Demand Derivatives

# RealVol® Strategies

Issue # 6

Updated 1 April 2020

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

## Hedge Hog
### (no pigs allowed)

*Hedging/spreading with RealVol™ Instruments is not hard, but the hedge can change over time.*

### Hedging RealVol Instruments

In previous issues, we focused on using RealVol instruments to hedge exposure in the marketplace. In this issue, the tables have been turned to discuss how to hedge RealVol futures and options using other, well-established instruments.

### Arbitrage

At first glance, it seems that there is no good hedge for a RealVol instrument. This may be true if one's definition of a "good hedge" is a "perfect hedge." However, it could be argued that if a perfect hedge were available, then a RealVol instrument would not be needed — a trader could simply utilize the already available instrument to get the desired realized volatility exposure.

### Range of Hedges

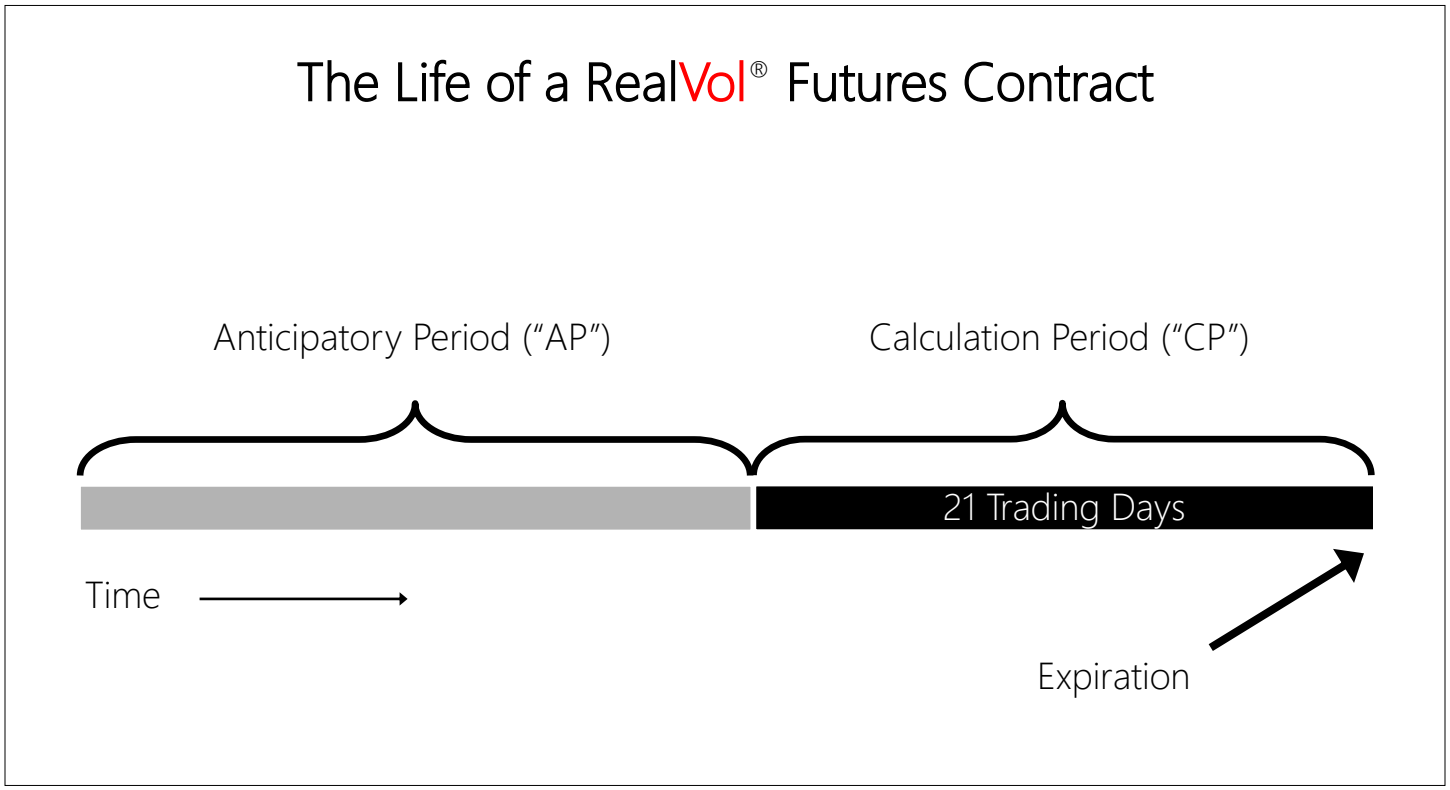
The following is a list of various hedges available for RealVol Instruments (VOL) in the marketplace:

