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Identifying the Differences Between VIX® Spot and Futures

CONTRIBUTOR

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The S&P Dow Jones Indices Practice Essentials series is a curriculum-based, educational program covering selected financial markets, asset classes and indexing concepts.

Implied volatility is more than just a barometer for an investor's outlook of the equity market. In recent years, implied volatility has emerged as an important asset class. Exchange traded securities enable investors to access implied volatility easily—either to generate alpha or to hedge potential market risk. However, investors should understand the distinct characteristics of the popular volatility indices and products available in the marketplace before taking the plunge. In this paper, we will focus on two major implied volatility indices: the CBOE Volatility Index (VIX) and the S&P 500® VIX Short-Term Futures Index. We will also illustrate the difference between the spot VIX and VIX futures markets.

History of VIX

The concept of a volatility index dates back to 1987, when Professor Menachem Brenner and Professor Dan Galai designed the Sigma Index as an underlying asset for futures and options. On Jan. 19, 1993, the Chicago Board Options Exchange (CBOE) announced the launch of real-time reporting of the CBOE Volatility Index or VIX. Professor Robert Whaley developed the formula, and the calculation was based on the S&P 100 Index option prices. Ten years later, working with Goldman Sachs, the CBOE changed the VIX calculation methodology and the underlying securities used to calculate VIX. The new methodology is based on the variance swap model, and the calculation now uses S&P 500 Index options. For more information on this model, please refer to the whitepaper.

VIX is a popular measure of the implied volatility of S&P 500 index options. It represents the market's expectation of stock market volatility over the next 30 days. To calculate volatility, the index first takes as inputs the current market prices for all out-of-the-money S&P 500 calls and puts for the first and second month expirations. It then calculates the square root of the risk-neutral expectation of S&P 500 variance over the next 30 calendar days. The VIX is then quoted as an annualized standard deviation in percentage points.

Research of volatility shows that VIX hits its highest levels during periods of market turbulence; hence VIX is often referred to as the "investor fear gauge." It is often seen as a diversification tool in a broad equity portfolio, especially when volatility tends to be more of a concern.

It is not possible to trade the spot VIX. Instead, investors take a position on the VIX through the use of VIX derivatives. In March 2004 and February 2006, the CBOE introduced futures and options based on the VIX. In January 2009, S&P Dow Jones Indices launched the S&P 500 VIX Futures Index Series. A variety of popular exchange traded products linked to these indices offer broad market access to volatility trading.

The S&P 500 VIX Short-Term Futures Index measures the return from a rolling long position in the first- and second-month VIX futures contracts. It maintains a constant one-month maturity by rolling continuously throughout each month from the first-month VIX futures into the second-month VIX futures contract. Exchange traded products linked to this index are among the most popular trading vehicles based on VIX.

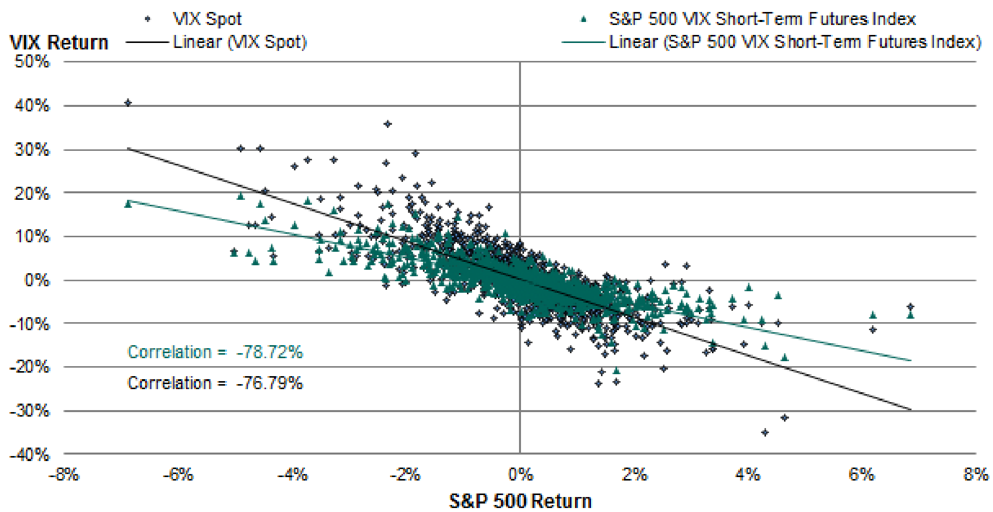
Characteristics of VIX Spot and Futures

Similar to other spot-futures markets, the VIX futures and spot indices are closely related but have differences. Since Jan. 22, 2009, the S&P 500 VIX Short-Term Futures Index has been highly correlated with VIX (89.75% correlation). The index, however, does not track the VIX perfectly due to the distinct characteristics of the futures market.

