Demand Derivatives

RealVol®

Strategies

Spread the Wealth

Spreading RealVol Futures against VIX® futures may provide interesting short-term trading opportunities.

Issue # 5

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$$\sqrt{\frac{252}{n}\sum_{t=1}^{n}R_t^2}$$

RealVol Futures

A RealVol Futures contract ("VOL") is designed, ultimately, to provide the actual, or realized, volatility of some underlying. Prior to expiration, VOL is expected to be priced similar to over-the-counter (OTC) volatility swaps, with one adjustment. The adjustment is a forward-starting feature to VOL typically not found in volatility swaps.

VIX® Futures

(Note: for the purposes of this article, VIX futures will be referred to simply as "VIX," as the VIX index is not relevant for this purpose.) VIX is designed to provide the user with a 30-day variance-swap price at expiration. However, the VIX price may not equal exactly the variance-swap price at expiration — rather, VIX is the options-arbitrage equivalent (OAE) of a variance-swap price. That is, prior to expiration, market participants are trying to forecast what the OAE variance- swap price will be at expiration.

Key Differences

To clarify, VOL is a forecast of a forward-starting, listed, volatility swap, while VIX is a forecast of a forward-starting, listed, variance swap. The pricing mechanisms of variance swaps and volatility swaps are not the same. For one, volatility is the square root of variance. However, even adjusting for the square root calculation, variance-swap prices should be higher, as variance is a linear function and volatility is a curve function. If the price of a variance swap were not higher, then there would be a risk-free arbitrage available. Therefore, one would normally expect to see VIX trade higher than VOL. However, there are other issues that make the simple inequality VIX > VOL not quite so definitive: one is that the instruments do not expire at the same time; another is that the forward-starting feature of VIX occurs at expiration, while the forward-starting feature of VOL is 21 trading days *prior* to expiration.

Warning

As of this writing, RealVol futures on equity indices have not yet begun trading. All results are hypothetical and historical. The hypothetical results derive from a pricing model. All models have assumptions that may or may not be valid. Actual market prices, had they been available, may not have coincided with the model's calculations. In addition, even if the model's prices had been available in the marketplace, historical performance is not an indication of future results.

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Trading Considerations

It is safe to say that because of all these differences, VIX and VOL will most likely trade at different prices. The point of Vol Strategies article #5 is to analyze those differences and give the reader an idea of any potential spread opportunities. Before beginning, there is one consideration that is paramount.

Time Period

As mentioned, when VIX expires, traders receive the synthetic variance-swap price (as calculated by options premiums). These options used in the VIX expiration calculation expire 30 days *later*. This means that VIX expires *30 calendar days* (1 month) *before* the result it is forecasting! However, VOL expires *at* the result — that is, at the actual or historical realized volatility over the *prior 21 trading days* (1 month). This means that the "correct" comparison is to spread VIX against the *following month's* VOL. For example, if VIX expired 21 *Nov* 2012, the most comparable VOL expiration would be 21 *Dec* 2012. In this manner, the two instruments now focus on the risks associated with roughly the same time period.

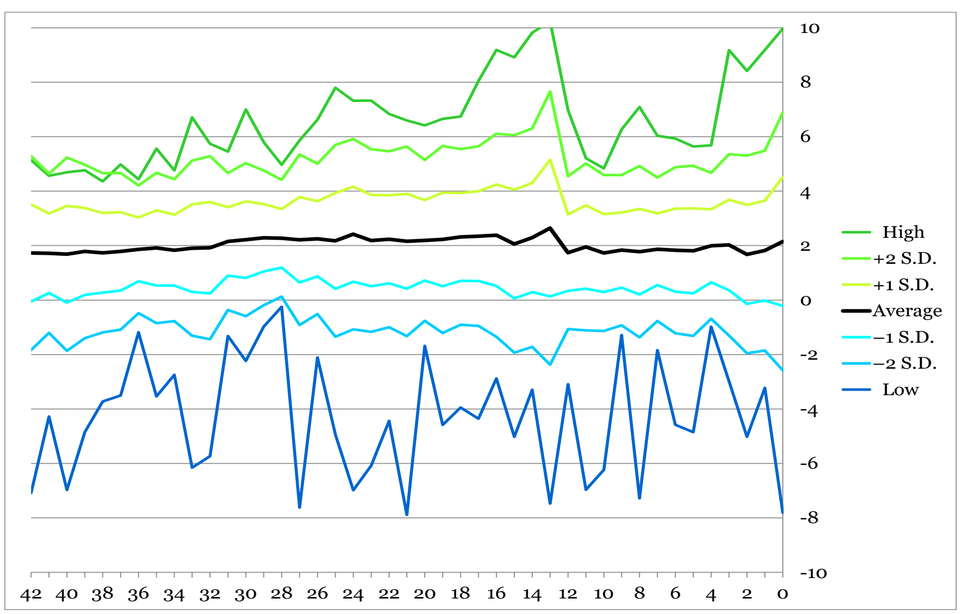
Theoretical Value

It is important to note that, as of this writing, VOL on indices are not yet listed. To have some indication of historical value, the Heston Model was used to calculate theoretical volatility-swap prices based on SPX index options. Then, an additional adjustment — application of a root-mean-square formula — was needed to address the forward-starting feature of VOL.