1. Volatility swaps
2. Variance swaps
3. VIX® futures and options
4. Delta-hedged options straddles
5. Intraday positions using the underlying
6. Successive VOL expirations (calendar spreads)
7. VOL futures to hedge VOL Options and vice-versa

Clearly, judging from the above array, there are, in fact, many suitable hedges for RealVol instruments.

### Timeline

The pictograph on the following page shows distinct periods for a VOL: the Anticipatory Period (AP) and the Calculation Period (CP). Because of this feature, the hedge may need to evolve as the contract progresses through time.




### Volatility Swaps

Over-the-counter (OTC) volatility swaps are the instruments that most closely resemble RealVol futures. Because OTC products can be completely customized, a volatility swap could be traded with the exact terms of a listed RealVol futures contract. This swap could provide a nearly perfect hedge. We say "nearly perfect" because OTC instruments still are subject to credit risk, whereas RealVol futures are listed on an exchange using a central clearing house and are, therefore, generally considered credit risk free.

During the AP, one could use a *forward-starting* volatility swap as a hedge. During the CP, one could use either: 1) a *backward-starting* volatility swap with the same notional value and days to expiration, or 2) a standard volatility swap (that begins today) with an adjusted notional amount and the same number of days remaining to expiration. The adjusted notional amount relates to the sensitivity of VOL based on the remaining days until expiration.

### Variance Swaps

Variance swaps, like volatility swaps, can be customized so that all of the terms are identical, except for one — variance itself. Variance swaps result in variance exposure while volatility swaps result in volatility exposure. In order to be considered a variance swap, the instrument must provide a payout of volatility squared. Obviously, squaring the potential payout makes for a different payoff profile. Again, as stated above, variance swaps should be forward starting in the AP, and backward starting, or notionally adjusted, in the CP.

Because of the squared payoff profile, theoretical pricing is not the same as that of a volatility swap. To get from the theoretical value of a volatility swap to the theoretical value of a variance swap (all other terms equal), one needs a convexity adjustment, which requires an estimation of the volatility of volatility. Therefore, variance swaps should be used as a spread by sophisticated market participants who understand the nuances of pricing and trading such instruments.

### VIX Futures and Options

VIX is based on implied volatility, which means instruments settling to VIX must expire prior to the underlying options upon which they are based. In the VIX case, this is 30 days prior to the associated options expiration. Since VOL can expire at the

same time as the options, the "correct" spread between VOL and VIX is for VOL to expire the month after VIX. Consequently, the best VIX–VOL hedge is during the AP only. As VIX does not exist after the AP of VOL ends, no subsequent hedged spread with VIX, during the CP of VOL, is possible.

To understand pricing discrepancies between the two instruments, one needs to define VIX. VIX is a forward starting, listed equivalent of a *variance swap*. VOL by contrast is a forward starting, listed equivalent of a *volatility swap*. As just mentioned, the pricings of variance swaps and volatility swaps are not the same. Therefore, the convexity adjustment needs to be taken into account when spreading VIX–VOL. See RealVol Strategies #5 for more details.