Correlation With the Equity Market

Both the VIX spot and futures markets are negatively correlated with the S&P 500. Since Jan. 22, 2009, the S&P VIX Short-Term Futures Index has a correlation of -78.72% with the S&P 500, which explains how it can be seen as a hedge to potential market risk. In particular, when the equity market drops significantly, VIX tends to move up in both the spot and futures markets (See Exhibits 1 and 2).

Exhibit 1: Correlation with the S&P 500 Index



Source: S&P Dow Jones Indices. Data from Jan. 22, 2009 – Dec. 31, 2013. Charts are provided for illustrative purposes. Past performance is no guarantee of future results.

Exhibit 2: Probability of VIX Spot and Futures Rises Given a Drop in the S&P 500

S&P 500 Daily Returns (%)	Prob. Of VIX Going Up (%)	Prob. Of S&P 500 VIX Short-Term Futures Index Going Up (%)
< 0	78.82	74.59
<-0.5	91.07	93.57
< -1	94.74	95.32
<-1.5	95.88	98.97

Source: S&P Dow Jones Indices. Data from Jan. 22, 2009 – Dec. 31, 2013. Charts are provided for illustrative purposes. Past performance is no guarantee of future results.

Beta of VIX Futures

While futures markets tend to move together with the corresponding spot price, they tend to move in smaller increments. A shock in the spot market is usually muted in the futures market, and the VIX futures market is no exception. Exhibit 3 shows the daily returns of the VIX spot and futures markets on the 10 trading days with the biggest market drops since Jan. 22, 2009. Historically the S&P 500 VIX Short-Term Futures Index has a beta of 53.41% with the VIX spot, meaning it tracks about half of the spot movement on a daily basis.

Exhibit 3: Daily Returns of VIX Spot and Futures During the 10-Biggest Market Drops

Date	S&P 500 Return (%)	VIX Return (%)	S&P 500 VIX Short-Term Futures Index Return (%)
8/8/2011	-6.88	40.55	17.44
2/10/2009	-5.03	6.71	6.11
8/4/2011	-4.90	30.32	19.35
3/2/2009	-4.77	12.74	6.35
2/17/2009	-4.64	12.53	4.25
8/18/2011	-4.55	30.10	17.59
8/10/2011	-4.47	20.39	13.60
4/20/2009	-4.37	14.36	7.44
3/5/2009	-4.34	5.34	4.52
5/20/2010	-3.97	25.96	12.64

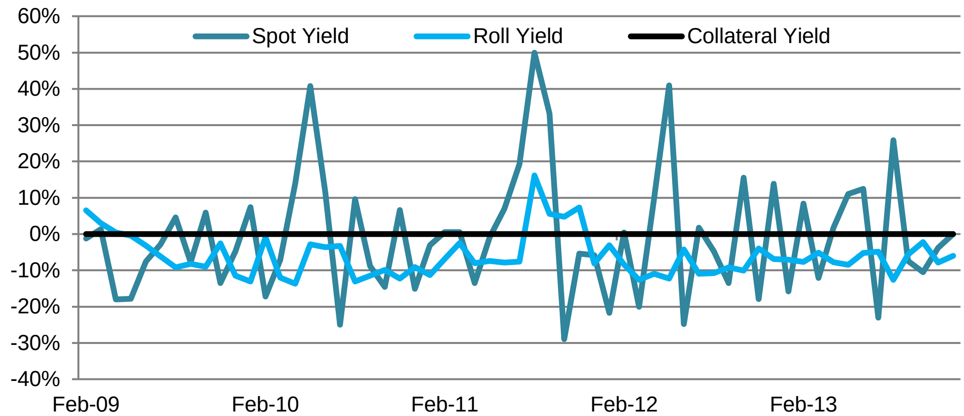
Source: S&P Dow Jones Indices. Data from Jan. 22, 2009 – Dec. 31, 2013 Charts are provided for illustrative purposes. Past performance is no guarantee of future results.

