RealVol™

Research Department

White Paper

More Than You Ever Wanted to Know About RealVol™ Instruments

Updated 1 September 2017

Notice

As of this writing, RealVol Instruments 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.

All items, text, charts, and exhibits, including contract specifications, are subject to change. Details vary according to the underlying asset. The information provided herein must not be relied upon, and RealVol LLC and its affiliates will not be liable for actions taken or not taken in reliance thereon. The strategies are for informational purposes only and are purely hypothetical. Interested parties should independently verify the data, seek professional advice, and draw their own conclusions regarding the benefits and risks of any strategy and the legal, regulatory, credit, tax, and accounting implications with respect thereto. Statistical results have certain inherent limitations. Such analyses are based on subjective assessments and assumptions and may use one among several alternative methodologies. Other methodologies may produce different results. Accordingly, such statistical analyses should not be viewed as facts and should not be relied upon as predictions of future events or results.

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About Volatility

IN THIS SECTION:

About RealVol LLC

RealVol began with the idea that a key element was missing in the investable universe: The idea of trading risk itself. While volatility swaps have existed in the over-the-counter (OTC) marketplace for decades, exchanges have been reluctant to embrace the idea of trading a listed version. RealVol LLC controls the patent on realized volatility instruments and realized volatility indices.

Company Objective
To transform the way the world manages and views risk.

Problem
Investors have always been able to manage risk, but have never been able to trade actual price risk directly.

Solution
One of the most volatile of "assets" is volatility itself. The ability to hedge this exposure will be a godsend to those trying to manage risk. Such strategies are especially useful in equities, but pertain to every asset in all asset classes. To achieve the desired result, market participants need an instrument that can be used to hedge away "actual," or "statistical," price risk known as realized volatility. There is also a growing body of research showing how volatility products can enhance a portfolio — either through risk reduction or additional returns.

The RealVol Concept

RealVol LLC is developing RealVol Instruments and RealVol Indices based on realized volatility as defined by the RealVol Formulas. Realized volatility measures movement of an underlying asset regardless of direction. RealVol Instruments can be listed on any asset and are designed for every major marketplace: futures, options, securities, and over-the-counter. RealVol Indices are available in one real-time version and 40 daily versions as a factor to consider in making investment decisions. The flagship product, the 1-month RealVol Daily Index (VOLm), measures daily (close-to-close) realized volatility of an underlying asset over 21 trading days and is used for contract settlement of RealVol Instruments. RealVol products offer market participants the unique opportunity to trade upon or hedge against actual price risk directly in a listed, centrally cleared, transparent environment.

Introduction to Realized Volatility

Realized volatility is the "actual volatility," "statistical volatility," or "asset volatility" that the underlying has displayed over a specific period. The term "realized volatility" is very closely related to standard deviation. Realized volatility is a specific form of standard deviation. If one were to use daily returns of an underlying (instead of actual prices) and annualize the results, standard deviation becomes realized volatility. RealVol uses a modified version of the standard deviation formula, the same one used in the over-the-counter (OTC) marketplace. We will refer to the RealVol version of realized volatility simply as "realized volatility," "realized vol," "volatility," or "vol."

One of the key issues regarding realized volatility is that it is measured not observed. In other words, one cannot look at a particular price and determine what volatility that represents. The only way to calculate realized volatility is to get prices over time and then use a realized volatility formula to calculate the movement of prices for that time frame. This is a key concept because all realized volatility formulas must use historical prices in order to calculate a result.

For example, if the evening news reports that the price of gold is currently $1,000 per ounce, it has expressed only the price of gold. The current price says nothing about how much gold had to move to get to $1,000. Did it just drop precipitously from $2,000? Or, did it move up slightly from $999? One cannot tell unless previous (historical) data are also used. Thus, saying that the price of gold is now $1,000 tells us nothing about its volatility, because we lack a historical perspective.

Realized Volatility Defined

Layman's definition: Realized volatility is the magnitude of daily price movements, regardless of direction, of some underlying, over a specific period.

Technical definition: Realized volatility is the daily standard deviation of log returns of an underlying asset, index, instrument, security, or ETF, over a defined period, with an assumed mean of zero, no degrees of freedom, and a constant 252-day annualization factor (regardless of the actual number of trading days within the year).

Implied Volatility

There is another type of volatility known as "implied volatility." Implied volatility is based on the relative expensiveness of associated options premiums. Implied volatility is a completely different approach to expressing volatility and often differs in value from realized volatility.

Many market participants think of implied volatility as a forecast of realized volatility until expiration of the associated options. This is not exactly correct. Academic research has shown that implied volatility is, on average, higher than the realized volatility that the market goes on to display. Of course, traders can always guess incorrectly. But, on average implied is "too high," and is, therefore, a biased estimate of future realized volatility.

The "extra" cost that buyers pay and sellers receive to trade an option is called the risk premium. The risk premium has endured because buying options has limited risk and is often used to reduce risk of holding other assets — especially risk of catastrophic losses. These two features are valuable and increase demand for the buy side of an option. Conversely, selling an option comes with unlimited risk. Sellers demand an additional premium to take extra risk in this manner. Therefore, the most accurate way to think of implied volatility is a forecast of realized volatility *plus a risk premium*.

Realized vs. Implied

A key concept regarding implied volatility is that it ceases to exist at expiration of the options. When an option expires, it is either in the money or out; it either has intrinsic value or it has none. Since implied volatility essentially measures the time value of an option, when the option expires it has no time value, and therefore, no implied volatility. This means that implied volatility indices must be measured *prior to* expiration of the underlying options. This has consequences. Instruments settling to implied volatility cannot provide a hedge for associated options when it is needed most — approaching option expiration. In contrast, realized volatility indices can be calculated right to expiration and therefore instruments settling to a RealVol Index could provide a very good hedge for the volatility component of associated options.

Example

Here is an analogy that may help explain the difference between realized and implied. Let's say two individuals have a disagreement about the forecasted average high temperature in New York during the upcoming month of May. One forecasts the temperature to be 70 and the other forecasts it to be 80.

How should we determine who is right?

Most people would say that data should be collected each day — that we should actually go outside and measure the temperature. After the month is over, the data collection effort will have been completed and the disagreement can be settled to the actual results.

Conversely, we could turn on the weather report on April 30 and see what this service is forecasting for the upcoming month of May. Settlement of the disagreement could be performed at the end of April to the forecast of May's temperature. Most would say that this does not make much sense since the parties are settling to a forecast and not to the result of the actual May temperatures.

Going outside each day and measuring the temperature is similar to how realized volatility works. In contrast, implied volatility products work similarly to settling to the weather report, that is, prior to the result's being known.

Another Example

Another analogy would relate to insurance. Let's suppose that a group of well-capitalized individuals have decided to get into the car insurance business. How should they determine the premiums to charge for their insurance policy? Most would say that they should get a lot of data regarding probability of an accident, amount lost on average, drivers' ages, seatbelt usage, etc. Instead, the businessmen could forgo all that analysis and just look at what other insurance companies are charging. Obviously, both approaches might be beneficial if in fact this were your business endeavor. But, if only one method could be chosen, which would be preferred?

Analyzing historical data and making your own projections of future accident rates and costs is akin to reviewing realized volatility. Looking at what other insurance companies charge is similar to looking at implied volatility.

Note: From now on, when the term "volatility" is used, it will mean realized volatility, not implied.

Volatility as an Asset Class

There has been much debate about whether volatility is an "asset." It is easy to see both sides of the argument. Opponents would say that volatility is just an abstract idea or calculation. How can something that is not tangible be an "asset"? Proponents would argue that any asset must have unique drivers of returns. In that regard, volatility certainly is an asset because no other asset has such a pattern of returns.

