

Boosting the SPY with the VXX The Daiquiri Strategy

Chrilly Donninger
Chief Scientist, Sibyl-Project
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<http://www.godotfinance.com/>

“My mojito in La Bodeguita, My daiquiri in El Floridita“
(Ernest Hemingway, <http://en.wikipedia.org/wiki/Mojito>).

Abstract:

The S&P 500 VEQTOR Index dynamically allocates long-only exposure between the S&P 500, the S&P 500 VIX Short-Term Futures Index in order to measure broad equity market exposure with an implied volatility hedge.

The Daiquiri is an improved version of the Veqtor strategy. It uses different allocation criterions and different weights. The paper presents a strategy with moderate risk and gain, and an aggressive version with more risk and fun. The Daiquiri improves the Veqtor by a wide margin.

Note:

The Daiquiri was already presented in a previous working-paper (see [1]). This paper is a complete rework and not just a revision of [1].

The Veqtor VIX- Futures Index:

S&P defined in [3] the Dynamic Veqtor VIX-Futures Index. The basic idea is to hedge the S&P with the VXX. The stylized facts of the VXX are described in [2] and especially in [4].

It can be compared to a strategy with SPY (or ES-Futures) and long Puts.

Barclays VQT ETN replicates this index. The VQT was launched at 2010-09-01 with a value of 101.69. The latest close at 2013-04-25 was 136.02. In comparison the SPY went up from 102.38 to 158.52 (the first price is dividend adjusted). Generally the VQT does better in times of troubles, but the insurance costs generally drag the VQT.

| Realized-Volatility | VIX-Down | VIX-Sideways | VIX-Up |
|---------------------|----------|--------------|--------|
| <= 10% | 2, 5% | 2, 5% | 10% |
| <= 20% | 2, 5% | 10% | 15% |
| <= 35% | 10% | 15% | 25% |
| <= 45% | 15% | 25% | 40% |
| > 45% | 25% | 40% | 40% |

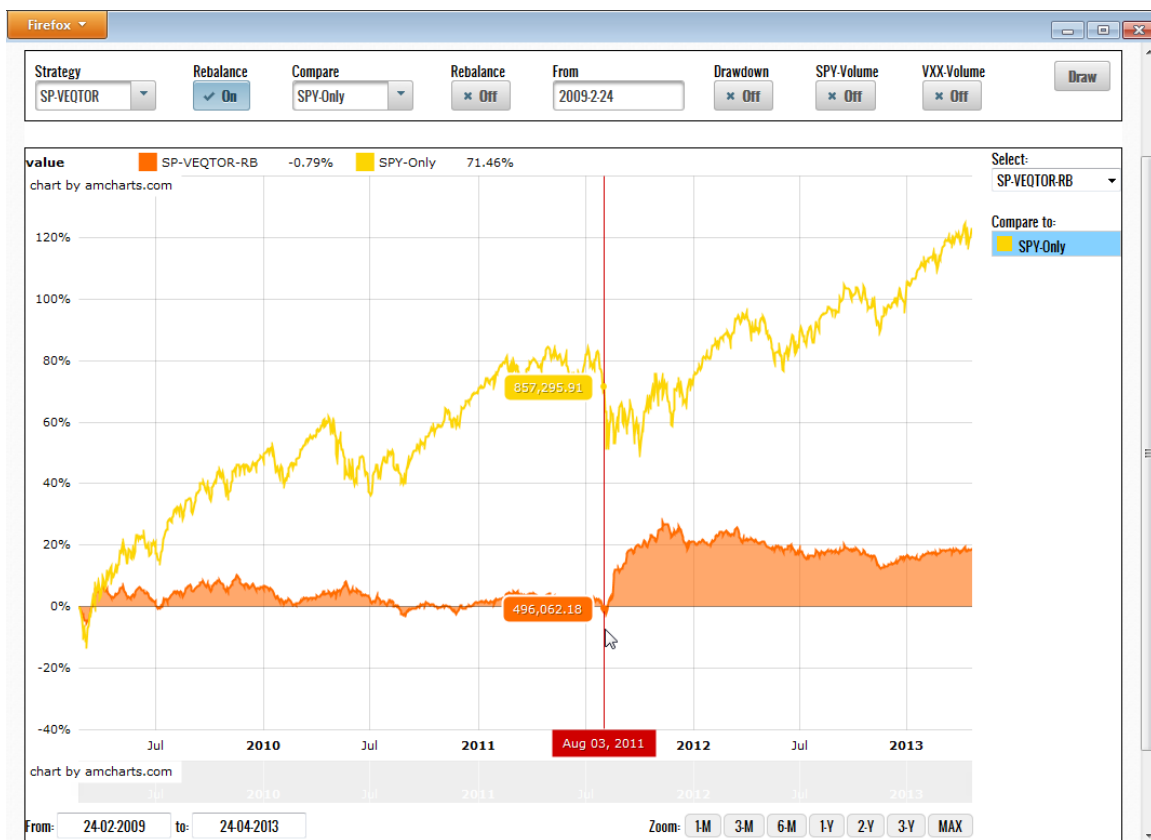
Table-1: VXX weights for the Veqtor strategy.

