a negative roll yield for VXX.

Roll Yield During Backwardation

When the term structure is in backwardation the fund is selling units of first month VIX futures and using the proceeds to purchase a quantity of second month VIX futures at a lower value. The "buy low, sell high" scenario results in a positive roll yield for VXX.

Magnitude

The actual size of the monthly roll yield depends on the difference between first and second month VIX futures -- a larger difference means a stronger roll yield. An approximate value is obtained simply by using the price of the relevant VIX futures in the standard percentage gain/loss calculation. Because most of my trades are on the order of weeks I like to have a roll yield measured in weeks. Therefore we need to divide the monthly roll yield by the number of weeks in the roll period, which is typically between 4 and 5. Given any monthly roll yield, a roll period with 5 weeks would have a smaller weekly roll yield than a roll period with 4 weeks.

Inverse And Mid-Term Products

The same process applies to inverse VIX futures products except the buying and selling is reversed. In order to obtain a value of the roll yield for the inverse products (XIV and SVXY) just change the negative sign in the VXX roll yield to a positive, or vice versa.

The mid-term VIX futures ETPs use a similar process except they are buying and selling a fraction of fourth and seventh month VIX futures while holding 33% of fifth month and 33% of sixth month futures.

Historical Values

Historically the roll yields as calculated above have fallen into the ranges outlined below. The maximum and minimum values are fairly extreme but it is still possible that roll yields could exceed these values in the future. Below are the average, standard deviation, lowest, and highest values of the weekly roll yields for XIV (past 11 years) and ZIV (past 7 years):

Historical Roll Yield Values		
	XIV	ZIV
Avg	+1.2%	+0.3%
Std Deviation	1.60%	0.50%
Low	-11.70%	-1.60%
High	+7.1%	+1.7%

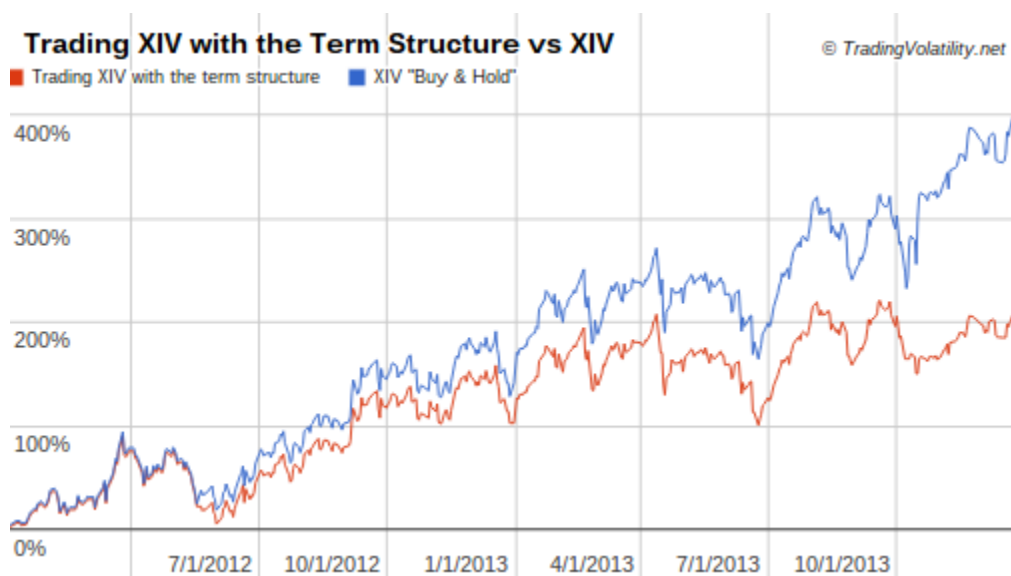
Plotting the daily closing values of the weekly roll yield for VXX provides further insight into typical roll yield values and how it changes on a daily basis.