Roll Cost of VIX Futures

All futures have fixed expiration dates. As a result, the S&P 500 VIX Short-Term Futures index has to roll from the first month futures contract to the second-month futures contract before the first-month contract expires. This roll process contributes to the daily return of the futures index. When the market is in contango, longer-term futures are more expensive than shorter-term ones and a roll cost is incurred. Conversely, when the market is in backwardation, longer-term futures are cheaper than shorter-term futures, and the roll generates profit.

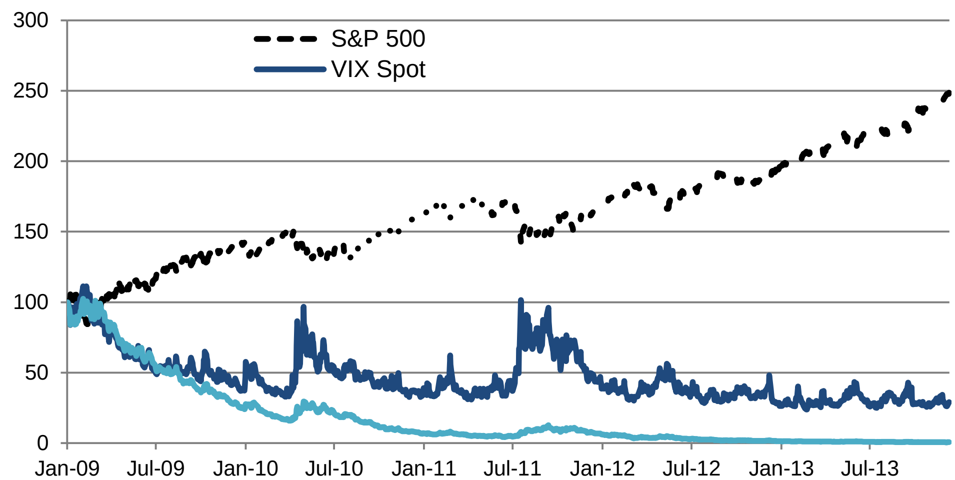
As with other futures-based indices, total return of the S&P 500 VIX Short-Term Futures Index can be broken into three components: return from the spot movement (spot yield), interest collected from the cash collateral (collateral yield) and the profit or loss from rolling to the next contract (roll yield). Exhibit 4 shows the decomposition of the monthly total returns of the S&P 500 VIX Short-Term Futures Index. Although the spot yield dominates in terms of magnitude, the roll yield effect is prominent. Since Jan. 22, 2009, in 52 out of 59 months (88.14%) the VIX futures market was in contango and generated a negative roll yield. Despite its small magnitude relative to the spot yield on a monthly basis, the accumulated roll yield has created a significant performance drag for the S&P 500 VIX Short-Term Futures Index (see Exhibit 5). VIX spot exhibits a mean-reverting return pattern, while the S&P 500 VIX Short-Term Futures Index trends down over the long term.

Exhibit 4: Decomposition of S&P 500 VIX Short-Term Futures Index Total Return



Source: S&P Dow Jones Indices. Data from Jan. 22, 2009 – Dec. 31, 2013. Charts are provided for illustrative purposes. Past performance is no guarantee of future results.

Exhibit 5: Performance History



Source: S&P Dow Jones Indices. Index values are normalized to 100. Data from Jan. 22, 2009 – Dec. 31, 2013. Charts are provided for illustrative purposes. Past performance is no guarantee of future results.

Key Takeaways

Both spot VIX and VIX futures are negatively correlated to the equity market. Investors use VIX's derivatives, including futures, to hedge market risk. However, VIX futures contracts do not track spot VIX perfectly. As such, investors should be aware of the distinct characteristics and limitations of using futures products as a hedge to their equity exposure. Since the S&P 500 VIX Short-Term Futures Index only tracks approximately half of the spot movement, it is important for investors to consider their appropriate hedge ratio. It should also be noted that the cost of rolling from the first-month futures to the second-month creates a long-term performance drag in the S&P 500 VIX Short-Term Futures Index. It is therefore worth noting that using the index as a long-term hedge can be generally expensive.

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