The corresponding SPY-weight is 100-VXX.

There are 5 different volatility-regimes which are characterized by the Realized-Volatility. From very low (below 10%) to very high (above 45%). Each volatility-regime is subdivided into a falling, sideways or rising Implied-Volatility (the VIX). Rising or

falling is defined by the relation of the 5-days to 20-days VIX average. The exact formulas for calculating the values can be found in [3]. For this study the performance is calculated from 2009-02-24 to 2013-04-24. The VXX was introduced at 2009-01-30. It gained immediate popularity. The somewhat later starting date was chosen to avoid VXX startup effects. The index starts with initially 500.000\$. This arbitrary value was used in previous studies. The current value of the index is multiplied by the weights and divided by the current price. The volume of the SPY and VXX is rounded down to integers. This represents (very) small trading costs.

Barclays implements the VQT probably with SPX- and VIX-Futures. The VQT performs somewhat better than the SPY/VXX based realization. The ETF implementation is more handy. The implementation details do not change the overall picture.



Graphic-1: Orange Veqtor, yellow SPY from 2009-02-24 to 2013-04-24

As can be seen in Graphic-1 the Veqtor performs fine in the crash of Aug. 2011, but otherwise the increase of the SPY is eaten up by the insurance-cost. The final value is 592.848\$ or +18.5%. The final value of the SPY is 1.113.455\$ or +122.6%.

The Daiquiri:

The Daiquiri uses the results in [6] for adjusting the weights of VXX and SPY. In this work 3 implied volatility-ratios are defined. They represent information from different places of the implied-volatility surface.

$$\text{IVTS}(t) = \text{VIX}(t) / \text{VXV}(t) \quad (1)$$

VXV is the 3-months volatility index. It is otherwise identical to the VIX.

$$\text{VIXFuture30TS}(t) = \text{VIX}(t) / \text{VIXFuture30}(t) \quad (2)$$

$$\text{VIXFutures30_45TS}(t) = \text{VIXFuture30}(t) / \text{VIXFuture45}(t) \quad (3)$$

VIXFuture30 is the value of a VIX Future with a maturity of 30 calendar days. Usually such a Future does not exist. In this case it is the weighted mean between the 2 nearest futures (see [6]). VIXFutures45 is the value of a VIX Future with maturity 45.

In the initial Daiquiri paper [1] only the IVTS was used.

| IVTS | VXX Weight | SPY Weight |
|-------------|------------|------------|
| ≤ 0.91 | -0.05 | 0.95 |
| ≤ 0.97 | 0.25 | 0.75 |
| ≤ 1.00 | 0.30 | 0.70 |
| > 1.00 | 0.30 | 0.70 |

Table-2: Daiquiri-Moderate: Thresholds and Weights.

Note: there are 4 different IVTS regimes, but only 3 different weight-settings. One could tune the Daiquiri further by using different weights.