Opponents would argue that there is no expected return to buying volatility and therefore, it should not be considered an asset. Proponents would argue that many commodities are considered assets but with no expected return stream. Obviously, one's perspective comes directly from the definition one uses for the term "asset."

References:

- Volatility as an Asset Class, presentation by: Julien Lascar, Published by: Société Générale Corporate & Investment Banking, June 2012, http://www.realvol.com/volatilityblog/?p=555

- Trading Volatility As An Asset Class, article by: Emanuel Derman, published by: Columbia University, 10 Jun 2003, http://www.realvol.com/volatilityblog/?p=322

- Volatility: Investment Characteristic or an Investable Asset Class? article by: Eric Brandhorst, CFA, Director of Research, Global Structured Products Group, published by: SSgA Capital Insights, 2010, http://www.realvol.com/volatilityblog/?p=239

Users/Uses

Who would be users of such an instrument? RealVol products can provide considerable benefits for virtually all segments of the investment community. Since all assets have risk, and because RealVol Instruments allow one to trade or hedge away actual price risk directly, the products are expected to appeal to a wide variety of market participants. Below is a list of potential users and the expected typical use for each group.

Users	Uses
Proprietary/Algorithmic Traders	Mathematical relationships among various instruments present possible arbitrage and spreading opportunities
Hedge Funds/Pension Funds/Insurance Companies	New way to diversify and to adjust risk profile
Volatility-Specific Hedge Funds	Listed, transparent, smaller-sized way to trade volatility swaps, and in time, potentially, additional listed assets
Investment Banks	Hedge price-risk directly; offset volatility swaps; market making; and provides new hedging products for customers
Corporations	Hedging volatility makes risk models more robust
Traditional Equity Index Portfolio Managers	Potentially enhance overall returns by mitigating losses
Futures Market-Makers	Brings new futures instruments to the mix
Options Traders	Use in conjunction with options positions to isolate directional exposure by hedging volatility risk
Options Market-Makers	Hedge options book
Retail	Desire for trading events and high-opportunity trades.
Contract for Difference (CFD) Brokers	Offer new volatility products to customers
ETP Sponsors	Transfer risk between SEC- and CFTC-regulated products

RealVol Products

IN THIS SECTION:

RealVol Indices

RealVol Indices will measure the magnitude of movement regardless of direction of an underlying asset over a set time frame. As mentioned earlier, the only way to measure volatility is by looking at history. Therefore, a time frame must be selected. It was decided to focus on 1 day, 5 trading days (approximately 1 week), 21 trading days (approximately 1 month), 63 trading days (approximately 1 quarter), 126 trading days (approximately 1 half year) and 252 trading days (approximately 1 year).

There are 40 RealVol Indices for each underlying asset. Most, however, will be used only as a guide. Only one RealVol Index, the flagship index of RealVol LLC, known as VOLm or just VOL for short (the 21-trading day, 1-month), will be used to settle RealVol Instruments. For example, the SPDR® S&P 500® ETF (symbol SPY) has a RealVol Index known as the RealVol SPY Index (symbol VOLS). Other VOL indices are contemplated, such as the VOL of gold (VOLG) or the VOL of oil (VOLO).

Daily vs. Real-Time

RealVol Indices measure the continuous, rolling realized volatility, and related statistical concepts, in a standardized manner on a daily basis (using the RealVol Daily Formula) and real-time basis (using the RealVol Real-Time Formula).

No index, that RealVol LLC is aware of, currently has both daily and real-time versions simultaneously. Most indices are updated on a real-time, or nearly real-time, basis. Some are calculated daily. But, none have both. Why the distinction in this case? Typically, realized volatility is measured on a daily basis only. Therefore, RealVol created the RealVol Daily Indices to correspond to the standard of using only daily (i.e., closing) underlying reference prices ("URPs").

However, traders often demand indices that are updated more frequently. The problem is how to furnish a real-time version for a daily index.

Real-Time Index

There is only one real-time index in the RealVol suite of risk indices. The RealVol Real-Time Index (VOL) uses a time-weighted, intraday underlying price to provide a real-time, 21-day, realized volatility.

The concept is as follows: if the time today is 75% of the way through the current trading day, then weight the partial day's return by 75% (this partial return is self-weighting) and weight the full day's return from 22 days prior by 25% (this term needs to be specifically weighted). All other days are full-weight, full-day (close-to-close) returns. In this manner, the index encompasses 22 data points but the weight of exactly 21 trading days at any moment throughout the trading day. Note: The "day" starts when the market closes, not necessarily at midnight or at the market open. In other words, a full day is market close to market close.

The intraday value is designed to give only an estimate of the daily index value, and it does so throughout the trading day.

Such a real-time update can be useful as a guide to position entry or exit within the trading day or for day-traders in the underlying.

The following table shows the various RealVol Indices. Note: the highlighted index is our flagship index and the only one used to settle RealVol Instruments. Note that the real-time version and the daily version are equal at the close each day. Therefore, it makes no difference if RealVol instruments settle to the daily or real-time version of the RealVol Index.

Symbol	Description	Day	Week (5-day)	Month (21-day)	Quarter (63-day)	Half Year (126-day)	Year (252-day)
VOL	Realized Volatility	✓	✓	✓	✓	✓	✓
VOV	Realized Vol of Vol	✓	✓	✓	✓	✓	✓
DVOL	Overnight/ Intraday "Daily" Realized Volatility	✓	✓	✓	✓	✓	✓
VCOR	Correlation of Underlying vs. VOL	N/A	N/A	✓	✓	✓	✓
VAR	Realized Variance	✓	✓	✓	✓	✓	✓
RVOL	RFSV "Rough" Model Forecast of VOL	✓	✓	✓	✓	✓	✓
HVOL	HARK Model Forecast of VOL	✓	✓	✓	✓	✓	✓

References:

- RealVol Indices are available at http://www.realvol.com/index.shtml
- Volatility and its Measurements: The Design of a Volatility Index and the Execution of its Historical Time Series at the Deutsche Börse AG, article by: Lyndon Lyons and Prof. Dr. Notger Carl, published by: Würzburg-Schweinfurt University of Applied Sciences, April 2005, http://www.realvol.com/volatilityblog/?p=585

- Modeling and Forecasting Realized Volatility, article by: Torben G. Andersen, Tim Bollerslev, Francis X. Diebold, and Paul Labys, published by: University of Pennsylvania, 2002, http://www.realvol.com/volatilityblog/?p=385

RealVol Formula

The flagship formula at RealVol LLC is the RealVol (interday) Daily Formula. This formula needs only the closing prices of the underlying asset. Unlike indices based on implied volatility, no options data are used in the calculation of a RealVol Index.

The heart of the formula is based on the day-to-day (i.e., close-to-close) returns of the underlying asset.

It should be noted that squaring any number, even a negative one, makes the result a positive value. In essence, squaring operates like an absolute value function, turning all *returns,* whether positive or negative, into *movement,* which must be a positive value. Intuitively, this makes a lot of sense. If we are interested in movement, then the "worst" case is the market's not moving, hence zero volatility; if the market does indeed move, regardless of the direction, then there is volatility. Thus, while a return may be negative, volatility itself can never be a negative value. Here is the RealVol Daily Formula,

$$VOL = 100\sqrt{\frac{252}{n}\sum_{t=1}^{n} R_t^2}$$

Where:

- VOL = daily (i.e., close-to-close) realized volatility
- 252 = a constant representing the approximate number of trading days in a year
- t = a counter representing each trading day
- n = number of trading days in the measurement time frame
- R_t = continuously compounded daily returns as calculated by

$$R_t = Ln\frac{P_t}{P_{t-1}}$$

Where:

- Ln = natural logarithm
- P_t = Closing price at day t
- P_{t-1} = Closing price on the trading day immediately preceding day t

Sample Calculation

The following spreadsheet shows the steps needed to calculate VOL.

