

Hard To Be Right On VIX

It is time to start a column not with a witticism but with a disclaimer. No, not one of those dreadful piles of boilerplate so beloved by compliance departments and other lawyer-infested dens of iniquity, the kind the judge throws out minutes into the trial en route to telling the firm to whip out the old checkbook and start writing, but rather an honest-to-goodness statement.

I love volatility in all its manifestations, yes I do. In practice it reminds traders this is a risky business, and it has a way of transferring positions from the tourists and the various weak hands in the market to those long-term investors we are supposed to admire. In theory, I use it in all sorts of analytic and modeling applications.

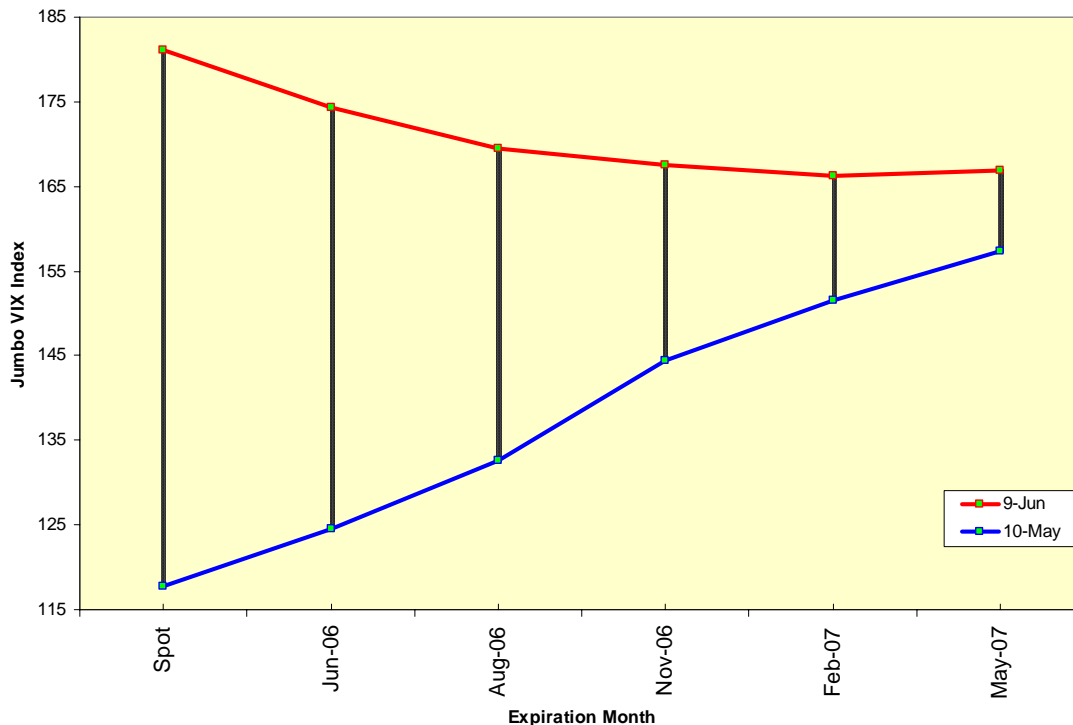
If loving the VIX is wrong, I don't want to be right.

But having a well-designed and useful instrument is one thing, having a good trading tool is something else indeed. The significant problems associated with futures on the VIX were apparent months before their actual launch in March 2004; these were discussed in [September 2003](#). Now that the Chicago Board of Options Exchange has launched options on the VIX - options on futures on an index of the two-month strike-weighted volatility of an index of common stocks, each of which represents the discounted stream of future dividends; who needs reality? – and the VIX futures have gained some real trading traction, let's see how they operate in practice.

Converting Opinion Into Dollars

The recent unpleasantness in the markets has led to a jump in the VIX after three years of a boring downtrend. Let's say you saw the whole thing coming on May 10th, and which time the jumbo VIX index on which the futures are based ($10 * VIX$, or VXB) was at 117.8. If you executed your market opinion by buying the June VIX future, how would you have done? Between May 10th and June 9th, the VXB rose from 117.8 to 181.2, an increase of 63.4 index points. The June future rose from 124.6 to 174.3, an increase of 49.7 index points, or 78.4% of the cash market's change. This is assuming zero-cost execution, too; I will now ask the experienced option traders to stop laughing before continuing down the screen.