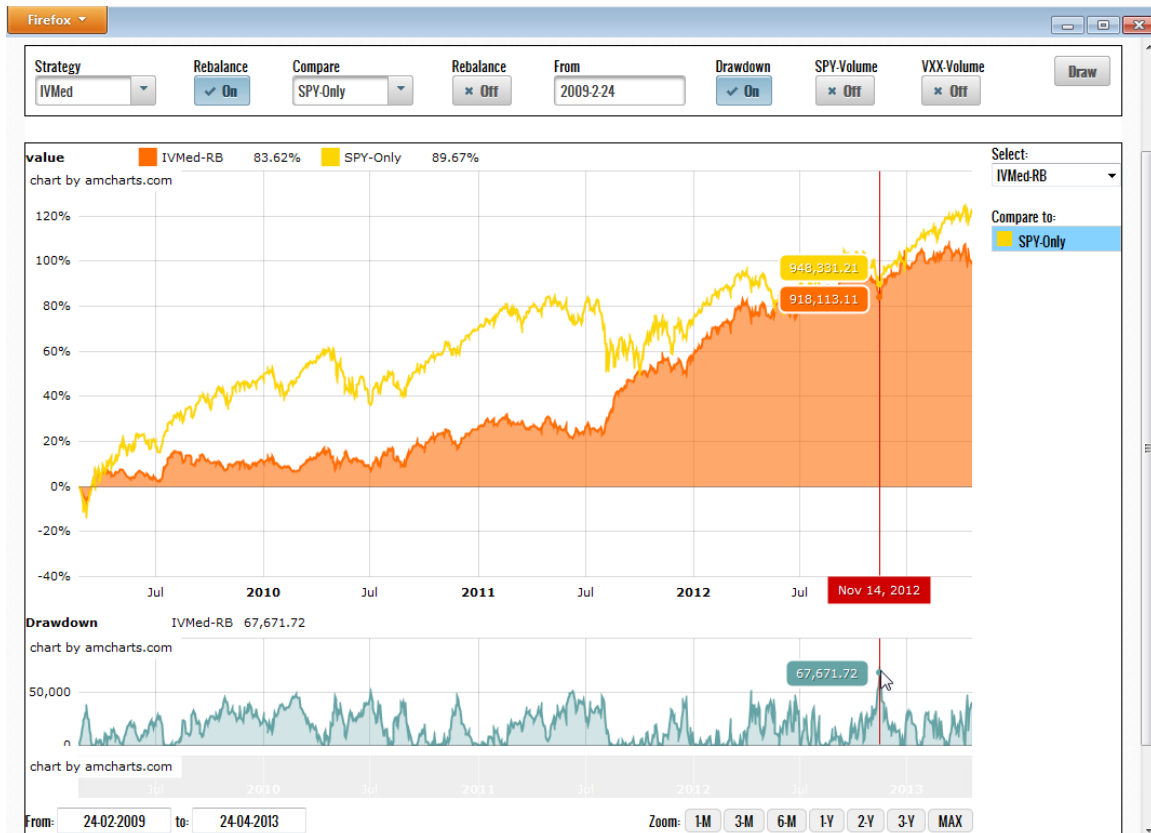
The Daiquiri does not hedge the SPY in the low IVTS regime. This corresponds to a low VIX value and a strong contango of the VIX-Futures. In this case the Daiquiri goes even the VXX short to boost the SPY-performance. On the other side the VXX hedge is restricted to 30%. The Vector goes up to 40% in a crash like in August 2011. The intention of the lower 30% VXX hedge is to avoid sharp losses in the recovery phase. Generally the overall performance is similar.

The VIXFuture30TS of equation (2) behaves similar to the IVTS. The measure is a little bit more responsive to sudden movements of the market. The thresholds and weights are thus the same.

The VIXFutures30_45TS of equation (3) is distinct. It moves much smoother than the IVTS and the VIXFuture30TS. It never falls below 0.91. One has therefore to use different market-regime thresholds.

| 30_45TS | VXX Weight | SPY Weight |
|---------|------------|------------|
| <= 0.97 | -0.05 | 0.95 |
| <= 0.99 | 0.25 | 0.75 |
| <= 1.00 | 0.30 | 0.70 |
| > 1.00 | 0.30 | 0.70 |