	A	B	C	D	E	F	G	H	I	J	K	L
1	Sample RealVol Calculation											
2	Long Version										Short Version	
3	Date	Close	Return	Return^2	21 Day Sum	Average	Annualize	Sqrt	VOL		Return^2	VOL
4	2-Jan-15	205.43										
5	5-Jan-15	201.72	-1.82%	0.000332							0.000332	
6	6-Jan-15	199.82	-0.95%	0.000090							0.000090	
7	7-Jan-15	202.31	1.24%	0.000153							0.000153	
8	8-Jan-15	205.90	1.76%	0.000309							0.000309	
9	9-Jan-15	204.25	-0.80%	0.000065							0.000065	
10	12-Jan-15	202.65	-0.79%	0.000062							0.000062	
11	13-Jan-15	202.08	-0.28%	0.000008							0.000008	
12	14-Jan-15	200.86	-0.61%	0.000037							0.000037	
13	15-Jan-15	199.02	-0.92%	0.000085							0.000085	
14	16-Jan-15	201.63	1.30%	0.000170							0.000170	
15	20-Jan-15	202.06	0.21%	0.000005							0.000005	
16	21-Jan-15	203.08	0.50%	0.000025							0.000025	
17	22-Jan-15	206.10	1.48%	0.000218							0.000218	
18	23-Jan-15	204.97	-0.55%	0.000030							0.000030	
19	26-Jan-15	205.45	0.23%	0.000005							0.000005	
20	27-Jan-15	202.74	-1.33%	0.000176							0.000176	
21	28-Jan-15	200.14	-1.29%	0.000167							0.000167	
22	29-Jan-15	201.99	0.92%	0.000085							0.000085	
23	30-Jan-15	199.45	-1.27%	0.000160							0.000160	
24	2-Feb-15	201.92	1.23%	0.000151							0.000151	
25	3-Feb-15	204.84	1.44%	0.000206	0.002539	0.000121	0.030467	0.174548	17.45		0.000206	17.45
26	4-Feb-15	204.06	-0.38%	0.000015	0.002221	0.000106	0.026656	0.163267	16.33		0.000015	16.33
27	5-Feb-15	206.12	1.00%	0.000101	0.002233	0.000106	0.026792	0.163683	16.37		0.000101	16.37
28	6-Feb-15	205.55	-0.28%	0.000008	0.002087	0.000099	0.025044	0.158252	15.83		0.000008	15.83
29	9-Feb-15	204.63	-0.45%	0.000020	0.001798	0.000086	0.021572	0.146876	14.69		0.000020	14.69

In columns A through I, each step is performed one-by-one. In columns K and L, the steps are combined to as few cells as possible. As one can see, VOL is easy to calculate and takes only two columns in a spreadsheet.

Below are the formulas. Note: only row 25 is shown as that is the first row containing all of the data. To recreate the rest of the spreadsheet, copy the formulas throughout the columns. Excel will automatically update the relative references.

Note: This spreadsheet, showing a simple, sample index calculation does not take into account dividends or market disruption events. Such exceptions are described in the Specifications of RealVol Indices document.

Cell	Formula
A25	3-Feb-15
B25	204.84
C25	=LN(B25/B24)
D25	=C25^2
E25	=SUM(D5:D25)
F25	=E25/21
G25	=F25*252
H25	=SQRT(G25)
I25	=H25*100
J25	
K25	=LN(B25/B24)^2
L25	=100*SQRT(SUM(K5:K25)*252/21)

Note: It takes 21 days of data (approximately one month) before the first VOL value can be calculated. However, after the initial month, VOL can be calculated each day, forever.

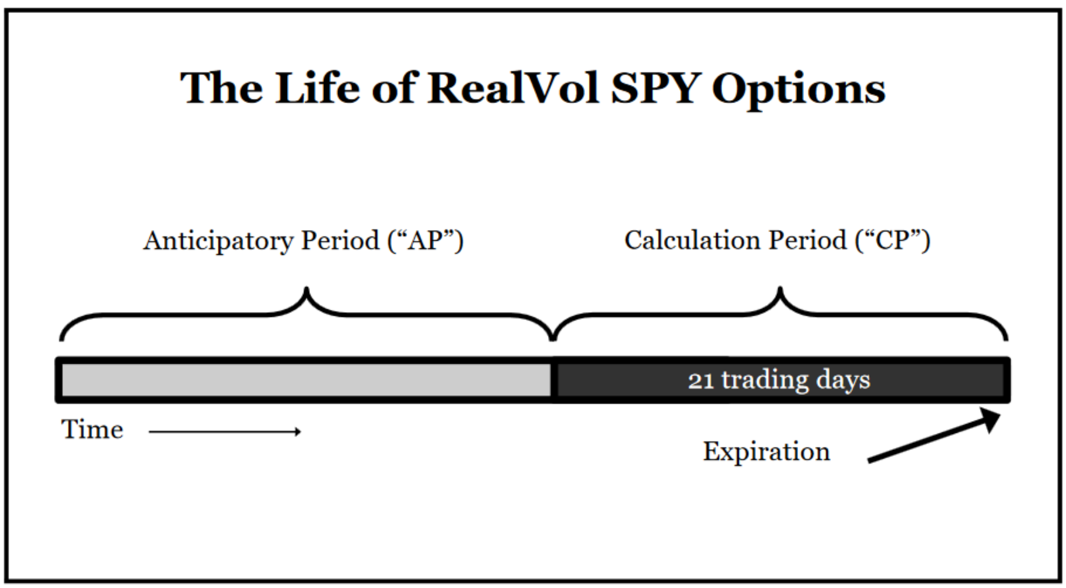
References

- RealVol Indices brochure, periodic updates, realvol.com website, http://www.realvol.com/BrochureVolXIndices.pdf
- Detailed discussion of the RealVol Formula, realvol.com website, http://www.realvol.com/VolFormula.htm

RealVol Instruments

RealVol Instruments are standard exchange-traded futures and options that settle to the corresponding RealVol Index. The first product is expected to be listed on the SPDR® S&P 500® ETF Trust (SPY). Therefore, RealVol SPY Futures and RealVol SPY Options will both settle to the RealVol SPY Index, which in turn is calculated from the RealVol Daily Formula.

When listed, RealVol Instruments will have two distinct periods: the Anticipatory Period (AP) and the Calculation Period (CP). The CP will, typically, consist of 21 trading days immediately prior to the expiration day. The AP will include all days prior to the start of the CP as shown on the following pictograph.

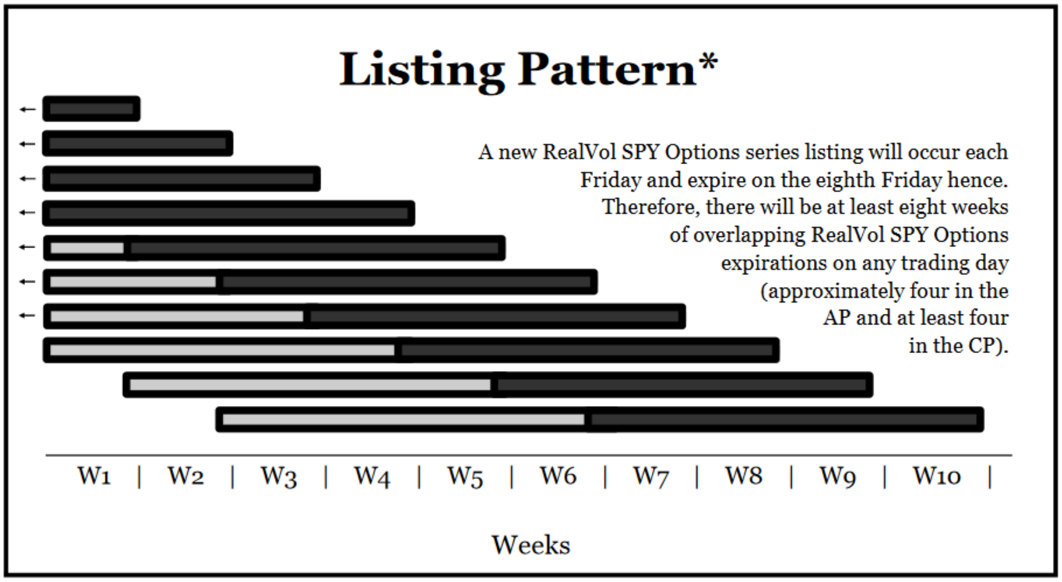


In a certain respect, a RealVol Futures contract will be unlike any futures contract in existence because it will settle to the actual volatility (i.e., price risk) of the underlying.

