

Betting On Volatility

Is volatility an asset class, or is it simply an attribute of another asset class? If you are reading this as an individual trader, your response likely is some (hopefully polite) variation on “Who cares?” If you are an exchange promoting tradable derivatives based on volatility, or if you are an institutional investor with billions of dollars to allocate amongst various asset classes, the answer is critical.

The answer here, one guaranteed to displease some, is volatility is an attribute of another asset class. In the case of the Chicago Board of Options Exchange’s Volatility Index (VIX) and its variants, the asset class is the S&P 500 index (SPX). The VIX provides a reading of future price uncertainty of the SPX; as such, it is irretrievably of derivative of the SPX and nothing more. Unlike recognizable assets such as stocks, bonds, real estate or cash, the VIX is an intangible concept. You cannot own it or detach a stream of returns from it any more than you can own the wind.

Now this is not to cast aspersions on the VIX, which over the years has proven its worth as an analytic tool and, as the more simplistic amongst us would put it, the “fear gauge” of the market. There is little question the VIX spikes during the stock market’s periodic high dives into an empty swimming pool, but beyond that, there is no accepted or statistically demonstrable connection between the VIX and the market’s overall course. The VIX’ long downtrend from April 2003 through May 2006 kept putting it to a succession of low readings that supposedly indicated mass complacency. When the stock market maintained its upward drift – the SPX rose from 830 to more than 1320 in these three years – those calling for swift and certain market retribution from sources yet to be named were afforded an opportunity to either prove their case or remain silent. They chose to do neither.

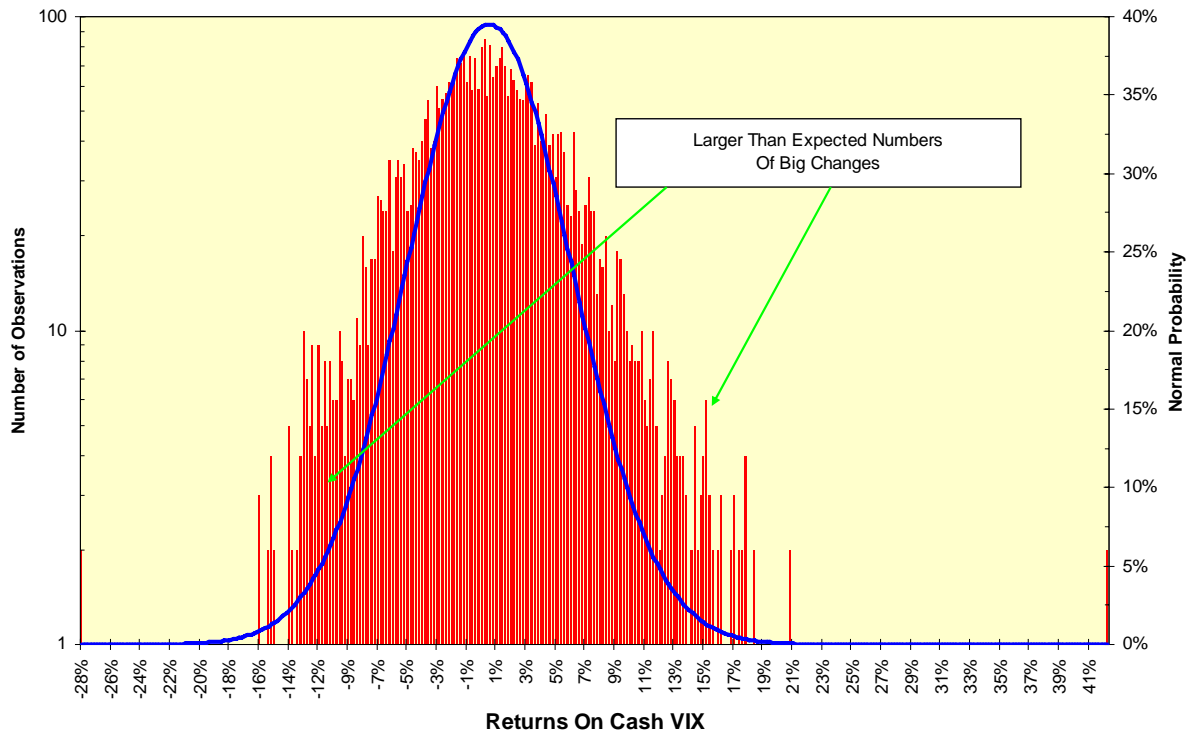
But traders and investors, even on their worst days, are still human beings. They see one part of a pattern, the VIX spiking when stocks plunge, and assume it must be a short step to completing the pattern and designing – get ready for this – a trading system. This is like finding a brick and concluding you, too, can build the Taj Mahal.

