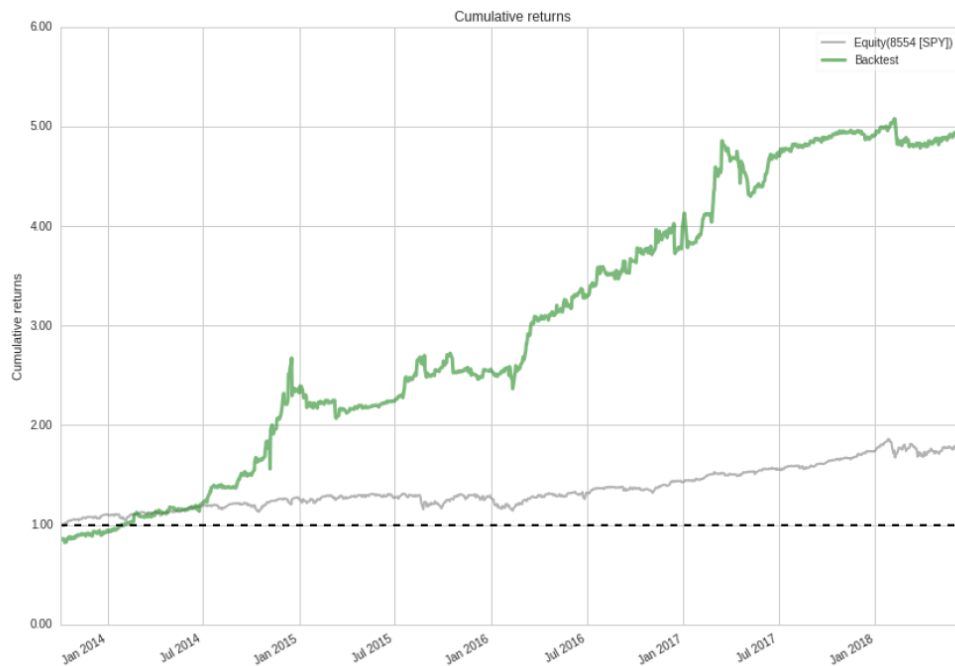


Quantopian API Exercise: Dynamicize

Problem: There is significant volatility in the leveraged ETF shorting strategy backtests.



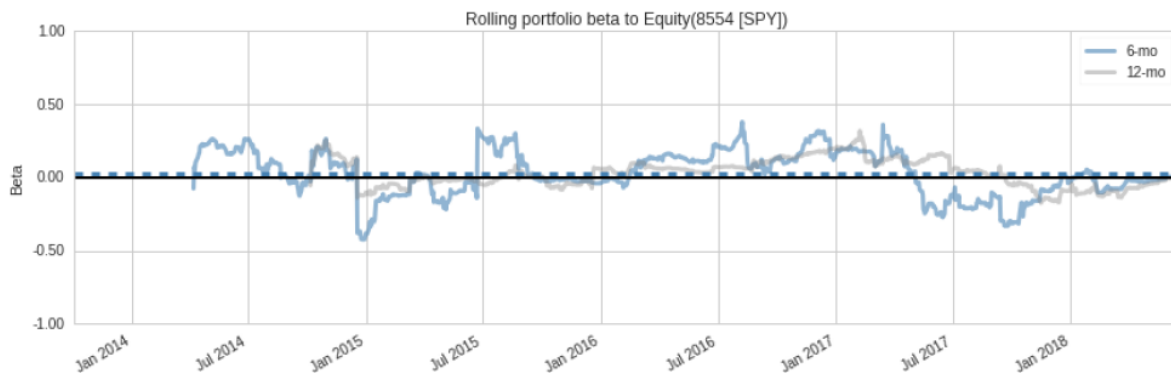
Strategy Backtest vs. Benchmark S&P 500

At first glance, it may appear that all is fine. The S&P 500 returns under 80% in the time that the algorithm returns almost 400%. This strategy of shorting Bull and Bear ETFs together eliminates all *market risk*. However, there is still significant unsystematic risk to this approach. It is clearly visible by the significant amount of volatility around the first half of 2017 in the algorithm's returns. Although the final return on investment may be acceptable to long-term investors, this short term volatility is simply unacceptable for investors in this strategy.