Forward Curve Of VIX Futures
On May 10 & June 9, 2006

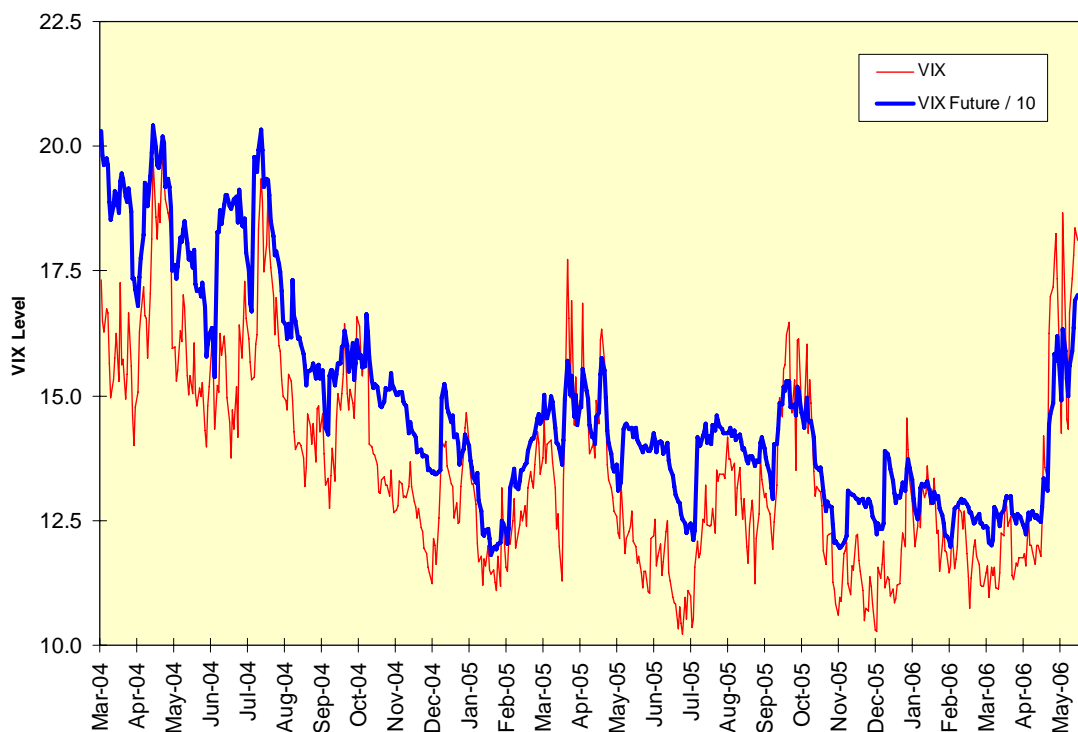


The chart above shows the changes in the forward curve of the VIX futures between May 10th and June 9th. The back-month futures barely rose at all. Nor should anyone really have expected them to; volatility is not an asset class whose price depends at all on the cumulative returns and arbitrage relationships between other asset classes. Volatility is an attribute of an asset class, in this case the S&P 500 index. Just as you would not expect the temperature readings of next January to depend at all on the temperature readings today – sorry, Al Gore – you should not expect a today’s readings of market uncertainty to affect those months down the road. The very concept of a forward curve, which is absolutely central to the very notion of futures markets, is meaningless for the VIX.

Covering All The Basis

A second property of futures markets is basis, or the difference between cash and futures. In normal markets basis is a function of interest rates, storage costs and in the case of physical markets, inventory levels. Basis in financial markets is stable; it generally moves solely as the function of interest rates and return streams such as dividends and coupon payments. Do we see a stable basis for the VIX as measured by its continuous front-month contract? We do not. Sometimes the futures are trading below the index, as today, and sometimes they are trading over the cash index, as they were several months ago. Basis appears to be meaningless for the VIX. This means you have no reasonable expectation of being able to convert a correct market opinion into something which gives you close to 100% of cash market’s movements.