The problem actually is worse than this. If volatility is the market’s instantaneous assessment of uncertainty and uncertainty unlike risk cannot be quantified, and if uncertainty is dependent on the arrival of unknown events at unknown points in time with unknowable consequences, then volatility should be process of shock-and-regression to the mean. It will jump higher and then decay over a non-uniform time period. Unlike the price patterns of actual assets, the daily returns on volatility cannot be expected to follow any known probability distributions. The VIX’ lack of “memory” in its history and this characteristic of returns is of critical importance in pricing and trading VIX futures and options, as we shall see below.

VIX Distribution

One assumption behind the original Black-Scholes option pricing model was a continuous lognormal distribution of returns. This assumption has been refined and modified countless times by various quants over the years, often to the fourth decimal place in a market quoted in five-cent increments. Daily changes in the cash VIX index depicted in Chart 1 show a very large number of greater than expected returns, especially but not exclusively to the positive side. The positive returns occur on those infamous large down days; the negative returns occur when the all-clear whistle is being blown. These large changes both higher and lower tell us the VIX process is highly discontinuous.

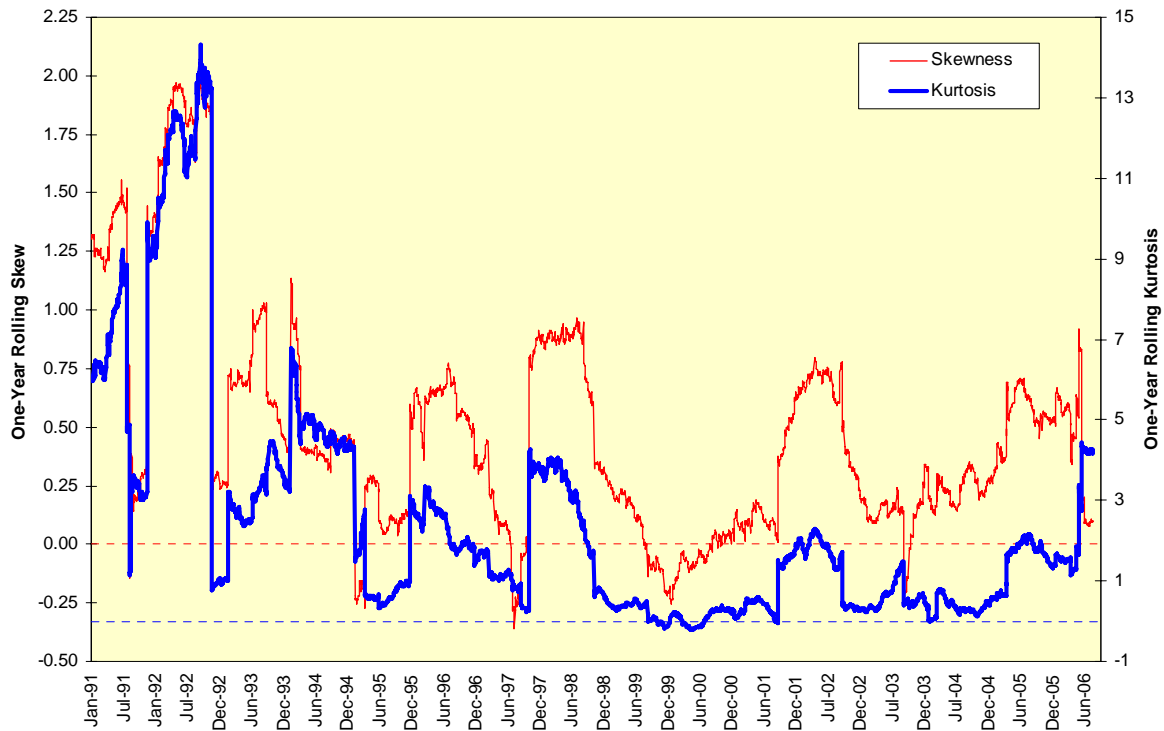
Chart 1: Distribution of VIX Returns January 1990 - July 2006



The degree to which this discontinuity exists is very large. Let's take a trip down memory lane to Statistics 101 and depict in Chart 2 the skewness and kurtosis of VIX returns taken on a one-year rolling basis to eliminate any seasonal effects. The skew of the distribution is almost always positive; the exceptions occur in times such as mid-1995 or mid-1997, right after prolonged and sustained market rallies. But look at how abruptly a one-year average of skewness can shift to large positive numbers. Such a jump-shift in skewness indicates different market regimes have different populations of volatility and that samples drawn from the different populations really cannot be compared to each other.