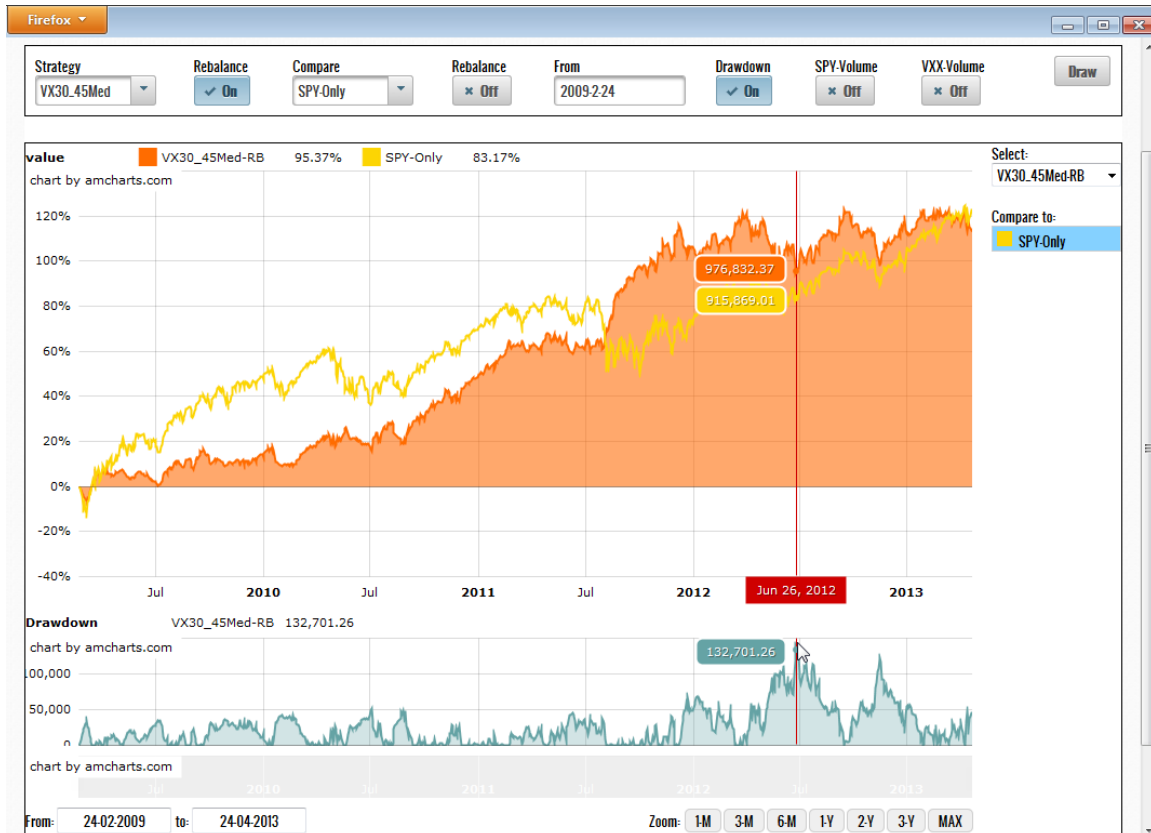
Table-3: Daiquiri-Moderate for VIXFutures30_45TS



Graphic-2: Orange Daiquiri-Moderate (IVTS), yellow SPY.

The moderate Daiquiri with the IVTS market signal performs still somewhat worse than the SPY.

The Daiquiri wins 99.4%, the SPY 122.6%. But the performance of the Daiquiri is much smoother. The max. drawdown is 67.671\$ at 2012-11-14. The SPY has at 2011-10-03 a max. drawdown of 171.626\$. The moderate Daiquiri wins in contrast to the Veqtor also in bull markets. One does not pay the constant insurance costs. In contrary, one cashes additional insurance premium in. But one pays the insurance when the market regime is unclear.



Graphic-3: Orange Daiquiri-Moderate (VIXFutures30_45TS), yellow SPY.