Notice that the VXX weekly roll yield is negative most of the time during this period, indicating that the term structure is in contango. Periodically the roll yield moves to positive as the term structure moves to backwardation. With the exception of the second half of 2011, most moves to backwardation during the past few years only lasted several days at most. While this is common, it should not be assumed that such moves will always be brief.

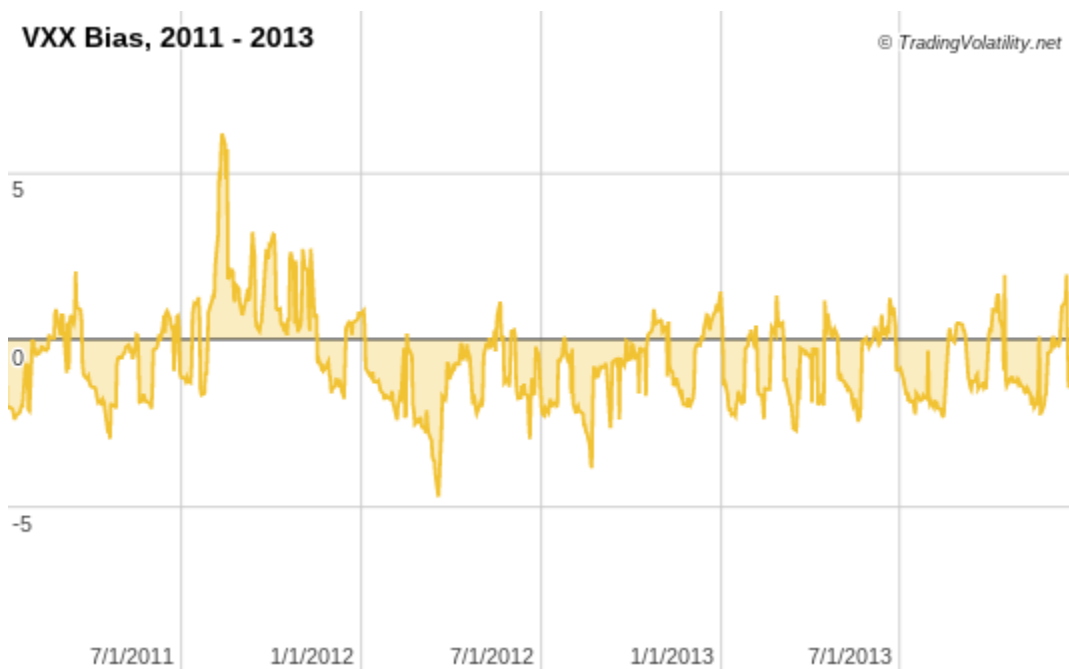
7 Optimizing Trading Performance Using Bias Indicators

In general, buying VIX futures ETPs when their roll yield is positive will allow an investor to do pretty well in trading these products along with their trends. The roll yield is a critical piece of information for trading volatility ETPs but does not tell the entire story. The headwind or tailwind from the roll yield can often be overwhelmed by a strong opposing move in the underlying VIX futures. In fact, trading only based on the direction of the roll yield will result in vast underperformance against a buy-and-hold approach when there are only brief periods of backwardation as we've seen during the past two years, as shown in the following chart.



Because of this problem, the roll yield is only one component of our forecasts. We take additional daily inputs to measure key momentum and state changes to generate our proprietary Bias indicators, providing a more holistic view of the directional force of a volatility fund. This provides us with a signal-based system to place better swing trades instead of blindly following the term structure or leaving our portfolio excessively vulnerable with a buy-and-hold approach.

The Bias values are normalized on a scale from -10 to +10, with a more negative reading indicating a stronger negative bias (headwind), and a more positive reading indicating a stronger positive bias (tailwind). Values from -10 to +10 represent +/- 4 standard deviations of values since March 2004. Therefore you can generally expect to see readings between +3 and -3 for VXX/XIV, and +2 and -2 for ZIV. The following graph shows a chart of the VXX Bias from 2011 through 2013.