Therefore, if one were to trade a RealVol Futures contract, the purchaser would be expecting increasing instability or chaos, while the seller would be expecting decreasing movement, or stability.

A new to list RealVol SPY futures and options listing will occur each Friday and will expire on the eighth Friday hence. Therefore, there will be at least eight weeks of overlapping RealVol SPY futures and options expirations on any trading day (approximately four in the

AP and at least four in the CP). The following chart shows the anticipated weekly expiration schedule of futures and options.



RealVol Futures

RealVol Futures will function similarly to any other futures contract that settles to an index. Of course, in this case, the index is based on realized volatility and not an averaging process of a number of component stocks. Futures are typically regulated by the Commodity Futures Trading Commission (CFTC) but may also be regulated by the Securities and Exchange Commission ("SEC") in certain circumstances.

Contract Specifications (Futures)

Please note that, as of the time of this writing, RealVol SPY Futures specifications have not yet been formalized. Regardless of when they are finalized, specifications are always subject to change.

Symbol
VOLS

Underlying Index
The RealVol SPY Index. This index is based on the rolling, 21-trading-day realized volatility (adjusted for dividends and any market disruption events) of the daily closing prices of SPY as calculated by the RealVol Daily Formula.

Index Price
Volatility, which is typically expressed as a percentage, will be quoted without the percentage sign; e.g., 23.45% is quoted as 23.45.

Premium Quotation
Stated in points and fractions; one point equals $1,000. Minimum tick is 0.01 = $10.

Margin
Futures exchanges predominantly use SPAN margining. Margin levels can change.

Trading Hours
8:30 a.m. to 3:15 p.m. CT

First Trading Day
Eighth Friday prior to expiration Friday.

Expiration Dates
Will correspond to the Friday expirations of standard PM-settled S&P Index options, SPY Options, and S&P E-mini® futures options.

Final or Contract Settlement
All RealVol SPY Futures (VOLS Futures) will automatically settle to the RealVol SPY Index (VOLS Index) at expiration.

Settlement Style
Cash

Listing Pattern
Approximately 52 weekly VOLS Futures per year with eight or nine VOLS Futures listed on any given day.

	VIX Futures	RealVol SPY
Symbol	VIX	VOLS
Normal Trading Hours	8:30 to 3:15 CT	Same
Multiplier	$1,000 x index	Same
Margin	See CBOE rules	Same?
Minimum Tick	0.05 points = $50.00	Same
Settlement Style	Cash	Same
Settlement	Special opening quote	RealVol SPY Index
Index Components	SPX options	21 days of SPY closing prices
First Listing Day	Varies	8th Friday prior to expiration
Expiration Day	30 days prior to associated options expiration	Every Friday
Expiration Time	At the day's open	At the day's close
Listing Pattern	Monthly & Weekly on Wednesday (maximum 15 months)	Weekly (maximum 8 weeks)

RealVol Options

RealVol SPY Options (VOLS Options) will function like any other European-style index options. They will be traded on an options exchange regulated by the SEC. Settlement will be to the RealVol SPY Index (VOLS Index).

References

- RealVol Options brochure, realvol.com, updated periodically,

http://www.realvol.com/Brochure.pdf

- Realized Volatility and Variance: Options via Swaps, article by: Peter Carr and Roger Lee, Published by: University of Chicago, Date: 26 Oct 2007, http://www.realvol.com/volatilityblog/?p=521

Contract Specifications (Options)

(Subject to the rules of the listing exchange)

Symbol

VOLS

Underlying Index

The RealVol SPY Index. This index is based on the rolling, 21-trading-day realized volatility (adjusted for dividends and any market disruption events) of the daily closing prices of SPY as calculated by the RealVol Daily Formula.

Index Price

Volatility, which is typically expressed as a percentage, will be quoted without the percentage sign; e.g., 23.45% is quoted as 23.45.

Premium Quotation

Stated in points and fractions; one point equals $100. Minimum tick for a series trading below $3 will be 0.05 ($5.00); above $3 is 0.10 ($10.00).

Margin

Purchases of puts or calls with nine months or less until expiration must be paid for in full. Writers of uncovered puts or calls must deposit and maintain 100% of the option proceeds plus 20% of the aggregate contract value (current index value x $100) minus the amount by which the option is out-of-the-money, if any, subject to a minimum for calls of option proceeds plus 10% of the aggregate contract value and a minimum for puts of option proceeds plus 10% of the aggregate exercise price amount.

To calculate maintenance margin, current market value is used instead of option proceeds. Additional margin may be required pursuant to Exchange Rules.

Trading Hours

8:30 a.m. to 3:15 p.m. CT

Strike Price Increment

- 0.50 points below 15.00
- 1.00 points between 15.00 and 30.00
- 2.50 points between 30.00 and 50.00
- 5.00 points above 50.00

Strike Prices

Strike prices will be listed in-, at-, and out-of-the-money. New series generally will be added when the underlying index exceeds the highest or lowest strike price available.

First Trading Day

Eighth Friday prior to expiration Friday.

Expiration Dates

Will correspond to the Friday expirations of standard PM-settled S&P Index options, SPY Options, and S&P E-mini® futures options.

Final or Contract Settlement

All VOLS Options will automatically settle to the VOLS Index at expiration.

Exercise Style

European (only at expiration)

Settlement Style

Cash

Listing Pattern

Approximately 52 weekly VOLS Options per year with eight or nine VOLS Options listed on any given day.

Comparing Specifications to VIX

The chart on the next page compares the specifications of RealVol Options to VIX Options. For the most part, all specifications are the same except for two key items: 1) RealVol SPY Instruments will settle to the RealVol SPY Index (not to the VIX index), and 2) expirations occur each week on Friday coinciding with the expirations of E-mini S&P 500 futures options, S&P 500 PM-settled index options, and SPDR® S&P 500 ETF options (unlike VIX, which expires on Wednesday morning 30 days before the underlying SPX options expire).

	VIX Options	RealVol SPY Options
Symbol	VIX	VOLS
Normal Trading Hours	8:30 to 3:15 CT	Same
Multiplier	$100 x index	Same
Margin	See CBOE rules	Same?
Minimum Tick	Stated in points and fractions; one point equals $100. Minimum tick for a series trading below $3 will be 0.05 ($5.00); above $3 is 0.10 ($10.00).	Same
Settlement Style	Cash	Same
Settlement	Special opening quote	RealVol SPY Index
Index Components	SPX options	21 days of SPY closing prices
First Listing Day	Varies	8th Friday prior to expiration
Expiration Day	30 days prior to associated options expiration	Every Friday
Expiration Time	At the day's open	At the day's close
Listing Pattern	Monthly & Weekly on Wednesday (maximum 15 months)	Weekly (maximum 8 weeks)

Considerations

IN THIS SECTION:

- Expected Return
- Key Drivers of Volatility Levels
- Daily Data
- Expiration Coinciding with SPY Options
- Convergence
- Theoretical Value
- Comparison to Other Volatility-Capturing Methods

Expected Return

There is no expected growth in volatility levels over time — therefore, no expected return. Of course, volatility will be higher and lower as events occur and get resolved. However, a systematic rise in volatility levels (academics would call such movement "drift") does not apply and really does not make much sense. It would follow then that one cannot simply buy and hold volatility and expect to make a profit over time.