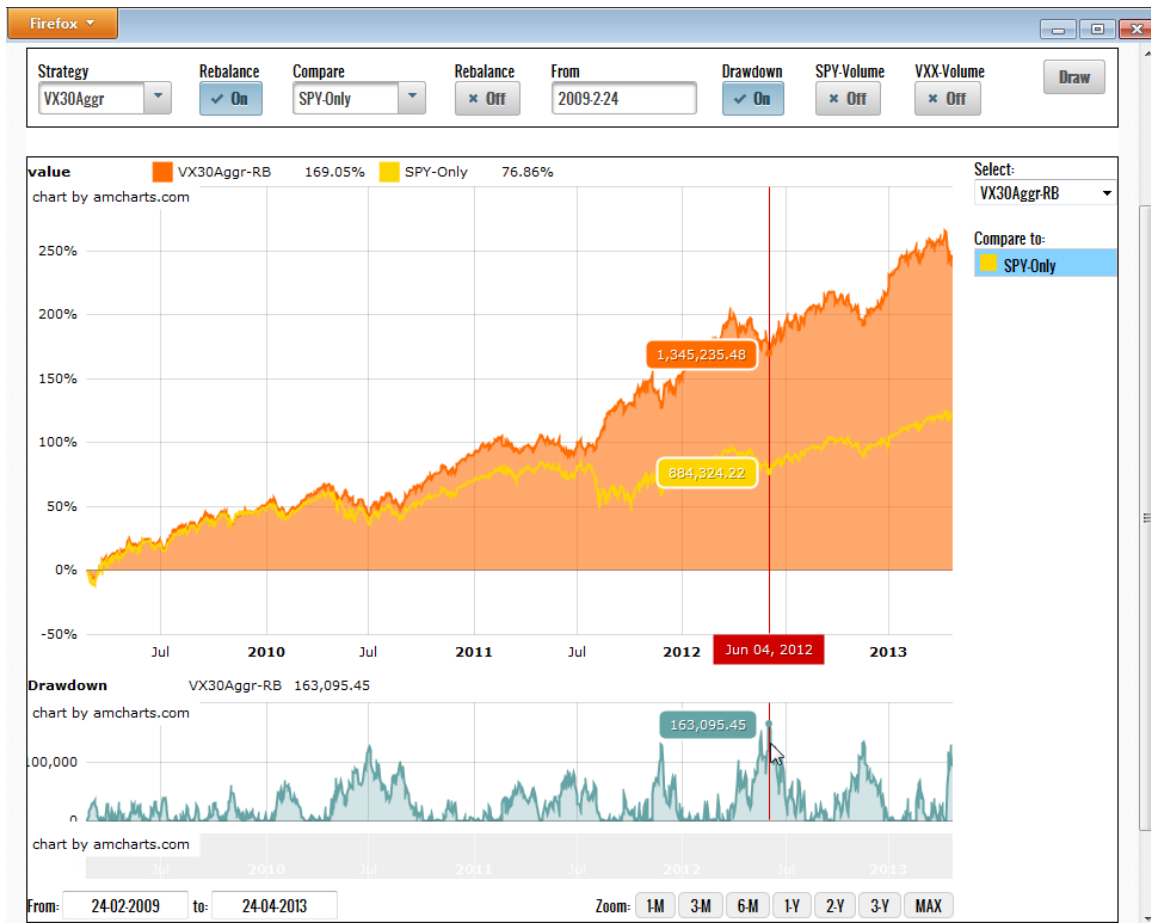
Graphic-3 shows the performance of the moderate Daiquiri with the VIXFutures30_45TS signal and the thresholds of table 3. This version catches up with the SPY. The performance is especially fine in the recovery phase of the Aug. 2011 crash. This is in line with the results in [6]. But the performance is not impressive afterwards. The max. drawdown is 132.701\$ at 2012-06-26. The IVTS based version performs much smoother. The VIXFutures30_45TS reacts slower and more robust to market changes. This was an advantage in [6]. For this application it is a mixed blessing. The VIXFutures30 signal reacts faster and stronger to market changes. But the moderate VIXFuture30TS Daiquiri does not work at all.

