

## STOXX And VSTOXX Are Not An X Too Far

Wall Street and Hollywood share many things in common including a large number of well-compensated individuals, a global product reach and a propensity toward re-runs and sequels. Let's take volatility. This concept has existed in financial and insurance markets from their very beginning, but it really did not show up on traders' proverbial radars until the launch of options trading and the acceptance of the Black-Scholes model in the mid-1970s. Some market veterans recall traders taking sheets of paper down to the floor of the Chicago Board of Options Exchange each day to sidestep the calculation of implied volatility via a Newton-Raphson search algorithm.

Volatility calculations eventually combined with indexation, another 1970s gift to humanity, to form the CBOE's volatility index or VIX. The VIX was based originally on the S&P 100 index and a small set of near-the-money options for two months; eventually it became a more robust calculation based on the moneyness-weighted smile of S&P 500 options.

Regardless of construction, the VIX followed a pattern of jumping higher during market declines and easing lower during rallies. The reasons behind this asymmetric behavior are both simple and probably eternal; as most investors are long and not short equities, they seek to add put option protection against their holdings during market selloffs. They do not, however, flock into call options in lieu of long equity positions during bull markets.

Moreover, the skew of option volatility is related to market trends as well. Writers of equity and index put options, still one of the better strategies ever devised for losing vast sums within a short period of time, find they have to scramble to cover their bets at a time when ordinary investors are looking to buy, not sell, put options. Finally, writers of variance swaps have to sell increasing quantities of stock at ever-lower prices to hedge their positions; variance is the square of volatility and therefore is a far-better exploding cigar for those who have not kicked the habit

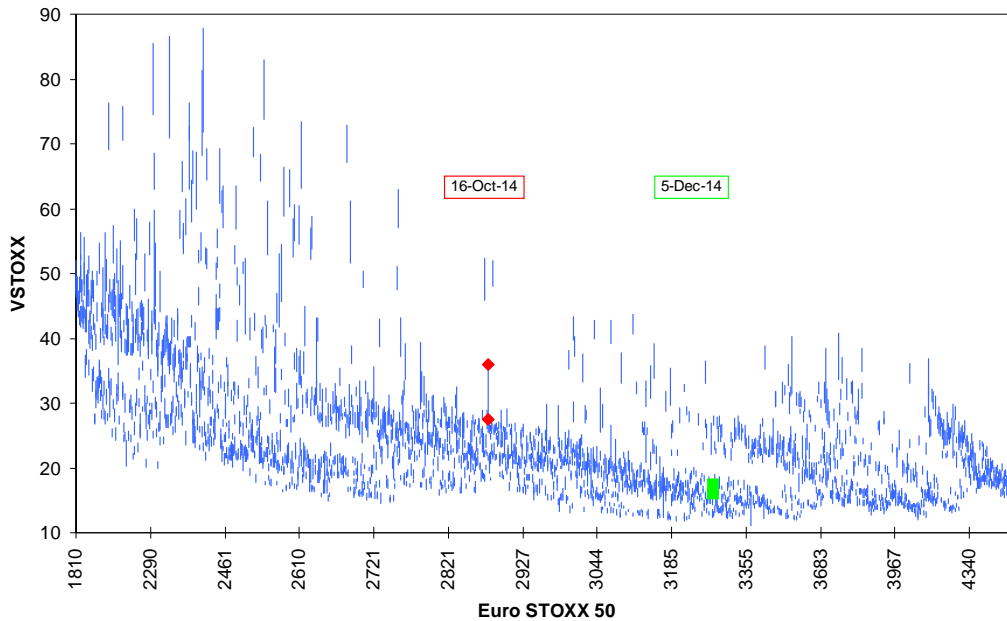
None this compares in importance to the rotation of the earth, though. As one market opens and another one closes, rallies and selloffs get transmitted from one to another in a predictable time sequence. The most important time period for this transmission is the overlap between European and U.S. markets. If the U.S. follows European markets or if Europe reverses course following the U.S. opening, positions and volatility levels adjust in a sort of risk-on / risk-off arbitrage state of mind. Let's isolate the VSTOXX, the common measure of European stock index volatility from any sort of real-time spread analysis against U.S. equities and the VIX and focus instead on the VSTOXX and the Euro STOXX 50 index (SX5E).