Volatility products are useful for risk control. They are not investments per se.

Key Drivers of Volatility Levels

Mean Reversion

Mean reversion is the term used to describe any dynamic process that tends to revert to its long-term mean, or average. Volatility has historically shown this tendency. Some would describe the mean-reversion process as similar to a rubber band's being stretched. When it gets far away from its resting state, the band "snaps back."

Autocorrelation

Autocorrelation is the tendency for recent past prices to influence future prices. In other words, high volatility often begets further high volatility, and low volatility begets low volatility.

A real-life example is in order: The temperature in the summer is high; the temperature in winter is low. Even though there is a recurring pattern, we still check the weather report each day before venturing outside because any particular day's temperature may stray from what is expected. However, while the current temperature can change, it won't change "dramatically." This means that in the middle of summer, we won't see temperatures below freezing. High temperatures in summer beget more high temperatures (autocorrelation), while there is a long-term tendency for those same high temperatures to fall toward the mean through the late summer and autumn (mean reversion). In essence, autocorrelation and mean reversion can coexist peacefully!

Shocks

Having shown how two seemingly opposite concepts can work together, there is yet another idea that may appear contradictory to both — shocks. Shocks can occur anytime. Essentially, a shock is an unknown event that surprises a market — prices jump, options premiums soar, and if there were a RealVol futures contract available on that asset, its price would probably spike higher as well. Depending on the severity of the shock, an event could have the power to move volatility from a lower regime to a higher one literally overnight.

Relief

We call the opposite of a shock "relief." In this case, typically there is a known event on the horizon, but with an unknown outcome. In such a case, implied volatility often rises into the event while realized volatility typically falls. After the event, implied volatility often collapses while realized volatility can at times jump. (As soon as it is perceived that the underlying has made its move, everything returns to "normal," thus providing the expected "relief.")

References:

- Volatility Strategies Article #3, http://www.realvol.com/VolatilityStrategies1.pdf

Daily Data

The RealVol Daily Formula uses closing prices of the underlying asset only in its determination of realized volatility. In the first launch based on SPY, the closing price used will come from NYSE Arca®.

Expiration Coinciding with Weekly Options

One of the success stories in the past few years has been the stellar growth of weekly options. It is easy to see why. Weekly options can be cheaper than longer-term options because there is less time value. Many professionals know that constantly hedging a portfolio is a losing endeavor. However, not hedging at all is even more risky. What is needed is a more precise hedge to use during times of uncertainty. Weekly options can hedge this uncertainty for targeted periods of time.

VOLS have been configured to address this need. VOLS Options expire at the same time that SPY options expire — every Friday afternoon. Therefore, portfolio managers, market makers, and other participants should have more liquidity, and more opportunities with all contracts expiring simultaneously.

Theoretical Value

RealVol Futures were fashioned after OTC volatility swaps. They use the same realized volatility formula for settlement and function very similarly. Pricing, therefore, should be roughly the same, but there are some mitigating circumstances.

RealVol Futures contracts are the listed, synthetic equivalent of a forward-starting volatility swap. The forward starting feature means that an extra calculation needs to be made in order to adjust for the forward-starting feature of a RealVol Futures.

One method to get a volatility swap price is to use a model. Similar to the way Black Scholes is one of the standard models to value an option, the Heston model is one of the accepted standard models to value a volatility swap. Of course, there are other models. Regardless of which model is used, an additional calculation using a root-mean-square formula is then needed to adjust for the forward-starting feature of a RealVol Futures.

References

There are many papers describing models and methods of calculating the theoretical value of a volatility swap. We selected a few.

- Volatility Derivatives, article by: Peter Carr, Roger Lee, published by: New York University, 27 Aug 2009, http://www.realvol.com/volatilityblog/?p=308
- More Than You Ever Wanted To Know About Volatility Swaps, article by: Kresimir Demeterfi, Emanuel Derman, Michael Kamal, Joseph Zou, Published by: Goldman, Sachs & Co., 1999, http://www.realvol.com/volatilityblog/?p=516
- Pricing Volatility Swaps Under Heston's Stochastic Volatility Model with Regime Switching, article by: Robert J. Elliott, Tak Kuen Siu, Leunglung Chan, published by: Applied Mathematical Finance, date: 16 Jan 2006, http://www.realvol.com/volatilityblog/?p=535
- Pricing and Hedging Volatility Derivatives, article by: Mark

Broadie, Ashish Jain, published by: Columbia Business School, date: 10 Jan 2008, http://www.realvol.com/volatilityblog/?p=532

- Root Mean Square calculation explained, Wikipedia, https://en.wikipedia.org/wiki/Root_mean_square

Comparison to Other Volatility-Capturing Methods

Straddles

Buying a call and a put at the same strike and for the same expiration allows for the underlying asset to move in either direction, and if overcoming initial costs, could profit. On the surface, this sounds like a volatility trade. In a manner of speaking it is. However, it is a "rough" volatility trade.

For example, if news came out that the president had been shot, the market might take a large and precipitous dive. If later it was determined that the president's wounds were superficial, the market might just as quickly recover. Did the underlying exhibit volatility? Yes. Did the trader profit from a "correct" forecast? No. The problem with a straddle position is that one initially does not care which way the market moves, but after this initial move, the position turns into a directional play with the trader rooting for the market to continue in the same direction.

Delta-Hedged Straddles

In the last example, the trader bought a straddle and then waited for a move to take place. In a delta-hedged straddle, the trader actively participates in adjusting the position, attempting to capture market movements as they become available. Think of a ladder that is in a hole — equate this to paying upfront for the call and put. Now that the option position is in place, one tries to follow up the position by trading the underlying in a delta-neutral manner. Every follow-up is like climbing up one rung of the ladder. If there are enough follow-ups, the trader successfully gets out of the hole (meaning he covers all of his upfront premium costs), and begins to earn profits. If follow-up opportunities are scarce, the trader may never get out of the hole before the options expire, leading to a loss.

Many equate such a strategy to "buying or selling volatility," and this thinking is correct. It is certainly more like a volatility trade than a simple long straddle that is bought and held, with few or no adjustments.

However, there is a caveat. The sensitivity of an option to volatility (its vega), changes 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 realized volatility, but it is not a pure form of such a trade. RealVol Futures deliver actual interday realized volatility. Therefore, they provide precise volatility exposure in a simple buy/sell format with fewer (and, therefore, lower) transaction costs than delta-hedged straddles.

Volatility Swaps

Over-the-counter (OTC) volatility swaps are probably the closest to RealVol Futures. Because OTC products can be completely customized, a volatility swap could be traded with the exact terms. This could provide a nearly perfect hedge. We say "nearly perfect" because OTC instruments contain credit risk, and RealVol Futures are listed using a central clearing house and are generally considered credit risk free.

Variance Swaps

Variance swaps, like volatility swaps, can be customized so that all of the terms are identical, except for one — variance swaps result in variance exposure while volatility swaps result in volatility exposure. In order to be considered a variance swap, it must provide volatility squared. Obviously, squaring the potential payout makes for a different payoff profile. Therefore, variance swaps should be used by sophisticated market participants who understand the nuances of pricing and trading such instruments.

VIX

VIX is based on implied volatility (as described earlier), which means instruments settling to VIX must expire *prior* to the underlying options upon which they are based. However, even if expirations of both VIX and VOL were aligned, the pricing would not be the same.