Historically there have been very wide gaps between M1 and M2 leading to extreme Bias readings. On the negative side the VXX Bias has hit lows near -5, most recently in March 2012 when M1 was at 16.15 and M2 was at 21.6. On the positive Bias side for VXX there have been readings above 10, notably in Oct 2008 when M1 was at 64 and M2 was 42.9. Each of those extreme readings translates into very strong directional moves and it is possible that we may see them again.

8 Trading With The Bias Indicators

The indicators are designed to be used to identify entries and exits for swing trades. We primarily care about the directional trend of the securities over multiple days, or preferably weeks so that we can trade with a tailwind from a meaningful roll yield. While the ETP can periodically move in the opposite direction of the trend, we don't focus too much on daily or intraday moves. We focus on the overall trend and let the data tell us when these trends stop and start. These signals are generated as the Bias switches from positive to negative, or vice versa.

With this information, we apply a simple signal-based strategy of buying XIV when the VXX Bias is negative (which we call the “Negative VXX Bias” strategy), or buying VXX when the VXX Bias is positive (which we call the “Positive VXX Bias” strategy). Trading in the direction of the Bias is critical since it can impact the price of the security by as much as 10% per week. By trading in the direction of the Bias we put ourselves in position to place trades which gives us the highest probability of profits.

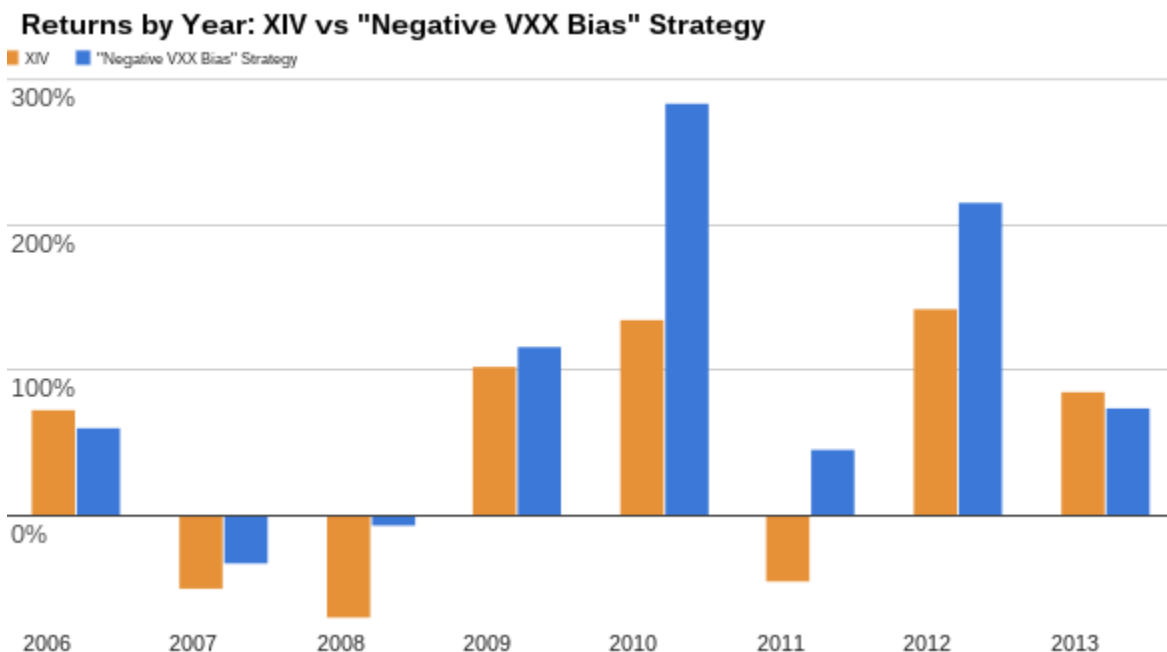
To help ensure that the indicators perform well in a variety of market conditions I have performed backtesting with all available VIX futures data (Note: since VIX ETPs did not

exist prior to 2009 I have calculated the prices for short-term VIX ETPs in those years using the available VIX futures price data and the roll process as outlined in the prospectus).