### VSTOXX

In the monkey-see / monkey-do world of financial markets, the SX5E and VSTOXX occupy the same niche as the S&P 500, the VIX and associated derivatives. Like VIX futures, VSTOXX futures can be added to STOXX-related investments to reduce overall portfolio volatility if you think this is superior to either selling the stocks outright or buying put options outright. Complexity is the flame for assorted financial moths.

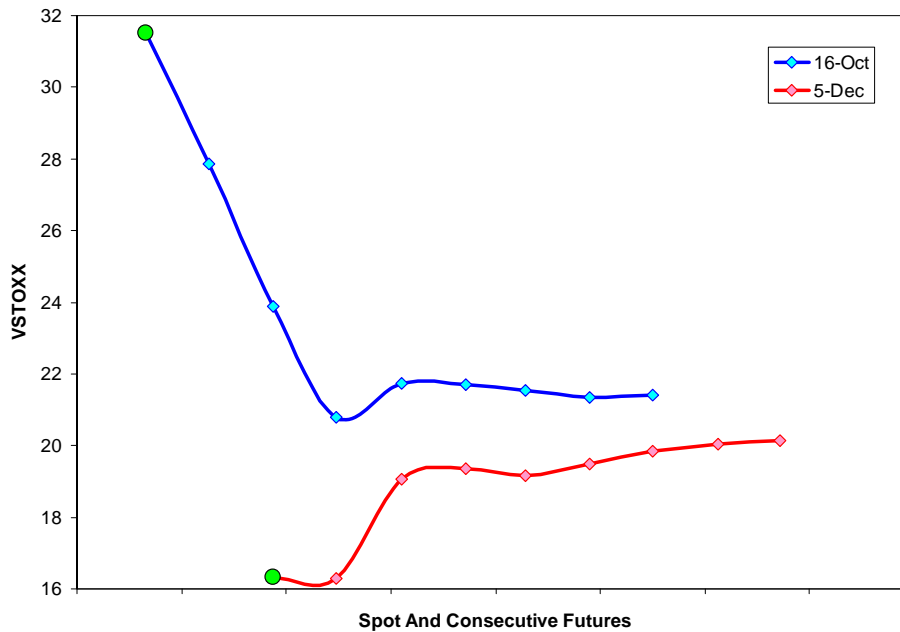
We can look at the VSTOXX/SX5E relationship several different ways. First, let's map the daily high-low range of the VSTOXX against the SX5E over the available data sample starting in April 2005; this measure takes time out of the equation. Not only is the expected inverse relationship visible, so too is the pattern of expanding volatility ranges at the lower price range of each cluster. The volatility of volatility increases as prices decline. The VSTOXX' high/low range for two days in late 2014, the October 16<sup>th</sup> panic low and the December 5<sup>th</sup> reaction high are marked.

### VSTOXX Shock & Regress Since April 20, 2005



VSTOXX futures' pseudo-forward curves have predictable rhythms, too. The 'pseudo' adjective is added as assets are not carried forward by these futures; instead, each month settles into what effectively is the fixed leg of a variance swap. As a result, a market selloff tends to elevate the spot VSTOXX, marked in green, more than the first month of the futures and so on with time; market rallies have the opposite effect of lower the spot VSTOXX relative to each successive month of the futures. This is visible on the closing forward curves for VSTOXX futures on the two dates noted.