VIX is a forward starting, listed, synthetic equivalent of a variance swap. As we mentioned, VOL is a forward starting, listed, synthetic equivalent of a volatility swap. The pricings of variance swaps and volatility swaps are not the same. The theoretical difference is known as the "convexity adjustment" (explained in the Sophisticated Strategies section subtitled: Spreading with Variance Swaps). The spread averages to about two volatility points (also explained in the Sophisticated Strategies section subtitled: Spreading with VIX), but varies with both the magnitude and the volatility of volatility.

References:

- Towards a Theory of Volatility Trading, article by: Peter Carr and Dilip Madan, Published by: NYU, 30 Jan 2002, http://www.realvol.com/volatilityblog/?p=287
- A Guide to Volatility and Variance Swaps, 23 Jan 2013, article by: Kresimir Demeterfi, Emanuel Derman, Michael Kamal, Joseph Zou, Published by: Goldman, Sachs & Co., 1999, http://www.realvol.com/volatilityblog/?p=519
- Market Risk for Volatility and Variance Swaps, article by: Neil Chriss, William Moroko, Published by: New York University,Jul 1999, http://www.realvol.com/volatilityblog/?p=538
- The CBOE Volatility Index – VIX, White Paper, updated periodically, CBOE, http://www.cboe.com/micro/vix/vixwhite.pdf

Strategies

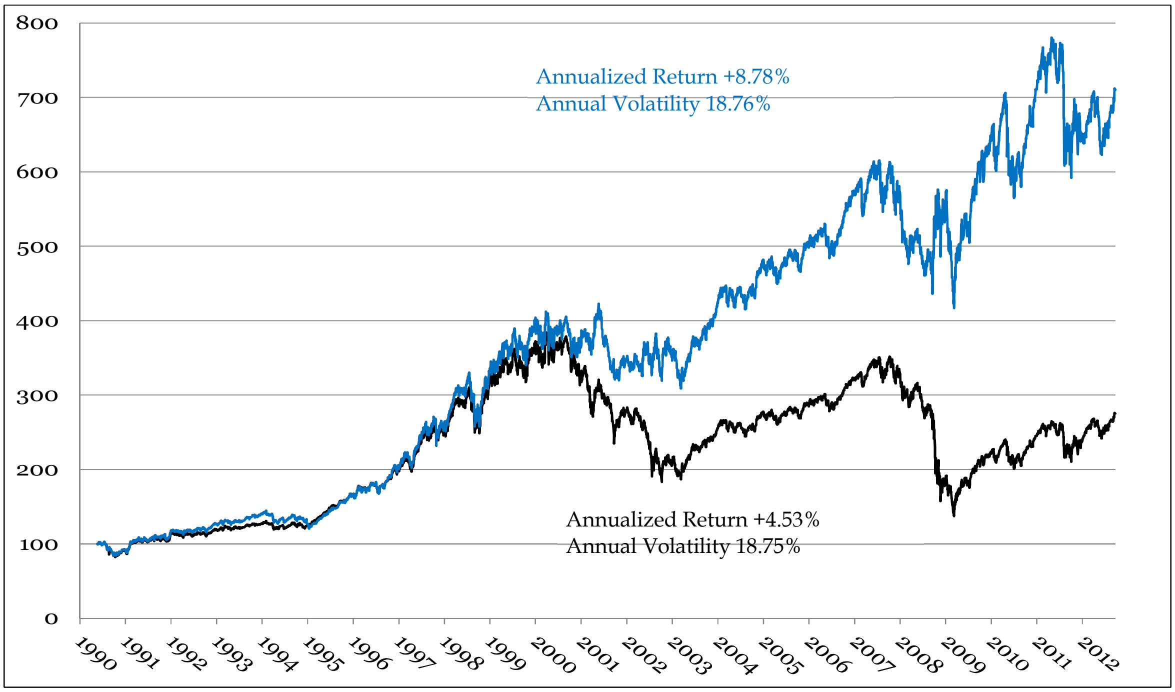
IN THIS SECTION:

Hedging an S&P Index Portfolio

In a landmark study, Sixiang Li found that a dynamic RealVol overlay to an S&P 500 index portfolio was shown to increase returns without increasing risk.

In the below chart, the black line is the total return index (TRI) of the S&P 500; the blue line is the TRI plus a dynamic volatility overlay. Over the 23 years of this study, the dynamic overlay-TRI combination returned almost double the S&P 500 total return, with the same level of risk.

Theoretically, this should not be possible and has widespread implications for portfolio managers.



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- Summary of Article: Over Hill, Over Dale, Overlays, Published by realvol.com, http://www.realvol.com/VolatilityStrategiesOverlay.pdf
- Full Article: VolContract [RealVol] Futures Overlay on an S&P 500 Portfolio, 08 Nov 2012, article by: Sixiang Li, published by: CAIA, http://www.realvol.com/CAIALi2013-Q3.pdf

Mean Reversion

It is a well-known mathematical fact that realized volatility is mean reverting. What this means, quite simply, is that, within a reasonable period of time, one can expect current realized volatility to revert, or return, to its mean (which is to say, to levels that are normal, or average, or customary, for the particular asset under consideration).

A Mean-Reversion Trade, or strategy, seeks to exploit this phenomenon by trading a RealVol Futures contract, or its synthetic equivalent, using options (long call, short put with the same strike price and expiration) in a direction, long or short, that corresponds to the direction of reversion to the mean volatility of the underlying asset. (Note: for all the strategies discussed on this page, whenever the terms "RealVol Futures" or "futures contract" are used, it is assumed that an analogous strategy, using the above structure, often called an option "combo," or "synthetic futures" may be employed as well.)

For example, suppose that the long-term historical mean volatility for Asset A is 30%. And, suppose further that a current RealVol Futures contract, about to begin its RealVol Calculation Period (CP), is trading at 40.00. One might consider selling the contract at 40.00, with the expectation that, over the next month, the underlying's volatility will revert to historical norms of 30.00, thereby creating the potential for a profitable trade should this reversion to the mean take place within the life of the contract.

Naturally, there can be no guarantee that such a movement will actually transpire within this given time frame. But, of course, a complete return to historical levels of 30 is not required for the trade to be profitable. All that is necessary is for the movement to be in the direction of the mean for the RealVol Futures' value to decrease from 40, creating a profitable opportunity for the seller of the contract.

Arbing with Volatility Swaps

Before the advent of listed RealVol Instruments, the only mechanism available to capture, in its purest fashion, the realized volatility of an asset was the volatility swap. Such an instrument is a contractual obligation between buyer and seller, over the designated time period, to pay a predetermined amount of dollars per realized-volatility point, with reference to an initial strike-price volatility. For example, suppose an investor is convinced that the realized volatility of Asset A is going to increase over the next three months. He might engage in a volatility swap, with an initial strike price of, say, 25.00, and an agreement stating that, upon expiration, in three months, each realized-volatility point of the underlying, above or below 25.00, will have a value of $100,000.

While no funds need change hands at the inception of the trade, it is understood that the buyer will receive from the seller (r – 25.00) x $100,000, upon expiration, where r = the realized volatility of Asset A over the designated three-month life of the swap, and r > 25.00. Conversely, if r < 25.00, the buyer remits to the seller (25.00 – r) x $100,000 upon expiration.

Spreading with Variance Swaps

Similar to the volatility swap, the variance swap rewards the buyer/seller with a payout that reflects the realized variance (square of volatility) of the underlying asset, with respect to a predetermined reference price, or starting variance. Such variance swaps have proven to be somewhat more popular than volatility swaps, in the OTC markets, because the variance-swap payouts are more easily and directly replicated with options on the underlying asset than is the case for volatility-swap payouts, and thus, the variance swaps are often deemed more suitable for hedging purposes than their vol-swap counterparts.

Once again, one might envision the possibility of an arbitrage between RealVol Instruments and a variance swap, but, in this instance, no completely riskless arbitrage is possible. Whereas the payout from a vol swap or RealVol Futures is purely linear, at $X per realized-volatility point above or below the strike, the payout from a variance swap is a squared function and is thus subject to the absolute levels of realized variance, which are not symmetrical around the current strike. A single example will suffice.