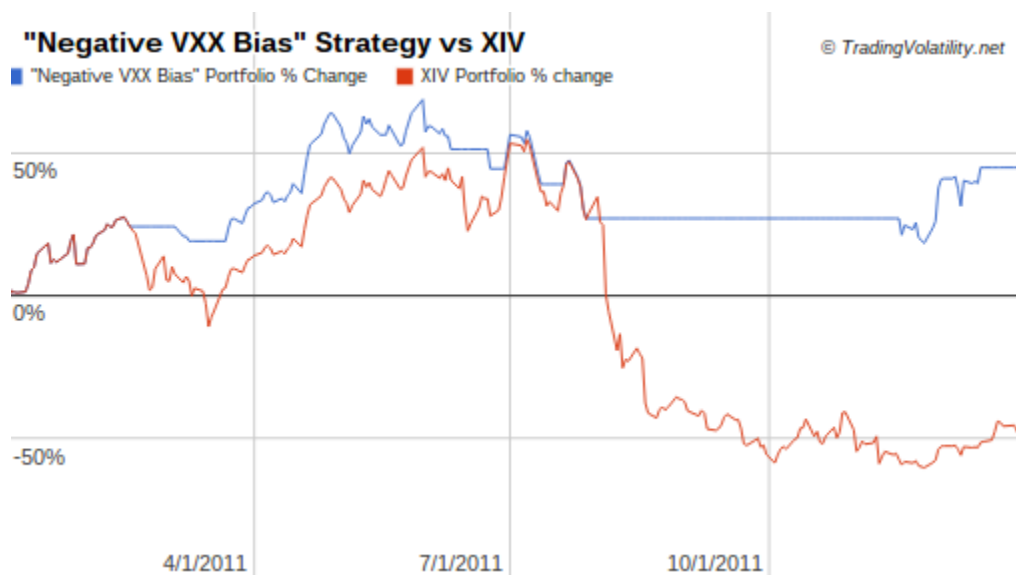
The performance of XIV from 2006 to 2013 is shown in the table below. While the average annual return of XIV is 46%*, it experienced several ugly years when there was an unfavorable Bias. The annual returns of XIV are compared with the returns obtained using the VXX Bias indicators in backtested simulation. The "Negative VXX Bias" strategy has been shown to substantially outperform XIV in 6 of the past 8 years, with an average excess performance of 48 percentage points (far right column, below).

% Gain / Loss By Year				
Year	XIV	"Negative VXX Bias" Strategy	"Positive VXX Bias" Strategy	Excess performance over XIV using "Negative VXX Bias"
2006	73%	60%	-15%	-13%
2007	-51%	-34%	13%	17%
2008	-71%	-8%	128%	63%
2009	103%	116%	-9%	13%
2010	135%	284%	42%	149%
2011	-47%	45%	61%	92%
2012	142%	216%	11%	74%
2013	85%	74%	-30%	-11%
Average	46%	94%	25%	48%

A look at each year's performance of the "Negative VXX Bias" strategy shows that while it is still vulnerable to losses, overall the strategy does exceedingly well compared to the alternatives. A comparison of the annual returns of XIV versus the "Negative VXX Bias" strategy listed above is better visualized in the following chart.



You can get a feel for how the strategy performs on a day-to-day basis by looking at a graph of daily change in value of each of the portfolios for a given year. The chart below compares the "Negative VXX Bias" strategy to XIV during 2011. Note the flat blue line which reflects that XIV was not owned in the "Negative VXX Bias" strategy during the time XIV experienced steep losses because the VXX Bias was positive.