The Spread

The first step is to take VIX minus next month's theoretical VOL. Then, calculate the spread each day using every monthly expiration back to the start of VIX trading (Jun 2004 expiration). Exhibit 1 contains plots of the ±1 and ±2 standard deviation lines along with the high, low, and average of all VIX–VOL differences. The horizontal axis displays the number of days prior to VIX expiration. The vertical axis displays the spread level. Let's call this Spread #1.

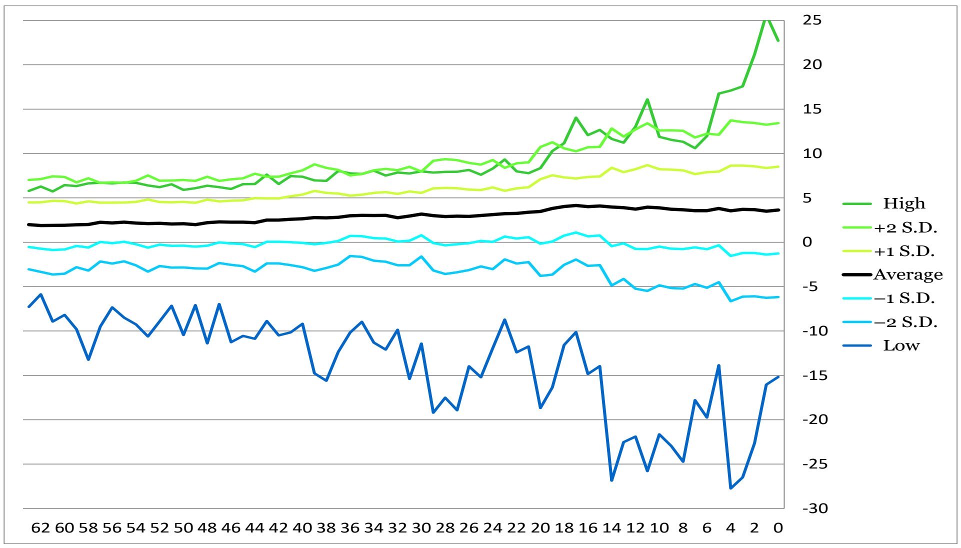
Exhibit 1: $VIX_{month=0} - VOL_{month=+1}$ (avg. by days prior to expiration)



Same-Month Spread

As mentioned, comparing same expiration months does not compare "apples-to-apples." However, this also means that a spread trader must liquidate VOL one month before it expires (when VIX expires); otherwise there would be no second leg and, hence, no spread. So, what happens if the trader spreads same-month VIX/VOL? While the months are the same, and intuitively, it seems that comparing such a spread is on the same basis, the spread is now comparing "apples to oranges." However, since there is still a valid spread, it would be instructive to see how such a spread behaves. Exhibit 2 charts VIX minus VOL using the same month for each. Let's call this spread #2.

Exhibit 2: $VIX_{month=0}$ – $VOL_{month=0}$ (avg. by days prior to expiration)
Compare Spreads



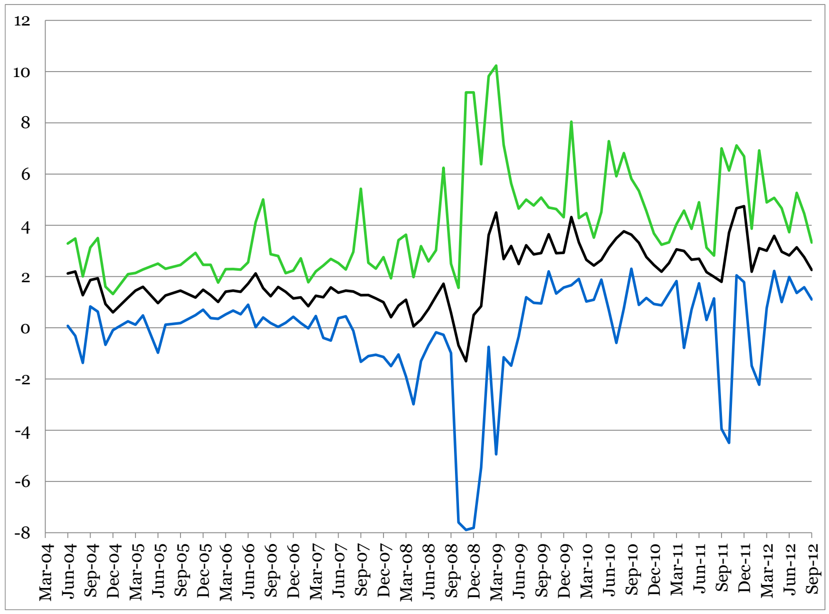
The two charts look very similar, but notice the scale. Spread #1 averages 2.03, while spread #2 averages 2.95. Also notice that the standard deviation (s.d.) is much greater in spread #2. Spread #2 is roughly double spread #1 — 3.14 versus 1.60, respectively. The reason that spread #2 is much wider than spread #1 may be because the time period is now not the same. In spread #2, the spread is more uncertain because at any moment during the life of the spread, traders would be forecasting the forward variance swap at expiration versus the backward-looking historical volatility near expiration. Note: Even though the expiration months are the same, there is also a slight expiration mismatch. VIX will expire 30 days before the next month's options expiration on a Wednesday, and VOL will expire on the third Friday.