Suppose the current volatility strike price for a vol swap and the current price of RealVol Futures were both 30.00. The corresponding strike for the variance swap might, therefore, be $30.00^2 = 900.00$. (In actuality, because of the aforementioned asymmetry of prices around the strike, an adjustment would be made, such that the variance-swap strike would not be 900.00, but somewhat higher.) Suppose realized volatility were 35.00 over the period. Difference in variance would be $35.00^2 - 30.00^2 = 1{,}225.00 - 900.00 = 325.00$. On the other hand, suppose realized volatility were 25.00 over the period. Difference in variance would now be $30.00^2 - 25.00^2 = 900.00 - 625.00 = 275.00$.

Compared to the vol swap, whose linear difference of five volatility points is the same up or down (35.00 – 30.00 = 5, and 30.00 – 25.00 = 5), it is clear that such is not the case for the variance differentials, which were shown to be 325.00 and 275.00, respectively. What is more, all such five-point volatility/variance differentials are not created equal! Were we to begin from a realized-volatility level of, say 40.00, a five-point move in either direction would produce corresponding variance differentials, this time, of 425.00 and 375.00 (we leave the math to the reader), although the payouts for the five-point moves in the RealVol Futures would remain unchanged.

For all of the above reasons, direct arbitrage between RealVol Futures and variance swaps is not possible, although creating a spread between the two vehicles, when prices appear to be out of line, is certainly a reasonable possibility.

Spreading with VIX

The CBOE Volatility Index on the S&P 500, or VIX, is a calculation that reflects current levels of average 30-day option implied volatilities over the entire range of current strike prices for the underlying asset. While it is not possible to trade this VIX value directly, futures contracts on the VIX that trade at the Chicago Futures Exchange (CFE), as well as options on the index that trade at the Chicago Board Options Exchange (CBOE), are readily available. Such contracts, in theory, reflect predictions of future levels of option implied volatilities, which, themselves, are often related to, though are rarely equal to, future levels of the underlying asset's realized volatility.

It is possible to conceive of spread trading between RealVol Futures or options and VIX futures. But, one must proceed with caution. Suppose the perception is that current implied volatilities, as represented by VIX futures prices, are higher than one's forecast for upcoming realized volatility of the S&P 500. One might envision a spread trade, whereby VIX futures are sold and RealVol Futures are bought. The thinking might be that, if realized volatility does, in fact, turn out to be lower than the implied volatility represented by VIX futures, a profit could be made.

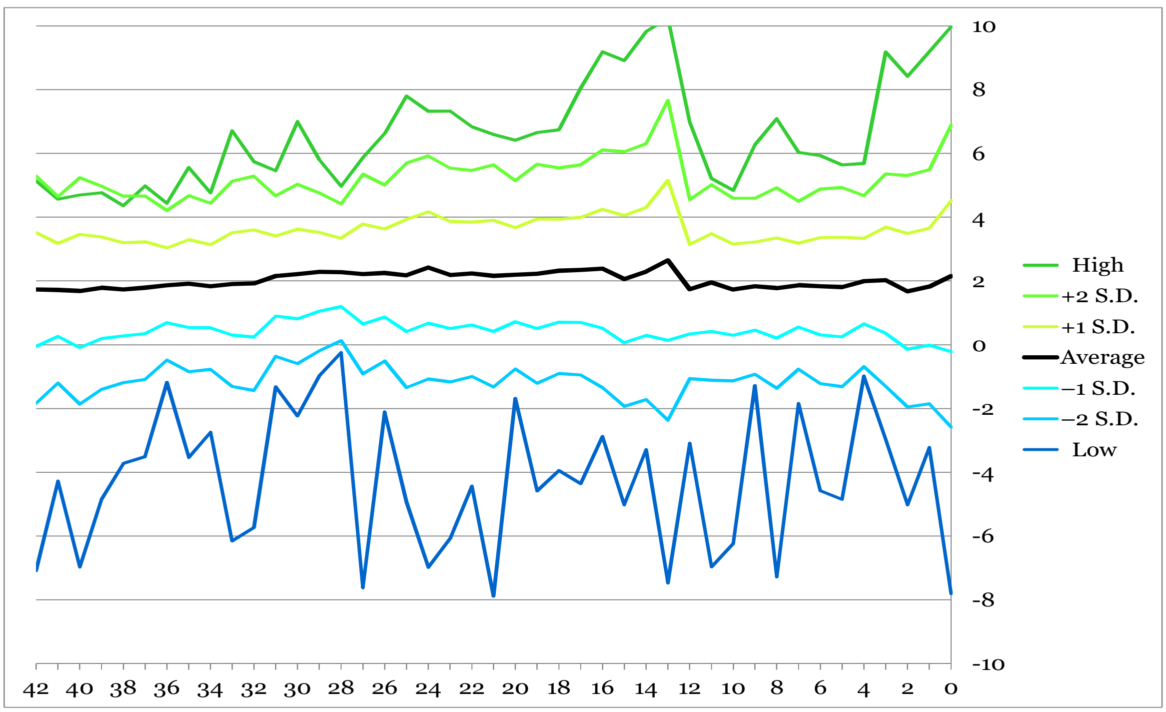
While this, indeed, may be the case during the Anticipatory Period (AP) of RealVol Instruments, when they are expected to trade mostly on sentiment and, therefore, ought to closely match VIX instruments in their pricing, such may not be the case once RealVol Instruments enter the RealVol Calculation Period (CP) of their existence. For example, RealVol Futures always settle to the past realized volatility over a given CP, and thus reflect, upon their expiration, what has already occurred, whereas VIX futures, upon their expiration, settle to yet another forecast of what implied volatilities will be. As a result, there can be no guarantee that such settlement price will reflect either past levels of implied volatility or realized volatility.

In short, spreading between RealVol Futures and VIX futures has inherent subtleties that must be taken into consideration, since the values that the two contracts represent are not only different as to their calculation but also as to the time period to which they apply.

Below is a chart showing the relationship between VIX and VOL (VIX – VOL). On average, VIX should be priced about 2 points higher than VOL in the Anticipatory Period. However, there are often substantial discrepancies from average that could lead to a number of spreading opportunities.

Reference

- Spread the Wealth, Volatility Strategies series #5, published by: RealVol LLC, http://www.realvol.com/volatilitystrategy5.pdf



Hedging a Delta-Neutral Options Book

Before the advent of RealVol Instruments and volatility and variance swaps, there was no direct method for trading pure realized volatility. As was explained in the previous section, in the absence of the above vehicles, traders turned to options contracts, specifically to at-the-money straddles, in an attempt to capture the realized volatility of the underlying asset. To this day, buying and selling ATM straddles, and then hedging them actively, to remain delta-neutral, remains the staple strategy of traders, market-makers, and portfolio managers, wishing to "trade volatility."

Now, one might contemplate the use of RealVol Instruments, in conjunction with straddle selling and buying, so that, in times of uncertainty, the straddle trader might, in turn, hedge not only the deltas of his options position but the very volatility that such a position is intended to capture in the first place.

It would suffice for the straddle buyer to sell RealVol Futures or their synthetic options equivalent, or for the straddle seller to buy RealVol Futures, in order to hedge much or all of the volatility exposure that the original straddle was designed to capture. What's more, the original options book need not be a pure volatility play, or straddle, in order to have, nonetheless, as one of its risk exposures, or "Greeks," sensitivity to changing volatility. One might imagine, then, the use of RealVol Instruments as a more general, global, hedge against the vega, or kappa (sensitivity of options prices to changes in implied volatility), of an entire options portfolio.