VIX Futures Basis Unstable

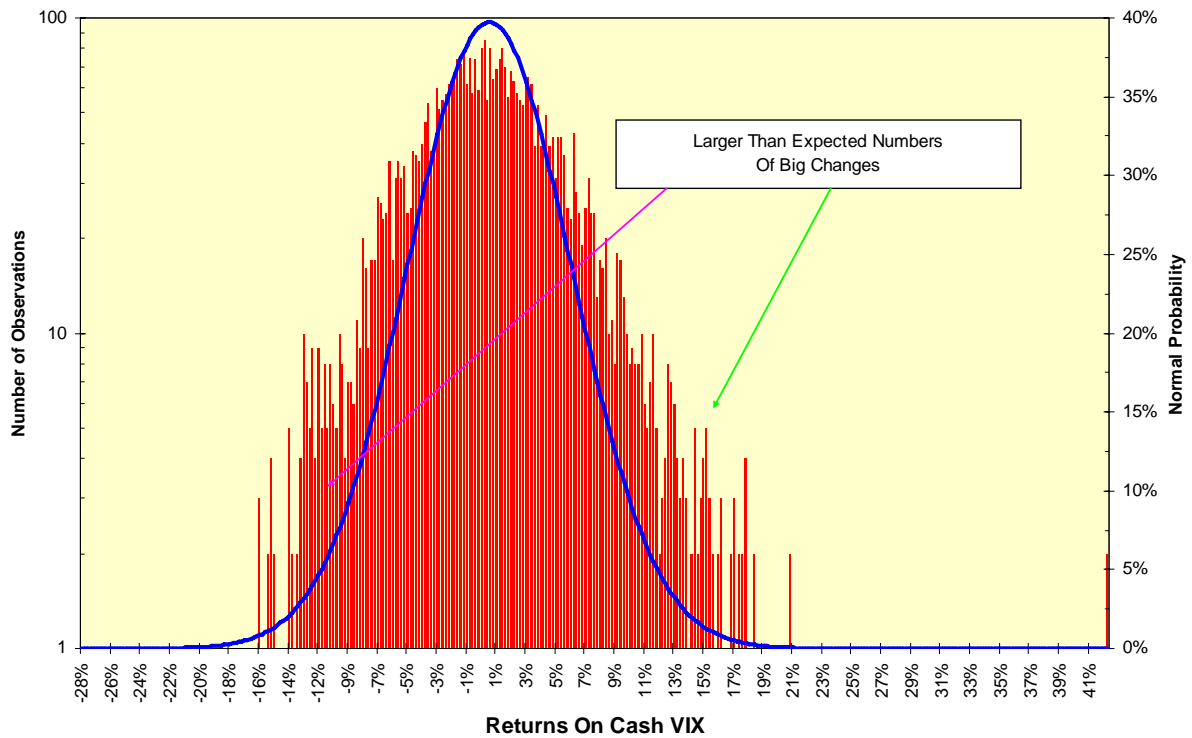


VIX Options

Given that the VIX options price off VIX futures, we should have some understanding of the distribution of returns on the VIX. The original Black-Scholes model presumed a continuous lognormal distribution of returns, and while this has been modified umpteen times over to accommodate various nuances of observed reality in markets, it was still good enough to earn Scholes and Merton a Nobel Memorial Prize (sorry about that whole Long Term Capital Management thing, guys).

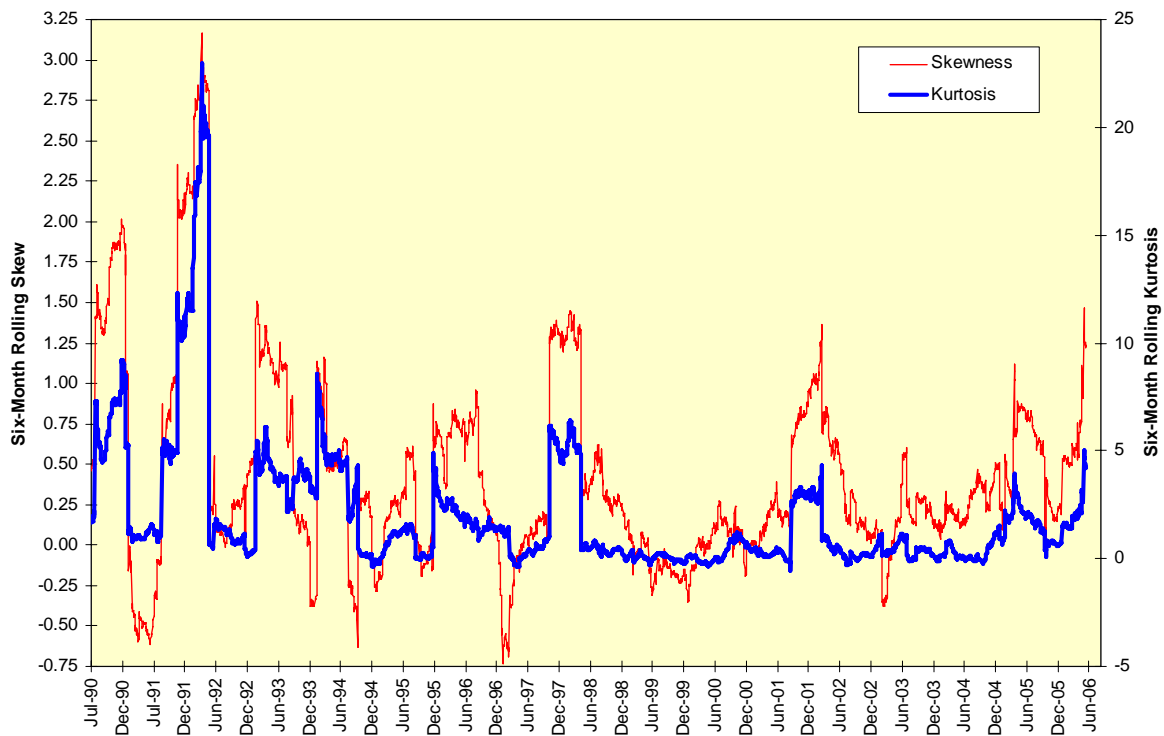
What should the theoretical distribution of returns be for the VIX? This is a trick question; there is none. Let’s offer two pictures of what it has looked like in practice. The first is a histogram of daily returns on the VIX overlain with what a normal probability distribution would look like. We can see the distribution is well over-represented in higher than expected large percentage changes.