### Delta-Hedged Options Straddles

In a delta-hedged straddle, the trader actively participates in adjusting the straddle (a call and put with the same strike and expiration), either with the underlying asset or the options themselves in a delta-neutral manner, attempting to capture market movements as they become available. Many equate such a strategy to "buying or selling volatility," and this thinking is generally correct. However, there is a caveat. The sensitivity of an option to changes in volatility (its vega), varies as the underlying market moves away from the strike price. This sensitivity is called path dependency. The bottom line is that trading a delta-hedged straddle may come close to capturing the realized volatility of the underlying, but it is not a pure form of such a trade. Since VOL is a pure form of realized-volatility capture, there may be a slight, or even substantial, mismatch in the performance of the two.

Spreading VOL with delta-hedged straddles should be contemplated during the CP only. This is because replicating the forward-starting feature with standard options during the AP would require creating another delta-hedged straddle in the prior expiration (i.e., a calendar spread), which roughly doubles the transactional costs and complexity. See RealVol Strategies #2 for more some ideas.

### Intraday Hedges Using the Underlying

Trading VOL *within the day* is quite sensitive to the directional moves of the underlying. This may seem counter-intuitive because realized volatility is defined as *movement regardless of direction*. This trade arises because both statements are correct. The phrase "within the day" is the key to understanding this opportunity. Because realized volatility is calculated using underlying close data only, a potential hedge between VOL and the underlying asset arises after the market, intraday, makes a move away from the close of the previous trading day (i.e., a move away from "unchanged").

The trade is as follows: If the market is up intraday today, then buy VOL and sell the underlying. If the market is down today, then buy VOL and buy the underlying. Of course, depending on the prices in the marketplace one could do the opposite. In either scenario (long or short), liquidation must occur at the close because at that point the reason for the spread ceases to exist. When the VOL is marked to the closing price of the underlying, it becomes unclear whether one should be long or short the underlying going forward. This phenomenon is outlined in RealVol Strategies #3.

### 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.

### Successive VOL Expirations (calendar spreads)

VOLs are expected to expire every Friday. If so, the calculations between successive expirations will include much overlapping data. For example, the first Friday in February is an expiration that includes the closing prices of the underlying for the prior 21 trading days. The second Friday of February will also include data from the past 21 trading days. Because the first Friday is only five trading days prior to the second Friday, 16 data points in the two CPs are the same (i.e., they overlap). It is easy to see how movements in the 16 days that overlap will affect the final settlement price of both the first and second Friday VOLs. Of course, because there are five days that are not the same, the end result of the two will only coincidentally be the same. However, they must, at least, be correlated because most of the data points are shared. This phenomenon is called autocorrelation and is prevalent in listed realized volatility instruments.

One should also be aware of autocorrelation during the AP. The forward-starting feature that affects, say, a week one forecast would most likely also affect a week two forecast, at least to some extent. Because of this expected high autocorrelation, weekly VOLs could be used to hedge/spread with other VOLs during the AP or CP.

### VOL Futures to Hedge VOL Options (and vice versa)

Just as one may delta hedge standard options with their associated futures, and vice versa, so too can one hedge VOL Options with VOL Futures. In the standard options case, delta hedging is akin to hedging direction and leaving the position exposed to realized volatility. In the VOL case, delta hedging is akin to hedging volatility and leaving the position exposed to the volatility of volatility.

***Number of Potential Hedges:*** 1 2 3 4 5 6 7

### Summary

There are many opportunities to hedge VOL using liquid, listed instruments and OTC swaps. This paper, RealVol Strategies #6, explored ways to hedge risk in the AP with VIX or forward-starting volatility or variance swaps. In the CP, one can use backward-starting volatility or variance swaps, delta-hedged option straddles, or spreading VOL with the underlying. Finally, autocorrelation was explored to trade successive expirations of VOLs in both the AP and CP. Autocorrelation makes reasonable hedges possible because of the many overlapping data points. Because of the tight interconnectedness of markets, theoretical values of standard futures, standard options, VIX futures, VIX options, volatility swaps, variance swaps, and even successive VOLs all need to be kept in line to avoid the possibility of riskless arbitrage. It is these very relationships that provide the basis for the many hedges that exist in the marketplace for RealVol instruments.

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