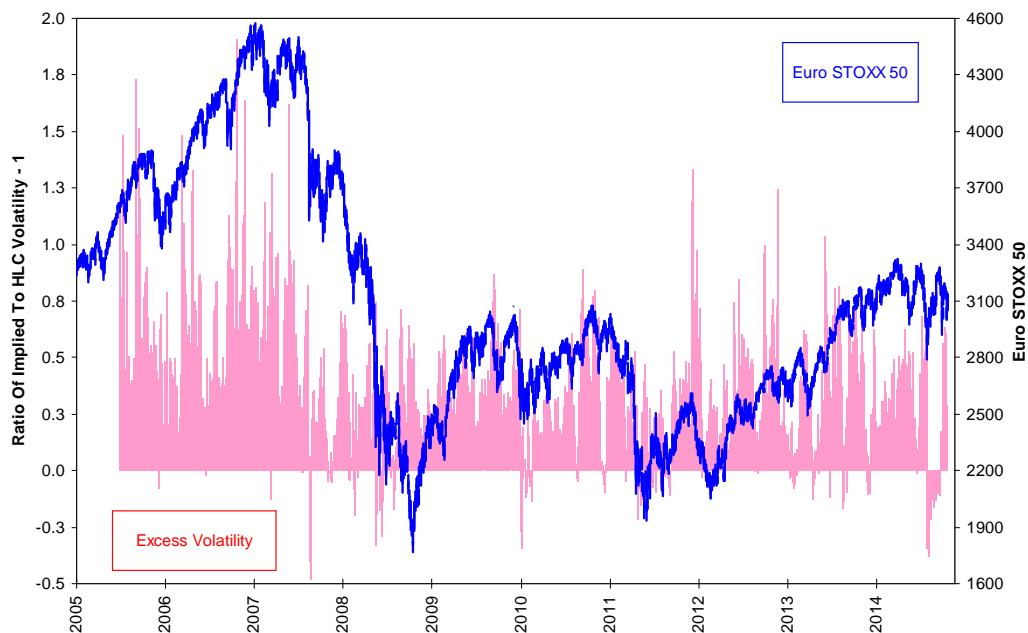
### Pseudo-Forward Curve Shifts In Response To STOXX Trend



Now let's construct a measure of excess volatility by comparing the ratio of the SX5E's implied volatility to its high-low-close volatility and subtracting 1.00 therefrom. High-low-close volatility incorporates the effects of intraday range as well as interday change and tends to decline during prolonged directional moves and to expand during sideways and transitional markets. As implied volatility is forward-looking or at least is alleged to be and as

HLC volatility is a historic measure, the excess volatility measure gives us a sense of when option buyers are willing to pay more for price insurance. The answer, somewhat surprisingly, is option buyers pay up more relative to historic volatility during the early phase of a downturn than during a full-blown selloff. However, the absolute level of the VSTOXX increases with the depth of the selloff as we shall see below.