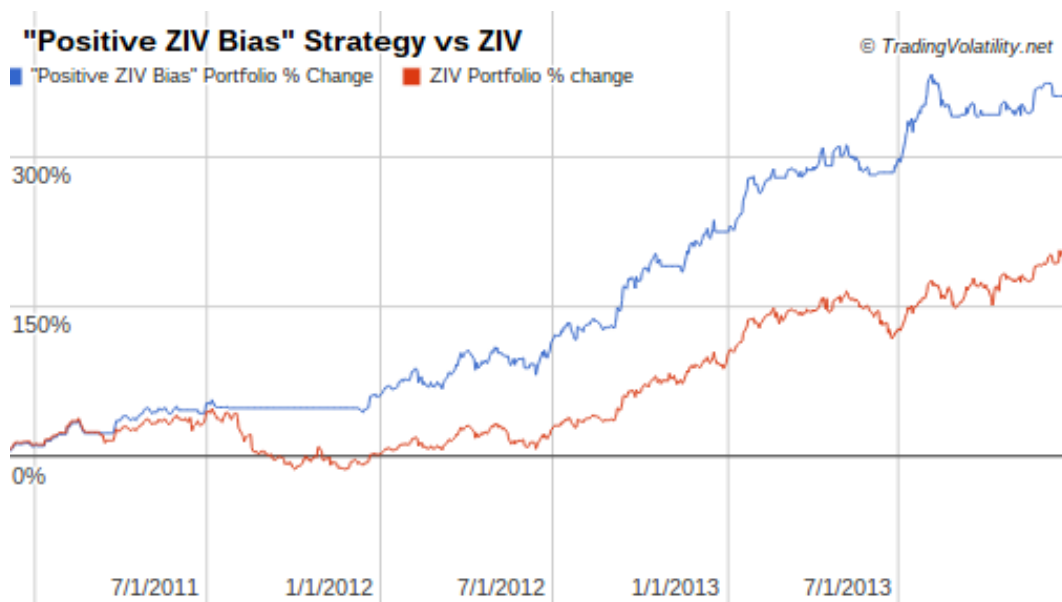
Strategy performance graphs for other years can be found in each of our data files (links to all data files used for backtest simulations are available at the bottom of our [Subscribe](#) page). In these files you can view a graph of the daily value of a portfolio employing both the Negative and Positive VXX Bias strategies.

The performance data files also contain the forecast VXX Bias values, entry and exit points, and gain/loss data including a histogram of trades. Below is a summary of trades each year for the "Negative VXX Bias" strategy.

Number Of Trades Per Year For Negative VXX Bias Strategy				
Year	# of Trades	Winners	Losers	Avg Trade Gain/Loss
2006	11	5	6	5.05%
2007	14	6	8	1.36%
2008	11	6	5	-0.59%
2009	10	4	6	-0.76%
2010	7	3	4	6.11%
2011	10	3	7	4.54%
2012	11	5	6	12.51%
2013	15	8	7	4.27%

As you can see, the win percentage from using the Bias indicators as entry and exit signals is under 50%. However, the size of our gains outweighs the losses to generate superior returns over the long-term. One of the reasons for this is that the hold times for the best winning trades are measured in weeks and months while losing trades are typically held for less than a week and their losses are kept small.

Data files are also available for the Positive ZIV Bias strategy which compare performance to that of a "buy and hold" investment in ZIV. The chart of performance from inception through 2013 is shown below.



9 Closing Thoughts

I hope that you have found this paper useful in demystifying the world of volatility and volatility-related products and that this information will help contribute to your future success as an investor. I also hope that our insight and strategies for trading volatility ETPs have inspired you to spend additional time researching this new area of the market.

You can learn more about VIX futures and track current data for free on our website at www.tradingvolatility.net. On our website you can also sign up to receive free email or RSS updates of our blog posts for our latest thoughts on the volatility market.

To get more frequent updates and interact with us please follow us on Twitter at [@tradevolatility](https://twitter.com/tradevolatility).

If you wish to contact me directly you can do so through our website's [Contact page](#). I am available to answer any questions you might have.

Thank you for reading.

Jay Wolberg
Trading Volatility