VolBits: Looking closer at the VVIX

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With recent discussions covering the historically low level of the CBOE's VVIX, we look at potential causes of such low values. A simple model shows that the combination of lower at-the-money volatility plus lower levels of skew jointly explain the move in VVIX.

The VVIX is a measure of "volatility of volatility", calculated using VIX options with the standard VIX methodology. The CBOE white paper is here.

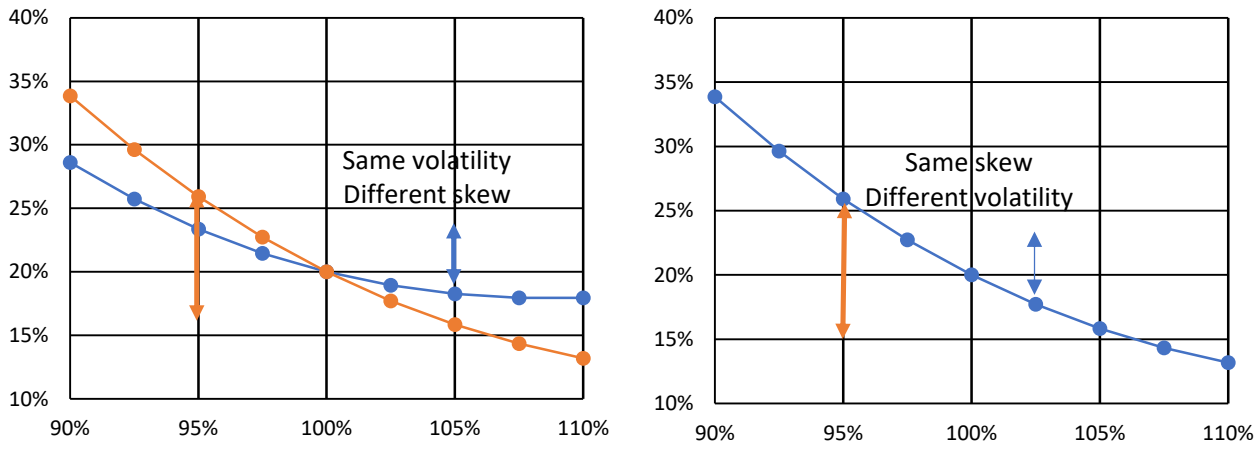
While transforming the S&P 500 surface to a VVIX calculation is quite complex owing to its forward start nature, we can create a simplistic "toy" model that provides a very intuitive means to estimate relative movements in volatility-of-volatility (VVIX) using only two features from options on the S&P 500.

We make some very restrictive assumptions in our model. That is, 1.) S&P 500 fixed strike volatility is constant and 2.) changes in at-the-money volatility on S&P 500 options are caused only by sliding up and down the skew.

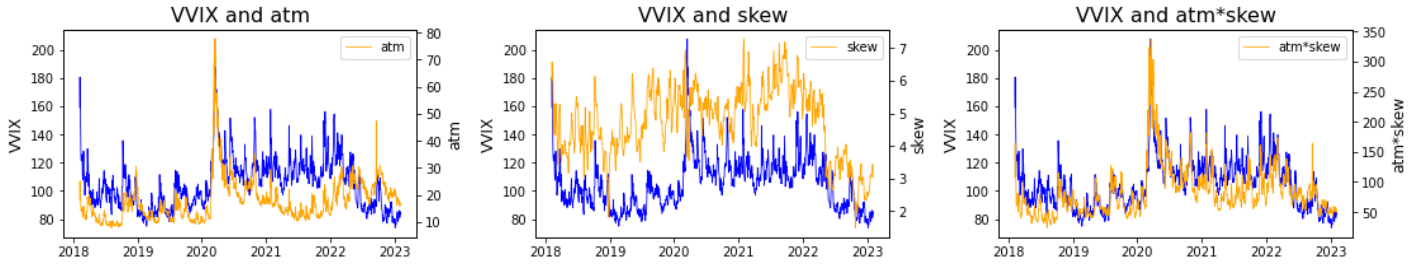
In this model, the VIX moves due to changes in the S&P 500 level solely, with the magnitude resulting from sliding up or down the S&P 500 skew. We show that moves in the VIX will be larger in magnitude with a.) higher S&P 500 volatility and b.) higher S&P 500 skew.

To illustrate, we consider two worlds representing volatility on the S&P 500. In world #1 (lhs), volatility is constant, but skew is higher in state "A" than state "B". As such, when the stock moves from 95% to 105%, at-the-money volatility in state "A" moves more than state "B" owing to higher skew.

In world #2 (rhs), the magnitude of the skew is the same, but higher volatility in state "C" results in more movement of at-the -money volatility compared to state "D" as the market slides up and down the skew.



To see how successful this model is in practice, we plot levels of VVIX alongside 2 month at-the-money S&P 500 implieds and the difference between 2 month 97.50% and 102.50% implieds on the S&P 500 (to represent skew). We also plot VVIX with our naïve "atm*skew" metric which is simply the product of the first two features.



Note how the interaction of volatility and skew from the S&P 500 track the VVIX better than simply using volatility or skew on its own. While this simple model is far from technically complete, it does illustrate that both volatility and skew have a part to explain levels of the VVIX.