Distribution of VIX Returns January 1990 - June 2006



We should not expect the distribution of the VIX to be symmetric, either. We all know the events that make volatility jump higher, such as sharp market downturns; it seems the return to lower values is less abrupt. If we divide the history in a set of rolling six-month periods to examine the VIX in detail, what should we see? We should expect skewness, or degree to which the returns are biased to be positive. We also should expect kurtosis, or degree to which the distribution is peaked around a central value rather than distributed normally, to be greater than 1. This is exactly what we find.

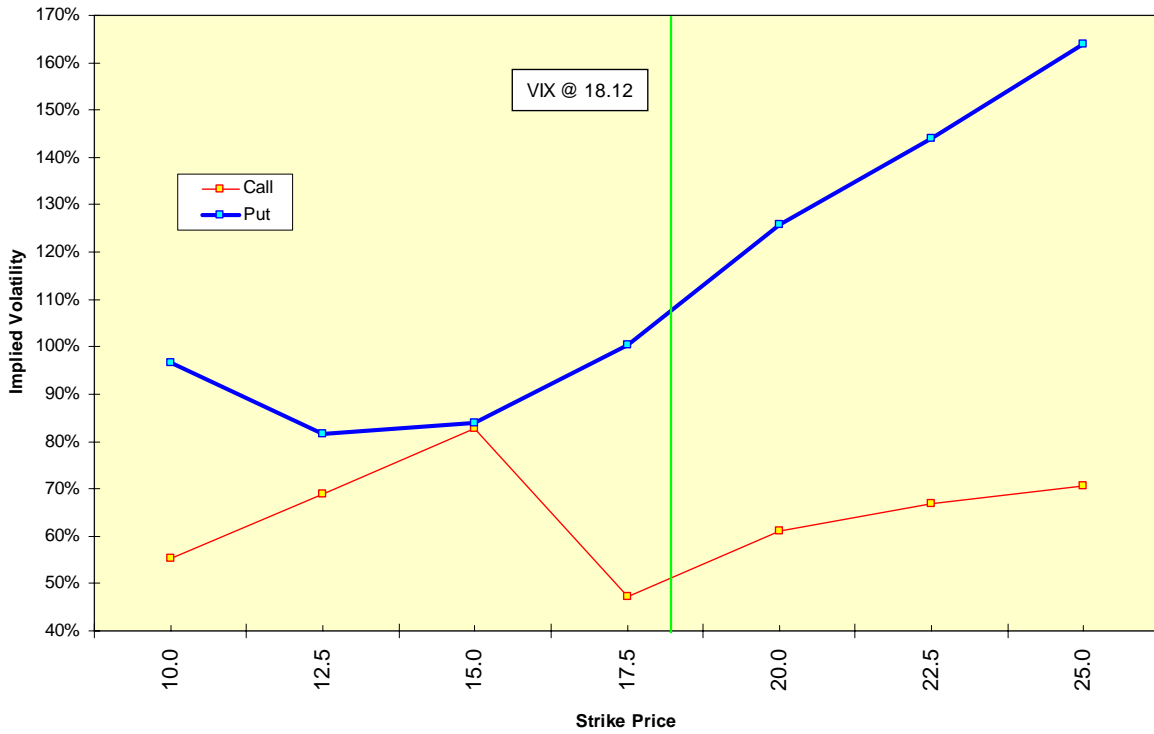
Distribution Of VIX Highly Asymmetric And Unstable



Nothing To Smile About

Finally, the implied volatilities of both puts and calls should be roughly the same by the end of the trading day; this is assured by what is called “conversion and reversal” arbitrage. These trades generally are executed by buying and selling the underlying stock or future, but with no underlying physical asset like a stock and futures whose behavior cannot be predicted, we see the distribution of volatility across strikes to be unrelated. The normal “smile,” or lower volatility near the at-the-money strike, is missing. On June 9th, put volatilities at the deep-in-the-money 25.0 strike were in excess of 163%. This is a high price to pay for betting volatility will fall. The call options followed no discernible pattern at all.

July VIX Options Smile June 9, 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?” Creating a justified trading instrument on volatility may be the next big challenge in exchange product development. The demand for volatility trading exists; just imagine how popular it would be if done correctly?