Evolution of the Spread

The final piece of the puzzle is to analyze how the spread changes through time. Averaging is a good way to aggregate the data over many years, but it can mask any systematic change over time. In Exhibits 1 and 2, days prior to expiration are averaged (at expiration day, at 1 day prior, at 2 days prior, etc.). In Exhibit 3, the averaging process is by contract (all days of Jan 2012 contracts, all days of Feb 2012 contracts, etc.). Averaging in this manner, it is easy to see how the average spread has changed over time. In essence, Exhibits 1 and 2 average the rows in a spreadsheet while Exhibit 3 averages the columns. Please see Exhibit 3.

"While the months are the same, and intuitively, it seems like we are comparing the spreads on the same basis, the spread is now comparing 'apples to oranges.'"

Exhibit 3: VIX $_{month=0}$ – VOL $_{month=+1}$ (avg. by contract month)



Focus for a moment on the average (black) line in Exhibit 3. There seem to be three regimes over the 7 ½ years. Prior to Q3 2008, the average spread was 1.27. During the third and fourth quarters of 2008, at the height of the economic crisis, the average was very close to zero (+0.34). Finally, since Jan 2009, the average spread has been 2.94. It seems rather curious that the economic crisis of 2008 has had such a long-lasting effect on the spread between implied and realized volatility.

Now, focus on the extremes. The green line is the highest spread between VOL and VIX (again, VIX minus VOL). The blue line is the lowest spread value. Notice how the VIX–VOL spread has had a large range from nearly –8, on the low side, to +10, on the high side.

In essence, the market seemed to misestimate the depth of the crisis when it was unfolding. Then, as the crisis progressed, the market finally relented, and seemed to believe at one point that the crisis would continue "indefinitely." Just at that point, the market calmed, realized volatility plummeted, and options buyers were left with very expensive disaster insurance that they really didn't need.

Exhibit 4: VIX $_{month=0}$ – VOL $_{month=0}$ (avg. by contract month)

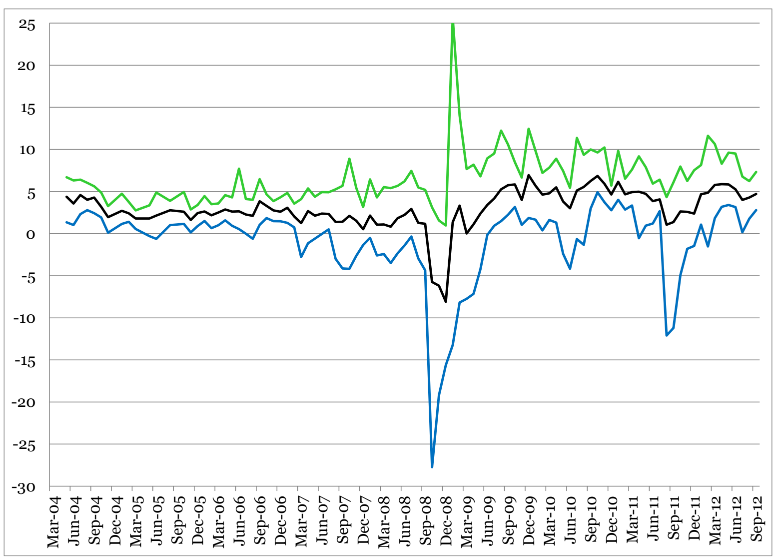


Exhibit 4 shows spread #2 again, except this time averaged by contract. It is easy to see that the spread is much more uncertain, with a high/low range near –25 to +25. It is interesting to note that not only is the uncertainty more than double (with higher highs and lower lows), but the spread is about double as well.

The bottom line is that there may be some very interesting and potentially profitable spread opportunities between VIX futures and RealVol futures, whether using lagged or same-month contracts.

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