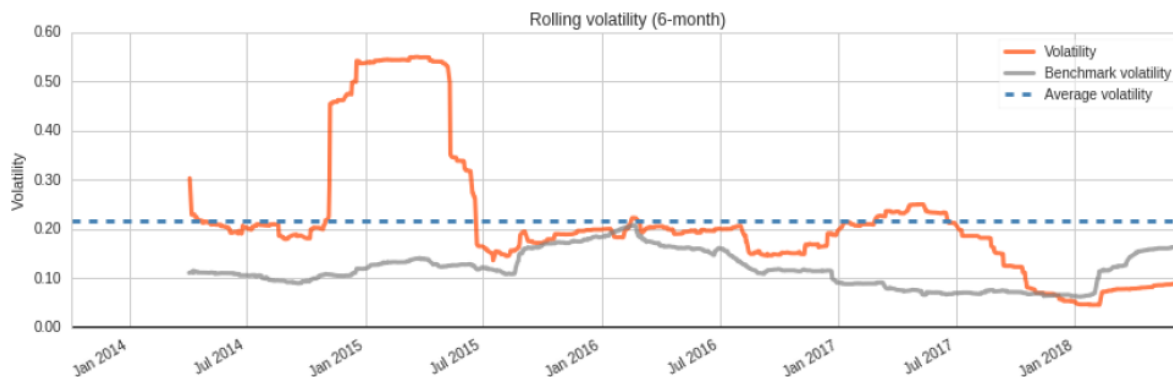
Drawdown Over Time

Generally “beta”, or covariance with the general market, is a great measure of risk for securities. However, in quantitative finance, where strategies take hardly any systematic risk, a more accurate measure of risk is drawdown. When using drawdown to assess a strategy, you’re essentially taking the distance from crest to trough for the trend. In the asset management industry, stop losses are generally placed at 12.5% drawdowns to mitigate risk. Above, you can see that the max drawdown in backtests for this strategy was about 22%, and the drawdowns consistently exceeded 10%.



Beta Over Time

To further drive this point home, we can also examine the rolling volatility of this strategy versus the benchmark S&P 500.



Rolling Volatility Over Time

Therefore, obviously there is a problem. Even if there is no obvious market risk to this strategy, there is another factor which is causing this massive amount of volatility. Investors hate volatility.

Moreover, another major issue is the lack of fluidity in the strategy. Gold has been a very volatile sector recently, and especially small-cap gold mining companies face a significant amount of volatility. Therefore, I felt it'd be appropriate to short the pair JNUG/JDST as it has suffered the most beta slippage in recent years. However, this approach prevents the strategy from being dynamic. What if gold started a bull run and stopped being volatile? What if the JNUG/JDST pair stopped suffering from beta slippage? These are potential risks which need to be addressed.

Potential Cause

The backtests above show the performance of a Leveraged ETF Shorting strategy solely based on two securities, JNUG and JDST. The volatility shown above can potentially be attributed to the "under-diversification" of this portfolio. If there is only one pair position being held throughout a duration, the strategy's performance is susceptible to its underlying factors. Of course the strategy isn't affected by the (gold market in this case) market moving. However, it is affected by the changes in volatility of gold. It may be hard to grasp, but the volatility of the pair is itself volatile. Therefore, a strategy reliant on the volatility, would reasonably show major fluctuations. As described above, not only are these fluctuations bad, but this also leaves you exposed to the changes in the volatility of gold. For instance, in a bear market, even if the bear ETF may be rising, the underlying asset generally becomes noticeably more volatile. As volatility *helps* this strategy's performance, the opposite is also true: A bull market of the underlying asset generally reduces the volatility of their corresponding leveraged ETFs.

Proposed Solution

Coming from the asset management industry, I know a common approach to mitigating market risk is to diversify. If you hold a variety of uncorrelated assets, you essentially eliminate the market risk of that portfolio. This thinking can be applied to this problem too. Since the single JNUG/JDST shorting strategy exhibits a lot of volatility, a solution can be to short other pairs too. Then the hidden market risks of this strategy are further eliminated, lowering its risk and making it more appealing to investors.

An easy approach to this would be to have a dynamic strategy, where more profitable shorts of leveraged ETF pairs can be “prioritized”. Essentially, leveraged ETF pairs which fall more in a given time period can be allocated a larger weightage in a portfolio. A good place to start would be to scan a database of pairs of leveraged ETFs and generate a list of ETFs which represent their sector (ex. The underlying of NUGT/DUST is gold). Then these “underlying” assets can be ranked by its rolling volatility over the last twelve months. Then we can take the top 5-10 leveraged ETF pairs on that list and combine them into a portfolio where the leveraged ETF pairs corresponding to the underlying assets with the highest rolling volatilities get the more weightage (proportionally).

A place to get started would be to clone the github repository I’ve shared with you and then transferring the code over to quantopian. You can play around with it a little there and understand how it behaves and then proceed to integrate this feature. Of course this is a relatively crude solution to the actual problem, but this is a good place to start and we have plans to improve the strategy in the future.

Future improvements can be to use a ML model to predict the future rolling volatilities of the ETFs rather than the past twelve months. This would be more representative of our investments.