The Aggressive Daiquiri:

The intention of the Vector-Index is to play save. This reflects the general mood after the 2008 crash. But the Vector is in normal times too less fun. The Moderate Daiquiri does already a better job. It is for the risk-averse investor an interesting combination. The goal of the Aggressive Daiquiri is to beat the SPY with about the same level of risk. The idea is quite straightforward. One boosts the SPY in bull markets by adding 10% of a short VXX position. The VIX has a beta of about -3.5. But the relation is non-linear and time-dependent. In an unclear market regime one is 100% invested in the SPY. In times of troubles one hedges as before with a weight of 30%. The exact definition is given in Table-4. The thresholds and weights are again for the IVTS and the VIXFuture30TS identical.

| IVTS | VXX Weight | SPY Weight |
|---------|------------|------------|
| <= 0.91 | -0.10 | 0.90 |
| <= 1.00 | 0.00 | 1.00 |
| > 1.00 | 0.30 | 0.70 |

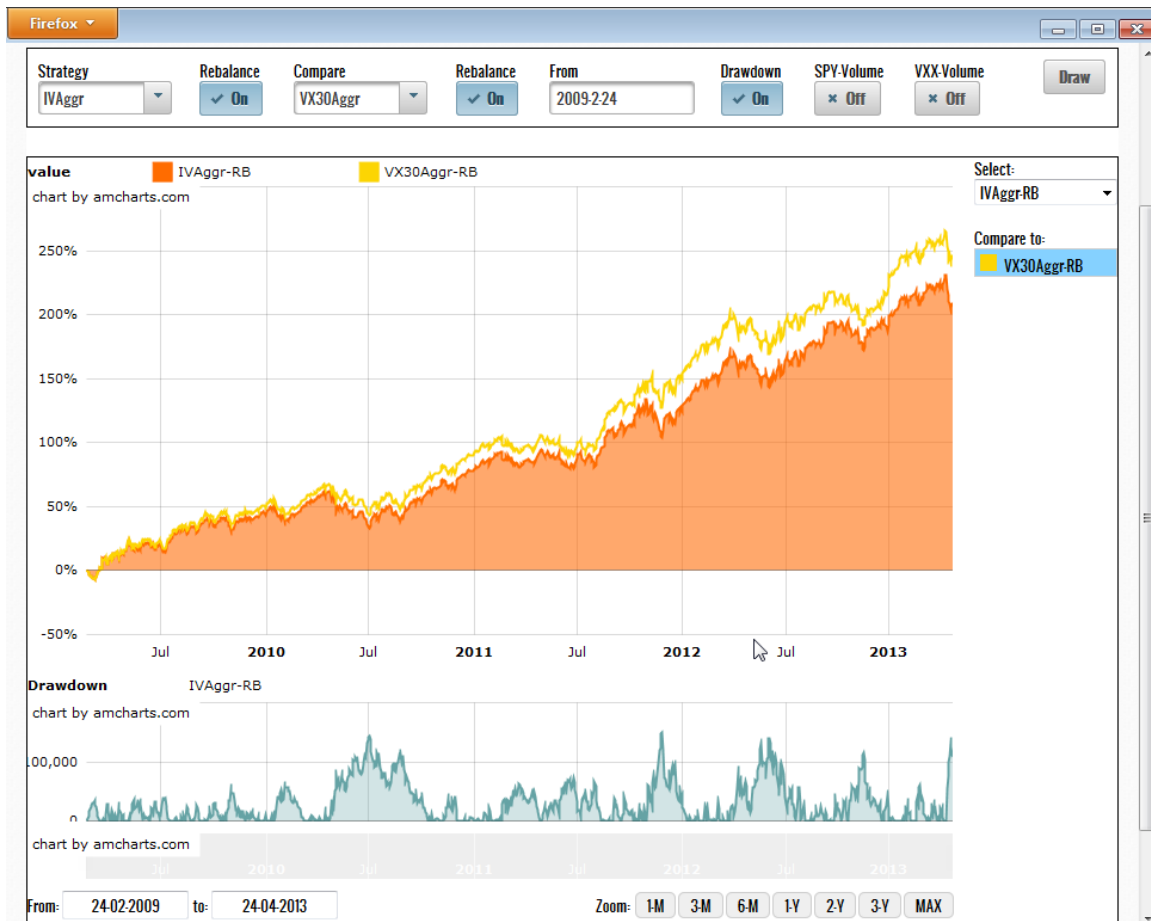
Table-4: Daiquiri Aggressive for IVTS and VIXFuture30_TS



Graphic-4: Orange Daiquiri-Aggressive (VIXFutures30TS), yellow SPY.

Graphic-4 shows the result for the VIXFuture30TS signal. The final value is 1.730.046\$ or 246%. The strategy beats the SPY by a wide margin. The max. drawdown is with 163.095\$ slightly smaller than the SPY-Drawdown. But the maxima are at different places. The SPY suffers most in the aftermath of the August 2011 crash, the Daiquiri in June 2012. But it should be noted, that this is also an effect of the different index-levels. The Daiquiri is in June 2012 about 1.5 times the SPY-Index. The SPY Drawdown of 94.000\$ is in relative terms about the same. The Aggressive Daiquiri did quite well in the August 2011 crash. This was a sharp crash and the hedge worked appropriate. The situation in May, June 2012 was more a market-slide. The red light did not flash and no hedging was done.

Graphic-5 compares the IVTS based Aggressive Daiquiri with the VIXFuture30TS signal of Graphic-4 (yellow). The faster response of the VIXFuture30TS seems to be an advantage over the slower IVTS signal. The drawdown is similar.

