

Derivatives Strategy

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Can the VIX Signal Market Direction?

Summary

- "Contrarians" are all in agreement (?) that a low VIX signals caution while a high VIX heralds rallies. They are right.
- Backtesting shows the ratio of the VIX to its 186-day MA has about 10% predictive power over the SPX 5-month return.
- The signal is worse at predicting short-term moves, while a low reading really means "buy puts" rather than "sell"
- VIX predictions have worked well over the last 3 yrs. Today the VIX is 20% below its MA—exercise extreme caution!

Not So Contrarian Anymore

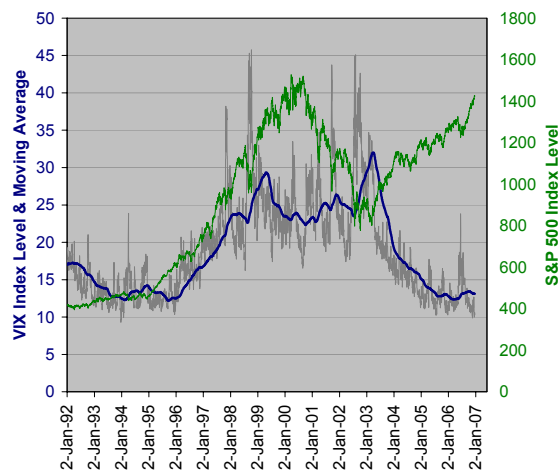
Popular trading wisdom holds that low stock volatility is a bearish signal while high vol indicates a rally. This used to be a contrarian idea: high volatility meant "fear", meaning the weak hands have already been shaken out, while on low vol "complacency" markets may falter. These days, however, the VIX indicator is pretty mainstream, as likely to be cited on CNBC or by taxi drivers as by contrarian extremists.

Of course the mainstream also once thought that the trend is your friend in tulip bulbs, and more recent crowds of investors loved Pets.com at \$11. Clearly its best not always to listen to "people," whether mainstream, contrarian or whatever. Historical data makes a more reliable source, though care must always be taken not to torture it into false confessions.

To find out whether implied volatility might really have the signalling power its credited with, we tested the correlation of the VIX relative level to subsequent moves in the S&P 500. "Relative level" here is defined as the ratio of the VIX to its own N-day moving average, minus one. So, for example, if the VIX was 15.0, and its N-day moving average was 10.0, its relative level would be $15 / 10 - 1 = -50\%$. The S&P 500 return was taken from the VIX close to K days out.

Surprisingly (at least to cynical efficient marketeers like ourselves), our results suggest that the VIX has been a strong indicator of direction since its inception in 1993. And in this case one can be unusually confident in the results—not because some particular combination of N and K worked, which might result from data-mining—but rather because *they all did!* When it comes to the VIX as a directional indicator, the tulip-bulbers are quite right. But don't scour eBay for old Pets.com share certificates quite yet; some caveats apply.

Figure 1. The CBOE's VIX Volatility Index is near all-time lows, and about 20% below its 186-day moving average. A sell signal? Not exactly.



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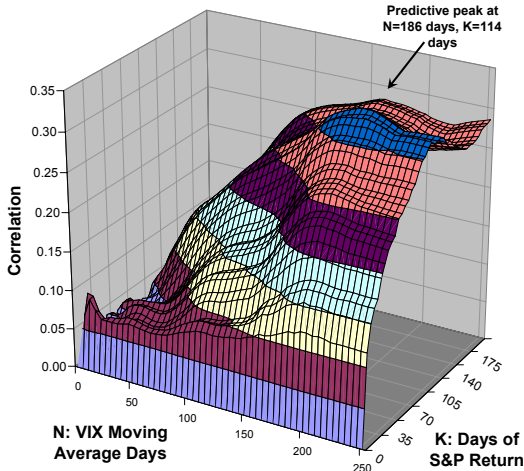
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Figure 2. Correlation of VIX level relative to N-day moving average vs. subsequent K-day S&P 500 return