The same applies to the kurtosis, or degree to which the distribution of returns is peaked. The more the kurtosis, the more clustered the distribution is around a central value as opposed to being distributed along the familiar bell curve. Once again, we can see a very asymmetric and unstable clustering of VIX returns indicating we do not have a continuous time series so much as a collection of hysterical moments stitched together under a common name.

Chart 2: Unstable Higher Moments

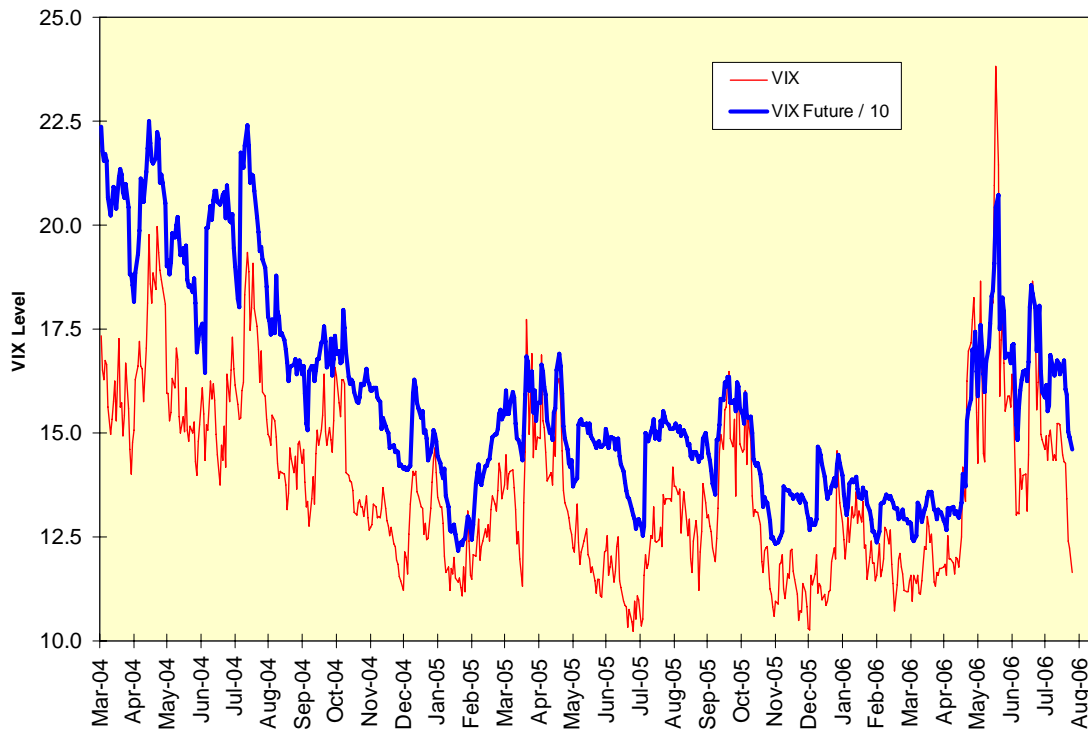


A Basis In Fact?

Futures markets are priced on the basis of indifference, and we do not mean whether they care about your well-being. If the forward curve of a futures market is in full carry, that is if all the costs of holding an underlying cash market position over a period of time subtracted from the futures price is equal to the cash price, we should be indifferent whether we buy the cash market today and store it ourselves or buy the futures contract.

The difference between cash and futures, or basis, should follow a predictable pattern of accrual or amortization of these costs, inclusive of such discontinuities as dividends or interest payments. Do we see a convergence pattern or a stable relationship in Chart 3 between the VIX (the actual VIX futures contract is based on the jumbo VIX, or VIX times 10)? We do not. Sometimes the futures trade below the index, and sometimes they trade over the cash index.