What's more, the maturities of the options and the RealVol Futures used as a hedge need not necessarily be the same. One might contemplate a long-term exposure, through sold options, to profitability through declining volatility. However, in periods of stress, or market turbulence, one might envision buying shorter-dated RealVol Instruments as a form of protection against rising volatility and as a means of "riding out the storm," without necessarily disturbing or liquidating the underlying, longer-dated, options positions.

Clearly, many such strategies, involving hedging the volatility exposure of an options portfolio with RealVol Instruments, are readily available.

Reference

- Hedging an Options Book, Volatility Strategies series #2, published by: RealVol LLC, http://www.realvol.com/VolatilityStrategies2.pdf

Trading the Decrease in Sensitivity to Changing Volatility through the RealVol Calculation Period

Once RealVol Instruments reach the Calculation Period (CP), their value going forward is no longer purely a function of anticipated realized volatility, as it was during the Anticipatory Period (AP). In essence, once the CP begins, the formula for calculating the final settlement price of any RealVol Instrument is invoked, and, with each passing day, the partial realized volatility (PVOL) plays an increasingly important role in the determination of the final value of that contract.

We might say that, the more days that have been logged into the formula, the less sensitive the RealVol Instrument becomes to any changes in future realized volatility, since such data points now become just one, or a few, of the many that have been entered into the formula for the ongoing determination of the expiration value.

Suppose we are 15 trading days into the CP of a RealVol Futures, with six trading days left to expiration. And, further suppose that the PVOL for the first 15 days of the CP has already been calculated as 40.00. We now feel that, from here until expiration, the underlying asset will display a somewhat lower volatility of, say, 30.00. How might we determine if the current price of the RealVol Futures justifies a trade in one direction or the other?

First, let us observe that, just because the PVOL is currently 40.00 does not mean that the RealVol Futures will be trading at 40.00. Although, in essence, a good part of the RealVol Future contract's terminal value has already been input into the RealVol Daily Formula, six more trading days remain. As a result, depending on trader sentiment, the RealVol Futures may be trading above or below the PVOL value of 40.00. Suppose, nonetheless, for simplicity, that the RealVol Futures price is, indeed, exactly 40.00. We are forecasting 30% volatility for the remainder of the contract's life. How do we determine how such a remaining volatility would affect the potential final price of the RealVol Futures? We use a calculation referred to as the "root mean square."

There are a total of 21 days in the CP. For 15 of those days, vol has already been calculated to be 40.00. In addition, we are forecasting vol of 30.00 for the remaining six days. First, we square the 40.00, yielding 1,600.00, which we multiply by 15, to obtain a weighted average: 15 x 1,600.00 = 24,000.00. Next, we square the projected 30.00 volatility for the last six days, yielding 900.00. Multiplying by six gives 5,400.00. We then add the two weighted values, giving 29,400.00, and we divide by the total number of trading days in the CP, which is 21. 29,400.00/21 = 1,400.00. Finally, we take the square root of this weighted average, or mean, of the squared results (the so-called root mean square), thus obtaining a projected final value of the RealVol Futures of $\sqrt{1{,}400}$ = 37.42.

Finally, we compare this forecast of the terminal value of the RealVol Futures, namely 37.42, which incorporates the PVOL of 40.00 and our estimate of the next six days' realized volatility of 30.00, to the current price of the RealVol Futures to see if a trade is advisable. Clearly, values above 37.42 might induce us to sell the RealVol Futures, or a synthetic equivalent, while values below 37.42 might trigger a purchase. At values near 37.42, we would conclude that the market has assessed remaining realized volatility levels in the same manner as we have, and we would probably pass on taking a position.

Day-Trading Convexity

Because realized volatility is calculated using underlying close data only, opportunities arise for those interested in day-trading. To fully appreciate the opportunity, let's take a large market move as an extreme case. It will be very easy to understand the potential this way.

Think back to the so-called "flash crash" on 6 May 2010, which occurred late in the afternoon. At one point, the market indices had been down about 10%. Pretend that everyone is now in the middle of the action not knowing what will come next. Suppose that God sends a message to the trader saying that the market will make yet another move of roughly 10% by the close. However, He does not happen to mention which way the market will move!

Had the trader known this, what position could have profited from this knowledge? Buying the underlying would have made a lot of money if indeed the market rallied. But, the next 10% move could have been down. Shorting the market is not a viable solution either as the next move could be up.

Trading a realized volatility instrument (assuming that it had been available for trading) seems to be just the right product. However, this assumption would be wrong if indeed the market move occurred prior to the close. This is because movement of a RealVol Instrument, within the day, is very sensitive to the direction of the underlying.

How can that be the case when realized volatility is defined as *movement regardless of direction?*

Suppose that indeed the market dropped 10% further. The close-to-close return would become –20%, and the resulting realized volatility for the day would be immense. However, what if the next hour's market move were up 10% (essentially moving back to unchanged)? In that case, the close-to-close return would be close to zero and the realized volatility would also be zero for the day.

Therefore, what is key to trading these new instruments is understanding that there is a strong directional *intraday* component that is not present *interday*. In other words, if one wants volatility exposure, RealVol Instruments may be just what the trader needs if the time frame is over several days, weeks or months. However if it is within the day, RealVol instruments' values can change closely with the direction of the underlying. This "feature" can be good or bad. Obviously, for this specific example, a RealVol Instrument may not work as well as other instruments. However, this points out the clear opportunity to hedge/spread a RealVol Instrument with the underlying when the trade horizon ends at the current day's close. For more, details on this interesting trading opportunity, see Volatility Strategies #1.

Reference

- Day Trading Convexity, Volatility Strategies Series #1, published by: RealVol LLC, http://www.realvol.com/VolatilityStrategies3.pdf

Summary

The RealVol product line uses the flagship 21-day RealVol Index, calculated from the RealVol Daily Formula, to settle RealVol Instruments. RealVol is based on the actual or realized volatility of the underlying. It is functionally different than instruments based on implied volatility.

Depending on one's definition of "asset class," volatility could be viewed as an asset class in its own right. Regardless of one's definition, the potential uses of the instrument appeal to a broad range of market participants over all types of markets. Such a diverse set of users and assets should, over time, finally provide much needed instruments for hedging, arbing, spreading, and outright speculating.

There are 40 indices in the RealVol suite of risk indices. Only one, the flagship 21-day realized volatility (VOL), is used to settle RealVol Instruments. The other indices can be used as a guide to estimate the risk of the underlying asset.

The RealVol Formula mirrors the formula used in the OTC marketplace.

The first RealVol Instruments are expected to be based on the realized volatility of SPY. Contract specifications are expected to generally conform to VIX specifications for both futures and options, except the expiration schedule will coincide with weekly options expirations (not VIX instrument expirations), and, of course, the underlying index will be based on realized volatility not implied volatility.

Some of the considerations for trading the instruments include: no positive drift; four key factors affecting the price: mean reversion, autocorrelation, shocks, and relief; convergence as expiration approaches; and the arbitrage/spreading opportunities with other volatility-like assets and strategies.

We have shown: how a dynamic RealVol overlay to an S&P index portfolio can increase returns while not increasing risk; how the contract acts differently in the Anticipatory Period compared to the Calculation Period; and how the contract has a strong directional component within the trading day that is not readily apparent at first glance.

In conclusion, several instruments already exist that allow investors to gain exposure to, or to hedge, volatility. While swaps and options straddles capture realized volatility, the former are OTC instruments not readily available to the general public and have credit risk, while the latter do not always provide the actual volatility of the underlying. VIX futures reflect a sentiment and are intended to represent the aggregate implied volatility of S&P 500 options. Some VIX investors are left wanting when the futures expire to yet another forecast, as opposed to a concrete calculation. RealVol Futures seem to respond well to all of the shortcomings of the VIX product and should offer an easily traded, exchange-listed instrument that settles to realized volatility (i.e., actual day-to-day price risk), while appealing to a wide array of market participants.