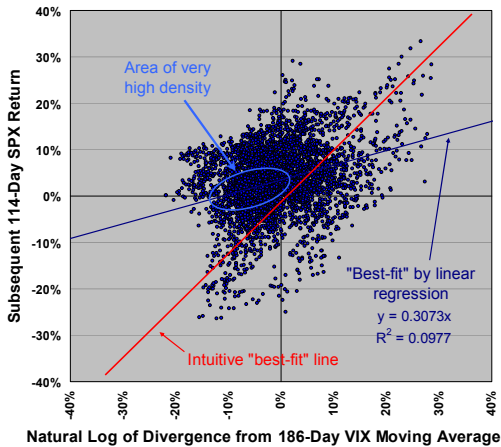
Interpreting the Results

The VIX is Best at Predicting Medium-Term Moves

The highest degree of linear predictive power from 1990-2006 occurred using a 186 trading day (9 calendar month) moving average for the “new” VIX, predicting 114 trading days (5 months) out on the S&P 500. However, the results were nearly as strong for any K and N within a month or two of these values (Fig 2.)

Short predictive periods (low values of K) are less effective, though what guidance they do provide is in the same direction as for longer periods. It should be noted that in technical analysis it is often the re-crossing of the moving average and not the initial crossing that is used as a signal, along with other inputs. Since this study looks only at the raw divergence from the MA, it is possible that there is other information in the signal that our test does not pick up. Also, while the information content in each short-swing prediction is lower, this may be compensated by the increased number of trading opportunities—indeed the best results we found in backtested trading strategies used only a 4-day horizon.

Figure 3. VIX 186-day log-divergence vs. subsequent 114-day S&P 500 return 1990 - Present



High Relative VIX is the Most Important Signal

An X-Y scatterplot of signals vs. returns for the optimal parameters N=186, K=114 provides important insights (Fig. 3.) Note that this chart uses the natural log of the divergence to provide a more linear signal. On the Y-axis (S&P return) it makes little difference.

The bottom-right quadrant, which indicates periods of relatively high VIX, but negative S&P returns, is by far the least populated. Only 20% of 1622 high VIX signals in the sample were wrong in their prediction of a market rise. By contrast, out of 2473 low VIX signals, 64% (1590) wrongly called for a decline.

This is misleading, though, since the S&P 500 rose fairly steadily over the last two decades, meaning that many more 5-month periods experienced rises than falls. Eliminating this market drift, low VIX signals achieved a 57% correct batting average, while high VIXes called the market correctly 63% of the time. We conclude that **the VIX is a better signal of 5-month rallies than of selloffs, but that both signals have merit as timing indicators.**

Old VIX, New VIX, Whatever. Its all Good.

Results for the “new” VIX index, which the CBOE introduced in late 2003 to match variance swap pricing, are only slightly better than from the “old” VIX index. This suggests that the predictive power of the index comes mainly from overall volatility levels, rather than skew (i.e. relative prices of puts vs. calls.)

Data Bunching: Small Down Signals Mean “Buy Puts,” not “Sell”

It seems strange that the best-fit trend line of a linear regression in Figure 3 goes nowhere near the line one would intuitively draw by eye. This happens because a large number of points, invisible on the chart because they overlap, are bunched around the X-axis for VIX relative levels of 0 to -10%. In other words, when the VIX is trending slightly below its moving average the S&P 500 usually does almost nothing, rather than falling as conventional wisdom predicts. However, it is also clear that the biggest drops in the index do tend to occur when the VIX is low.

One can conclude that a mildly low VIX is not a reliable sign of an impending selloff, but that it might well be a necessary precursor to one—after all, only very few of the S&P 500's sharp drops took place in a high implied volatility environment (lower right quadrant.) **Since a low VIX is obviously also a direct indicator of low option prices, those are opportune times to switch into protective puts and calls:** Buy 3-6 month puts with strike prices of 95% or below, perhaps financing them by selling 110 calls to make a protective “collar” position.

On average, low VIX readings work as a pure directional signal, but it makes more sense to use options to take advantage of the asymmetric dispersion of returns that occur during these periods.