Chart 3: VIX Futures Basis A Meaningless Concept



But what is the cash VIX? There is none. You can say you are trading volatility by buying and selling option straddles, the put and call at the same strike in the same month, or even strangles, the put and call at different strikes in the same month. However, both of these option strategies have considerable price and gamma risk. If you are short a straddle, for example, and the market falls you become increasingly underwater by virtue of the short put option position. A long VIX futures contract may or may not offset this price risk; as we shall see below, it probably will not.

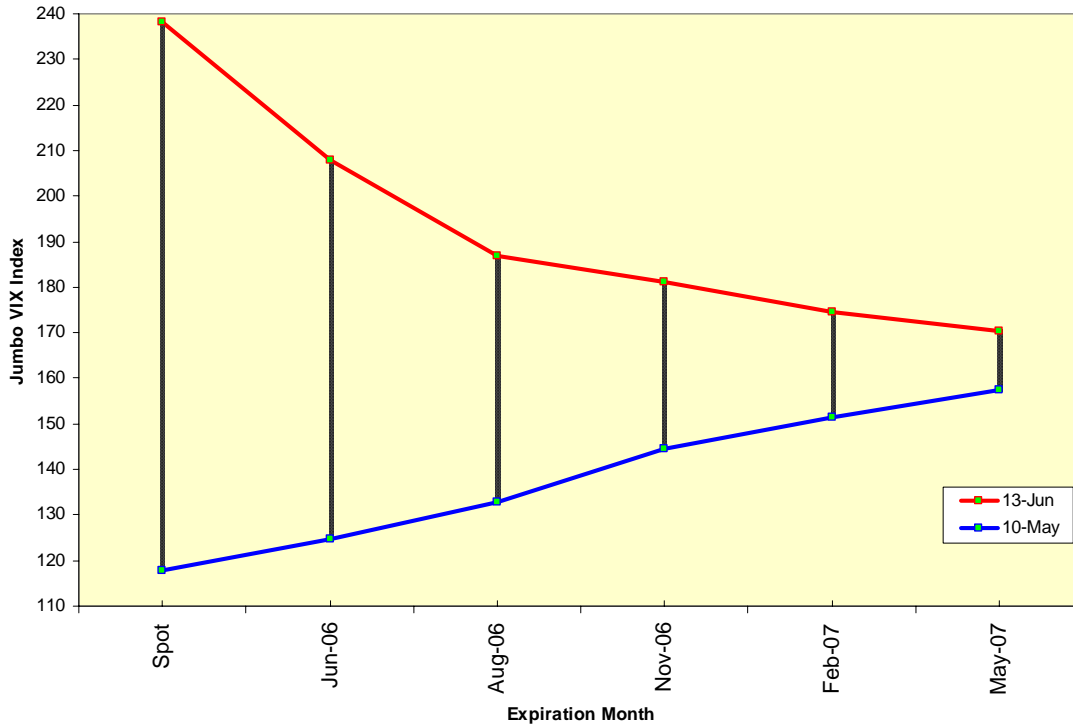
What Do You Win?

Basis has another nice attribute. It should ensure us that if the cash market moves by some number the futures market will move by that number as well, plus or minus some nominal change in the basis. The plus-or-minus number is kept within a no-arbitrage range of transactions costs; once it gets outside of that range, arbitrageurs can buy/sell the cash and sell/buy the futures.

Does this happen with the VIX, a series we already have seen has no internal memory, defined distribution of returns or stable basis? Let's say you are the world's greatest stock market forecaster (you are, aren't you?). On May 10, 2006, you smelled a big rat about to enter the room. You figured the market was about to take a tumble and therefore volatility would jump as it tends to do in these situations.

And as smart as you are on the way in, you are just as smart on the way out. You knew the selloff would end by June 13, 2006, and the VIX would tumble as it tends to do in these situations. How would your trade have gone?