Excess Volatility And Euro STOXX 50

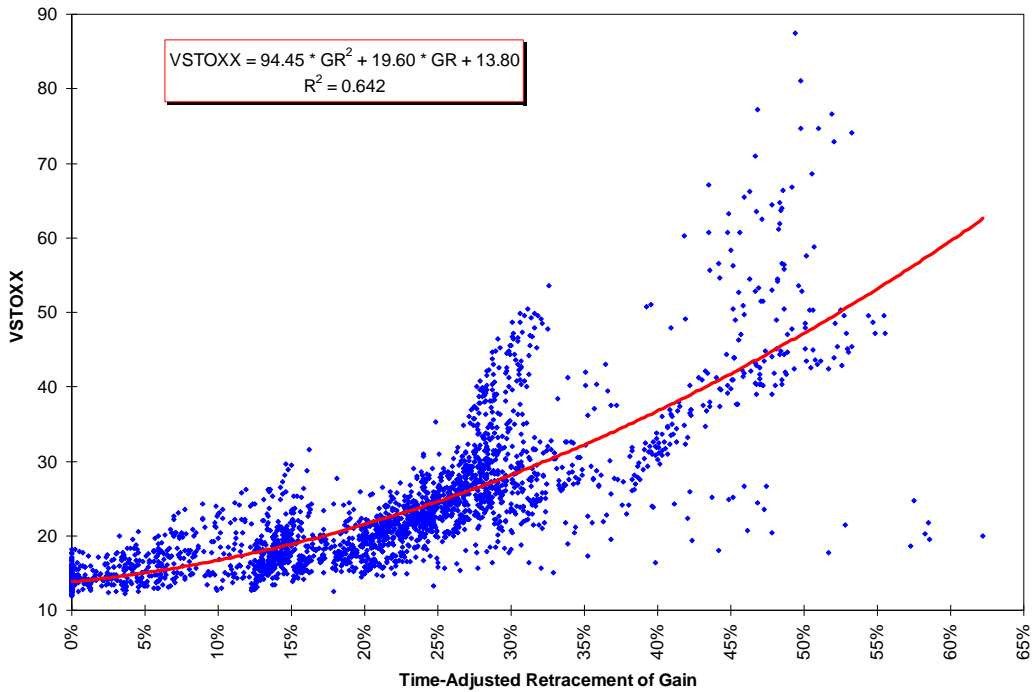


### Fear And Regret

As Joni Mitchell once warbled, “You don’t know what you got till it’s gone.” The psychology of option markets is consistent with this sentiment regardless of whether we are talking about the VIX or the VSTOXX (see “Crying Over Spilled Milk,” February 2001). If we map the VSTOXX against the time-adjusted retracement of gain of the SX5E from its high, we see it follows a quadratic relationship. As noted above, it is the largest price declines that produce the largest and most volatile gains in the VSTOXX.