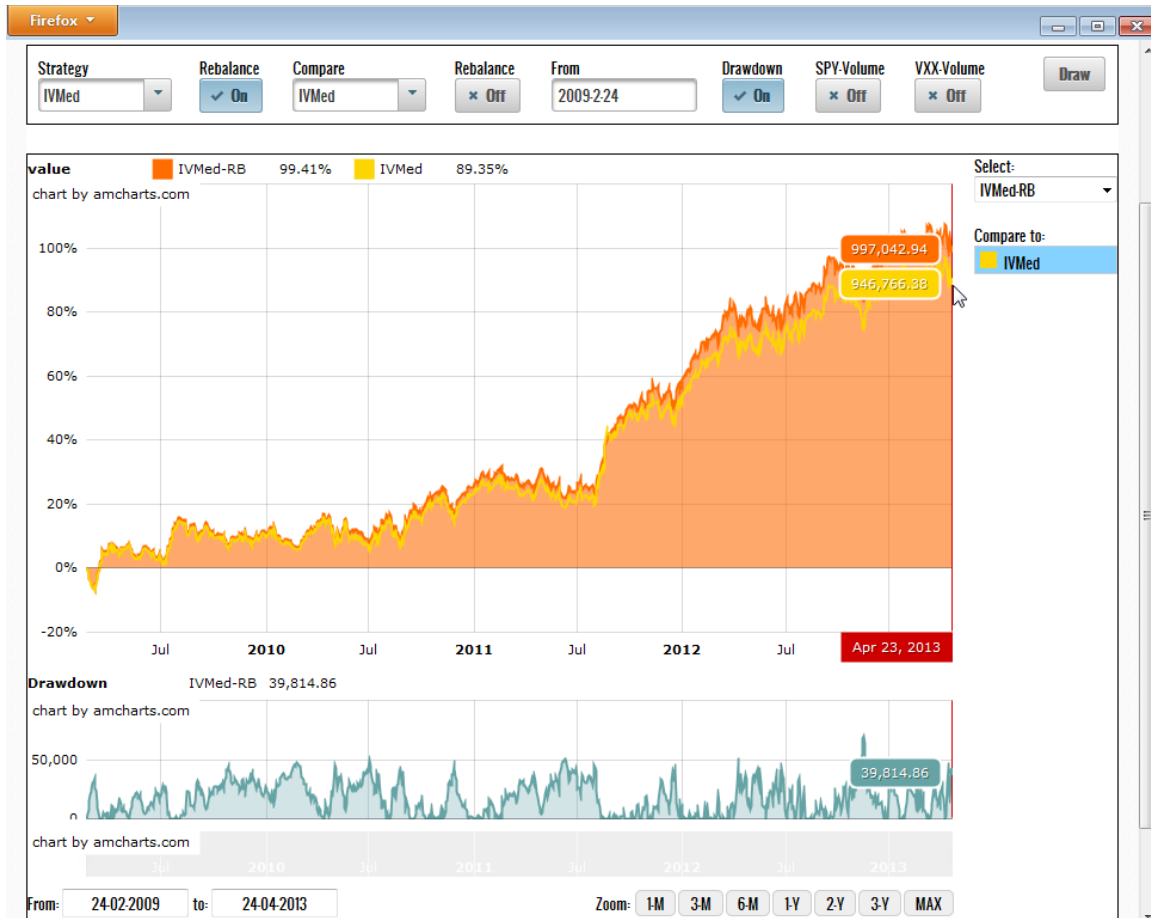


Graphic-5: Orange Daiquiri-Aggressive (IVTS), yellow VIXFuture30TS.

The VIXFutures30_45TS is the slowest moving signal. The performance is hence also the worst of the 3 volatility ratios.

The Effect of Daily Rebalancing:

Obviously one has to readjust the volumes in case of a regime switch. But the weights also move within a regime gradually away from the defined values. If the SPY moves up, the VXX down, the weight changes in favor of the SPY. The reverse holds for a declining market. One has therefore to rebalance the portfolio at a daily basis. Although the necessary adjustments are usually small, one would like to avoid these small transactions at all.