**Chart 4: Forward Curve Of VIX Futures
On May 10 & June 13, 2006**



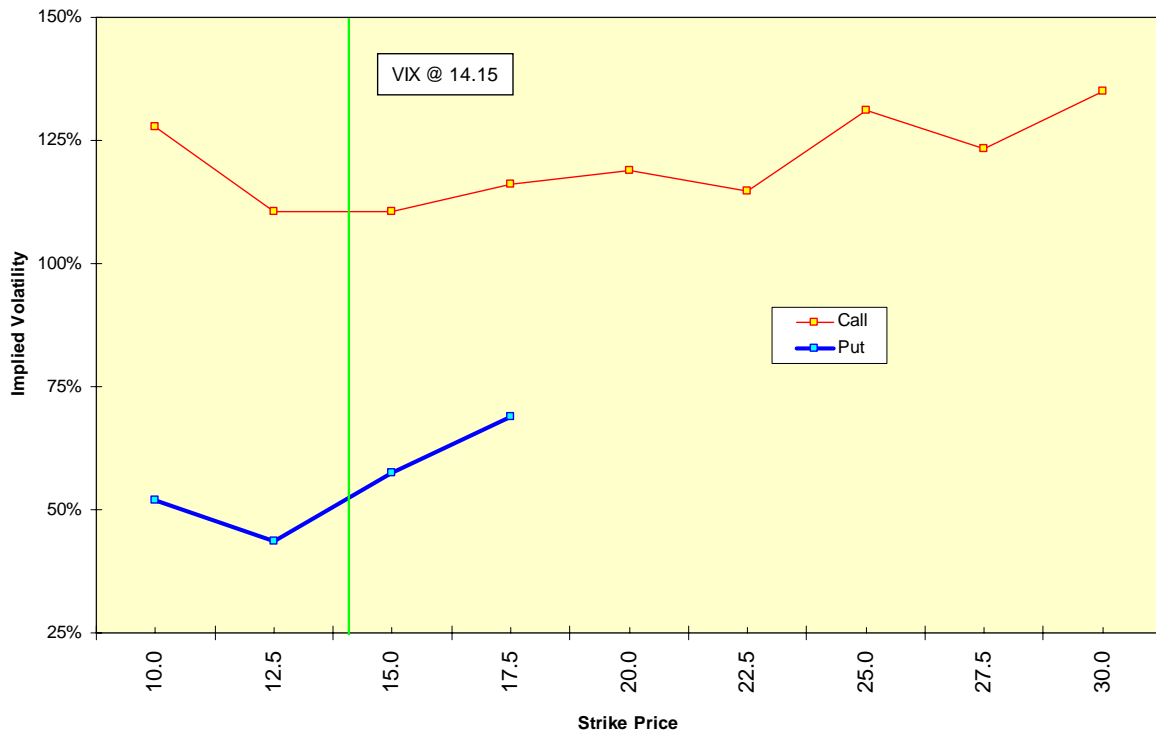
Not well. The jumbo VIX rose from 117.8 to 238.1 between those dates, a gain of 120.3 index points. The June future rose from 124.6 to 187.0, a gain of only 83.2 points, or 69.2% of the cash market's gain. That gain assumes zero transaction costs in an illiquid market; do not hold your breath while waiting for this to happen.

The back month futures rose even less; given the lack of memory in the VIX, one could ask why they even rose at all. Without an underlying asset to carry, the forward curve simply devolves into a series of bets on where one group of speculators is willing to buy volatility from another group of speculators. The back months could have fallen on some cockamamie forecast from the latest hot Wall Street guru that the S&P had hit a good long-term support point and was bound to rise from here and nothing, but nothing, would violate any arbitrage constraints. Future estimates of volatility are disconnected from present readings of volatility.

What if you wished to play the trade not with futures but rather with options on the VIX? These options are priced off the VIX futures as their underlying asset. Roll that around your mouth a few times and savor the bouquet: You are going to trade an option on a future lacking a tradable underlying asset when the future itself is based on the instantaneous estimate of volatility of an index of common stocks, each of which represents the discounted value of estimated future dividends. Reality is nice when you can get it; this may make an acceptable substitute.

Let's take a snapshot in Chart 5 of closing volatility for the August 2006 VIX options on July 5, 2006. Call volatility is in triple-digit territory as traders were scrambling to buy volatility. Put option volatility was much lower and fewer strikes traded. Experienced option traders might be shouting, "Hey, what about conversion-and-reversal arbitrage?" If calls are overpriced relative to the puts, you could buy the synthetic call by combining a long VIX future with a long VIX put option and sell the overpriced natural call option. That no one was doing this trade stands as evidence of an incomplete and highly inefficient market.

Chart 5: August VIX Options Smile
July 5, 2006



For all of the problems noted above, both the VIX futures and their options are being accepted in the market, which puts criticism in the camp of “OK, it works in practice, but how does it work in theory?” The urge to trade volatility, to predict the by-definition unpredictable and unquantifiable concept in an incomplete market, is extreme. Traders want to do it. But wanting something to work and successfully trading a futures contract in the absence of an underlying asset are two different things. As structured, VIX futures and options are a problem without a solution, just trading volume.