

## “VAR: Driving while looking in the Rearview Mirror”



Thelma and Louise - 1991

Today's RateLab does not intend to claim that there is a vastly superior method than VAR (Value at Risk) to analyze and capture risk exposure across a large risk-taking entity, rather it serves as a reminder as to why we still read Aeschylus, Sophocles and Herodotus some 2500 years after these authors first put ink to paper. The conclusion can be revealed before the last paragraph: "It is never different this time". As markets, firms and people tend to respond in similar fashions when presented with particular situations, we can broadly predict certain trends under a given set of circumstances. But, before we reveal what we are hinting at, let's review VAR.

Briefly, VAR is a measure of how much money one might lose on an exceptionally bad day. Typically, one takes the current risk position and shifts, twists, and flexes the various vectors to match what would have been the worst 95<sup>th</sup> to 99<sup>th</sup> percentile day in the past one to three years. In a nutshell, using a "real" 2<sup>nd</sup> or

3<sup>rd</sup> Standard Deviation event as opposed to simulated output from some theoretical decision tree. There are pluses and minuses to this structure, but the core idea of using real events as opposed to a regression based computer model has some elegance. That said, there is one small problem, namely, how far back in history should one look ? One year, three years, maybe fifty years ? Moreover, should one pick the single 5<sup>th</sup> worst day or maybe some sort of levered function of the distribution such as 120% of the average of the 10 worst days ?

There are two observations one can quickly make. First, there is no unique solution to the question, only a series of better answers. The second is that no matter how you slice it, one is still tossing historical data into the Veg-O-Matic and hoping for Champagne instead of V8 Juice.

## But We Digress....

The above is only a broad description as a prelude to introducing our concept. Namely, that many risk managers adhere tightly to VAR because they have to.

Many Hedge Funds raise money with some sort of risk limiting framework so as to give comfort to investors that potential losses may be floored. Usually there is both a **drawdown** limit and a **risk exposure** limit. The drawdown limit (in theory) "stops out" the hedge fund manager from staying too long in a bad trade. So for example, if the fund is down by more than 10% in a week or 20% in a month, the manager would have to reduce his risk for some given period of time.

Purple - Sw10yr Realized Volatility One month avg  
Green - Sw10yr Realized Volatility One year avg



All charts, unless otherwise noted, are sourced from BAC/MER data

The risk exposure limit would cap overall investment risk to some dollar amount relative to the size of the fund. So a Billion dollar fund may not be able to risk more than \$50 million. This \$50 million of risk would be generated via some sort of VAR analysis.

To reduce complexity and increase transparency, many Hedge Funds (and other risk managers) will often use some sort of a Moving Average of the Actual/Realized Volatility to create and manage their VAR limits. A popular method is to use the one-year moving average of the main market risk vectors, such as the Ten Swap Rate or the S&P 500 Index. In the chart on page 2, **-the green line-** is the one-year moving average of the Realized Volatility of Ten year swap rate expressed as an Annual Normalized Volatility. Weaving itself around this value is **-the purple line-** representing the one-month moving average of the same vector. Notice how the short-lived October '08 "Lehman" event and the June '09 "Inflation" event created concentrated spikes in one-month Realized Volatility that pulled up the more stable one-year moving average.

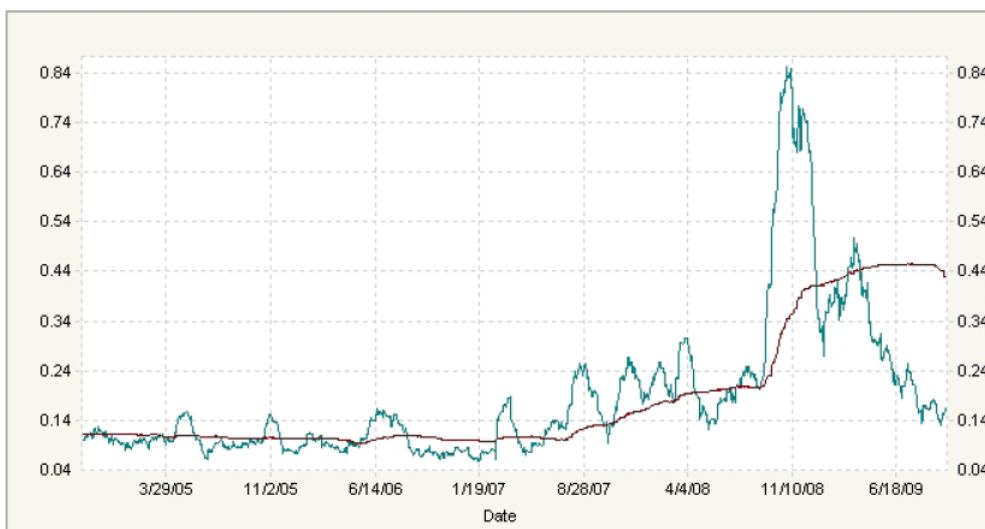
Orange - 3m-10yr Implied Volatility  
 Purple - Sw10yr Realized Volatility one month avg



The interesting observation here is that although the one-month Realized Volatility at 110nv is only 6% above its 15 year average of 103nv, the one-year Realized Volatility is almost 70% higher at 174nv. The markets have started to sniff out this differential. Notice **-the orange line-** above, which is the 3m-10yr Implied Volatility. Its 140nv close is 27% above the one month actual of 110nv but almost 20% below the one-year level.