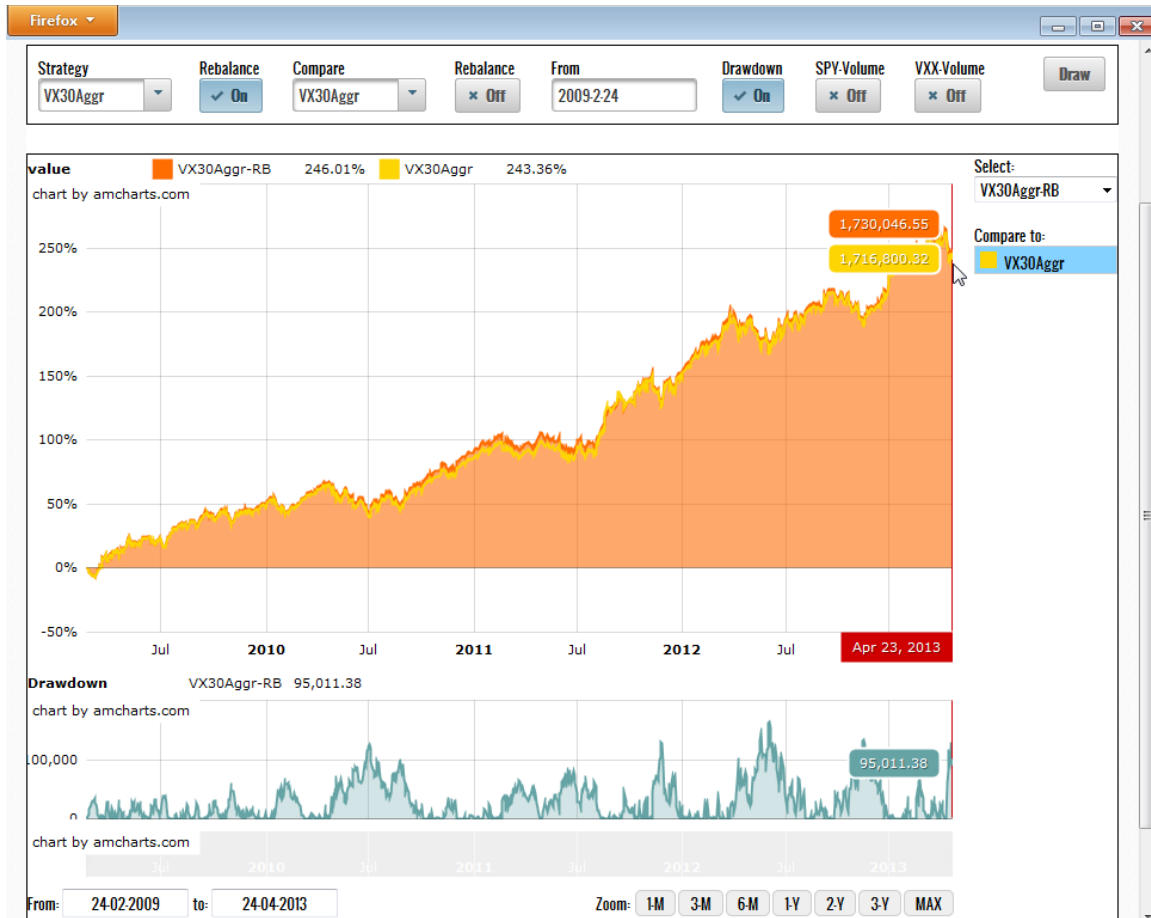


Graphic-6: Orange Moderate (IVTS) with Rebalance, yellow without.

Graphic-6 shows the effect for the best moderate strategy. The daily rebalance improves the performance by about 10%. The drawdown is similar. The performance difference should (over-)compensate the additional transaction costs. One can also define a band around the defined weights. As long as the weights stay within this band, nothing needs to be done.

According to the results in [1] a band of $\pm 1.0\%$ has no negative performance effect (the savings on transactions is also small). The band can be widened up to 5%.

The effect is less pronounced for the Aggressive Daiquiri (Graphic-7). The strategy is most of the time only invested in the SPY. The VXX is only added in strong bull or bear markets. The effect on the max. drawdown is also minor. The rebalanced version has a slightly lower drawdown in the Aug. 2011 crash, but is worse in the May/June 2012 slide. But it should be noted, that the savings in transaction costs are also moderate. One could again define a band and rebalance once the band is left.



Graphic-7: Orange Aggressive (VIXFuture30TS) with Rebalance, yellow without.

Conclusion:

In [6] the SPY was combined with the TLT (20+ y Treasuries). For this setting the slower moving robust VIXFutures30_45TS signal was superior. This result does not hold for the Daiquiri. The VXX has a different behavior. The TLT reacts in good approximation linearly on the SPY. The VXX has a clear non-linear part. Additionally the VXX has in the long run a clear downwards trend. The TLT goes up. It is for the Daiquiri more important to react as fast as possible. Robustness is of a secondary concern.

But for the Moderate Daiquiri the fast moving VIXFuture30TS did also not work. Maybe one has to find different thresholds and weights. For the moderate, the IVTS is clearly the best signal. For the Aggressive Daiquiri the fast VIXFuture30TS has in contrast a clear edge. The fuzzy region between 0.91 and 1.00 is ignored in the Aggressive Daiquiri. One fully invests in the SPY. The VXX is only added in clear bull or bear markets. The risk of being on the wrong side is hence reduced.

The choice between the Moderate and Aggressive Daiquiri is a matter of risk appetite. A reasonable rebalancing strategy is to define a band of about +/- 2% and to rebalance once the weights have left this band. This question was already addressed in [1] and was hence not repeated here.

Further work:

The Mojito is – not only by the alcoholic preferences of Hemingway - closely related to the Daiquiri. The next step is to update the Mojito results in the same way.

References:

- [1] Ch. Donninger: Improving the S&P Vector Index: The Daiquiri Strategy. Sibyl-Working-Paper, Rev. 1, 2012.07.06.
- [2] Ch. Donninger: Improving the S&P Dynamic VIX-Futures Strategy: The Mojito Strategy. Sibyl-Working-Paper, July 2012.
- [3] S&P: S&P 500 Dynamic Vector Index Series: Index Methodology. March 2011.
- [4] Carol Alexander, Dimitris Korovilas: Understanding ETN's on VIX Futures.
- [5] S&P: S&P 500 Dynamic VIX Futures Index Methodology, Aug. 2011
- [6] Ch. Donninger: A broad hint from the VIX: Timing the market with implied volatility, Sibyl-Working-Paper, April 2013.