### Volatility And Retracement of Gain

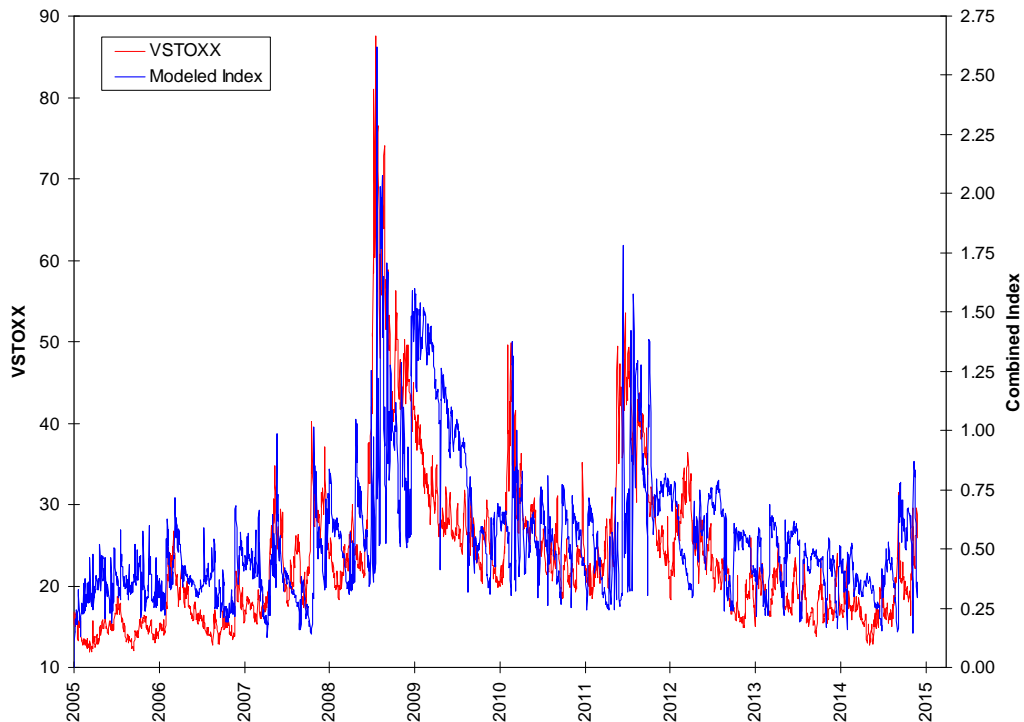
April 2005 - January 2015



There is one very significant difference between the S&P 500-based VIX and the SX5E-based VSTOXX, though. The S&P 500 started making new nominal highs with great regularity in 2013 while the SX5E's high remained at a July 2007 level. The high-level of intraday correlation between the two markets attenuates with time.

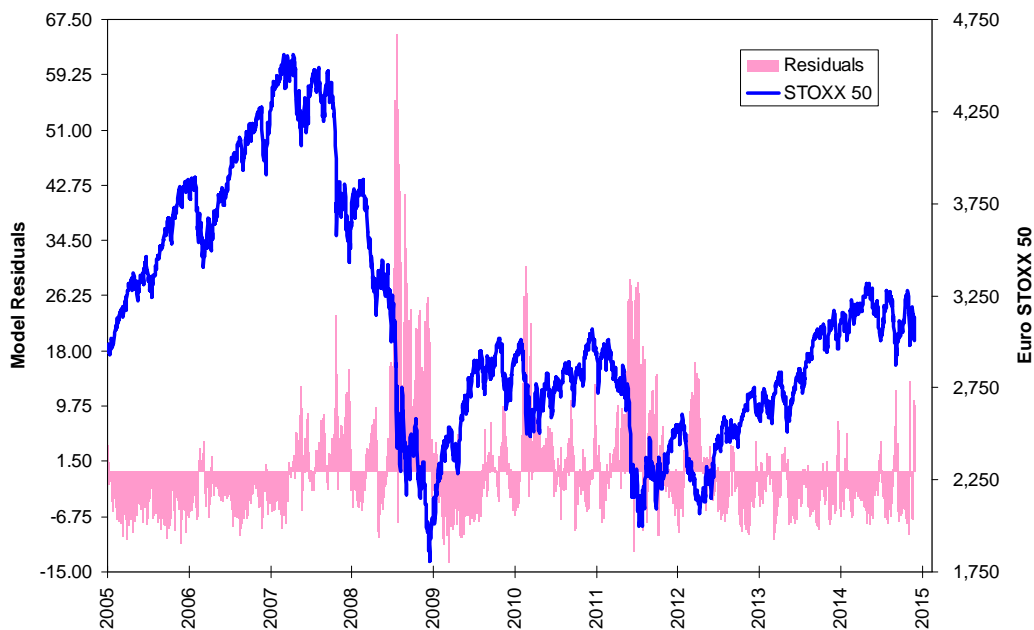
Let's incorporate the time-adjusted proximity of the SX5E to its last new low, the point accompanied by an expansion of the VSTOXX, into the time-adjusted retracement of gain model in a technique used for the S&P 500 (see "Balancing Fear And Greed," September 2003). A combined index whose values are not designed to correspond to the VSTOXX itself rises and falls with the VSTOXX.

### VSTOXX As A Function Of De-Anchored Price Action



If we map the residuals of this model, the difference between the VSTOXX and its fitted value against the SX5E, we see spikes at the right times in the series' mutual histories, such as the 2008 collapse and the various Eurozone sovereign debt crises in 2010 and 2011. The period of financial repression following the July 2012 "whatever it takes" statement by European Central Bank president Mario Draghi was characterized by lower than expected volatility.

**VSTOXX Relative To Expectations**



The VSTOXX thus acts not only as a volatility index and a trading vehicle, but as a psychological barometer as well. It tracks investors' collective senses of rising fear climaxing as selloffs end and of complacency as bull markets signal happy days are not only here again but intend to stay forever. In short, this is a market that works.