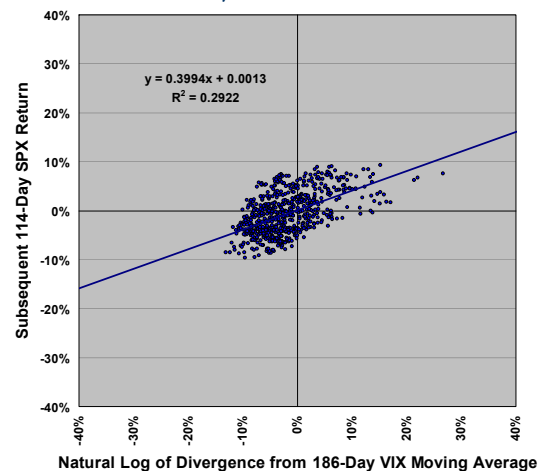
But Does it Still Work? Yes...probably

Whether the VIX is still a meaningful indicator is a hard question to answer, simply because there can never be enough recent data to know, especially using the long prediction horizons that have worked best. For what it is worth, **the indicator has never been more accurate than over the past 3 years** (Figure 4), during which it has provided a spectacular 29% predictive power ($\rho=0.54$.) Even more remarkably, many of the most accurate predictions were from slightly low readings...perhaps it is best to ignore the previous paragraphs on data bunching

But, of course, past performance is never a guarantee of future return. This was a period of steady upward trending on low volatility, which may not be representative of the next few years. Also, this 3-year period contains only about 6 independent samples (our analyses uses overlapping data), so the possibility that the results are due to luck is higher than the charts make it appear. That said, we would venture to pronounce the VIX indicator alive and well—and to note that it is a good time to be cautious as the VIX is around 20% below its 186-day moving average.

Note: The risk from buying protective puts is equal to the premium paid. The risk from selling uncovered calls is unlimited.

**Figure 4. VIX 186-day log-divergence vs. subsequent 114-day S&P 500 return
Jan. 1, 2003 - Present**



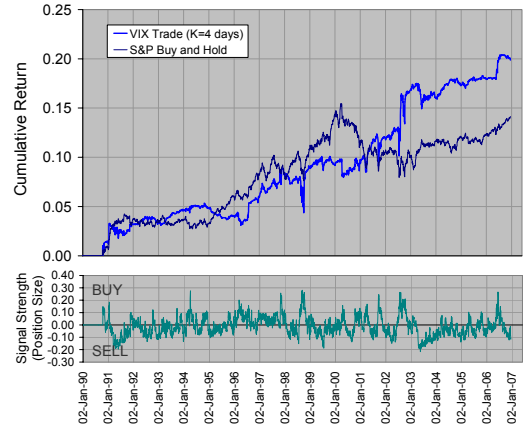
Footnote: Instant Hedge Fund—A VIX Timing Strategy

Optimizing the signal's time horizons to maximize Sharpe ratio instead of linear predictive ability, we obtained different parameters for N and K; The averaging period N is nearly unchanged at 202, but we found the best risk/return with a short holding period of 4 days.

The strategy used in the backtest was simply to put on a long or short position each day in a size inversely proportional to the log of the ratio of the VIX to its moving average, then hold it for K days. For our benchmark return we used an outright long S&P position in a size equal to the RMS average of the test strategy's long or short amounts (this is a forward-looking measure, but it is only for scaling and risk measurement; it does not affect the strategy's returns.) This yielded an annualized Sharpe Ratio of 0.38 excluding trading costs.

More importantly, this strategy has very low long-term correlation ($\rho=0.10$) and virtually zero beta ($\beta=0.02$) to the buy-and-hold strategy—in other words, it provides a nearly pure alpha overlay. Performance over the past three years has been slightly worse than the long-term results (Sharpe drops to 0.12), but it still beat the index return through a steady rally, while providing significant diversification benefits. With K set to 2 days, the Sharpe Ratio over the past 3 years goes back up to 0.38, suggesting the best holding period going forward might be somewhere in-between, such as K=3 days.

Figure 5. Cumulative Return on VIX strategy vs. S&P 500 total return



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