A similar situation exists in the Equity market. –The maroon line- is the one-year moving average of the Realized Volatility of the S&P 500 index while -the teal line- is the one-month moving average. At a reading of 16.6, the one-month Realized Volatility is a mere 12% above its 40 year average of 14.8 while the one-year moving average at 42.6 is still near its all-time peak.

Teal - S&P Realized Volatility one month avg  
Maroon - S&P Realized Volatility one year avg



Similar to Interest Rate traders, some Equity managers are also trying to leap ahead of the pack by selling 3 month Implied Volatility –the lime line- below at 23.6, fully 42% above the recent Realized Volatility.

Teal - S&P Realized Volatility one month avg  
Green - S&P 3mth Implied Volatility



## Polish That Rearview Mirror

Financial firms, more so than ever, require stringent risk management. The only way to create solid boundaries, that all can agree to, is to craft some sort of blend from past data points. This is necessary since no one can agree on some formula to predict the future. **As such, any method requires you to drive your business forward while looking backwards.** We also know that money managers have a strong desire to maximize their returns (and compensation). As such, they will want to increase trades subject to their limits. Assuming the key driver of risk limits is the trailing one-year Realized Volatility of the appropriate risk vector, the current all time high of Realized Volatility is a severely constraining factor.

A common explanation for today's heightened Volatilities is that sellers fear a repeat of last June's rate rise. But an alternate view is that the natural sellers of Volatility are forced to keep their "guns holstered" because they are near their VAR limits. As described above, VAR limits tend to be created from longer data sets. And because the "Lehman event" is still in the one-year moving average, such VAR limited investors have a reduced ability to sell options and take other risks, at least for now.

Let's put pencil to paper. The one-year Realized Volatility for the Sw10yr rate is 174nv. So a three standard deviation move would be 32.9bps. Assuming one has a \$10mm VAR limit, a trader could be net long (or short) \$352mm of Sw10s. [Bond math: 32.9bps times a Dv01 of 863 times 352mm equals \$10mm]

Fast forward: Let us assume that the next three months will be as volatile as this past month. The "Lehman Event" history will drop out of the data set and the new lower volatility will enter the moving average. The one-year level will mathematically decline by 15% to 148nv. Moreover, a three standard deviation event will now be 27.9bps and a \$10mm VAR limit will allow a position increase from 352mm to 415mm. Multiply this times the universe of risk takers and this is a substantial increase in the risk limit available to market participants.

The potential impact on the Equity markets of the "Lehman Event" dropping out of the data set is even greater. The current one-year moving average of Realized Volatility of at 42.6 would decline by 28% if last month's Realized Volatility of 16.6 continued for another three months. Risk parameters that are fully linked to trailing one-year Realized Volatility would see their limits expand next year by nearly 40%.

Although we have not done the calculations for other markets, I am sure the potential for limit expansion in the credit markets could be even greater.

## Beware of Greeks Bearing Gifts

We referred to a trio of ancient Greek authors at the beginning of the RateLab. The concept, as we have repeatedly noted in this space, is that human nature does not change and that Hubris and Greed always precede the tragedy revealed in Act III. This is why we still read these poems some 2500 years after their creation while the fine pulp fiction of first millennium is long lost.

So we have created a situation where we continually close the barn door after the horse is long gone. When risk measures are at their lowest and the distribution of returns is vastly skewed against a positive outcome, we allow and encourage maximum risk taking. And when the worst case scenario is fully priced into the market, we clamp down the hardest. Consider the risk parameters available for Rates traders in mid-2007, soon after Bear Stearns collapsed but before the Lehman Event. The trailing one-year Realized Volatility of the Sw10yr rate averaged about 64nv. Ignoring the Dv01 differences, a trader with a \$10mm VAR limit could position \$960mm of exposure, approaching three times his current limit.

Not to put too fine a point on this, VAR limits created in the fashion described here would have allowed \$960mm of position limits in June of 2007 when Implied Volatility was at record lows, spreads were tight and the curve was essentially flat. Presently, when risk vectors are near their all time wides, the same trader can only commit \$352mm, 63% less !

A more interesting thought would be to examine how the market was impacted by a mandated risk reduction imposed by a VAR regime. Most pundits attributed the Q4-08 risk liquidation to a lack of balance sheet by financial firms. **Maybe the marginal seller was NOT balance sheet driven but VAR driven.** Using our example, a Sw10yr generated VAR limit would require a 21% risk reduction between Sep 15 and Dec 15 of last year. Considering the wide usage of VAR, this must have been a contributor.

After recent events, VAR is sure to find a wider following; and this will only add to the cyclicity of risk. In the same way that banks reduce credit loss reserves at the top of the cycle, other risk managers will continue to sell low and buy high and hope to make it back on volume.

As such, one should fully expect an increase in the desire to add risk going into year-end the Lehman Event falls out of the historical database and VAR generated limits expand. **We remain fully committed to the idea of selling mid-expiry "hump" Volatility and buying CMM vs. 10CMS at any level under 49bps one year forward as detailed in our last RateLab.**

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