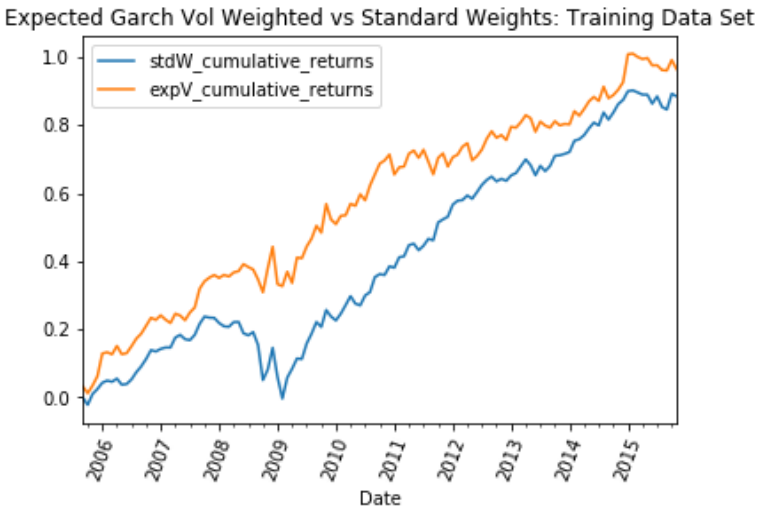
Risk Parity Portfolio

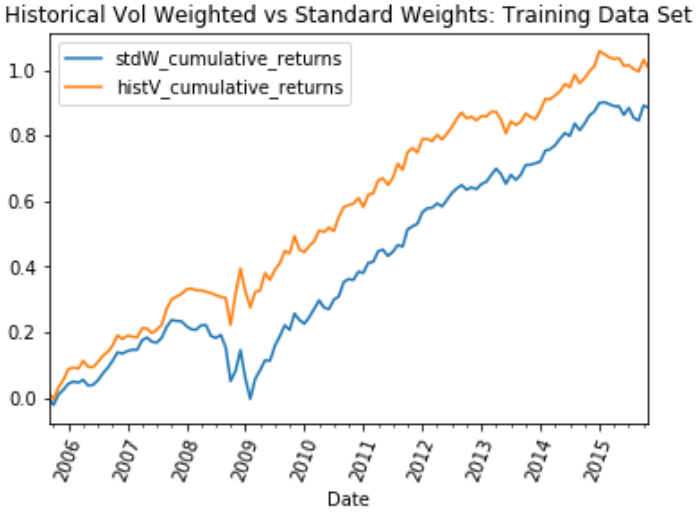
Key Points:

1. Monthly rebalancing, hence using monthly resampled data
2. We are benchmarking the risk parity portfolio to a standard weighting portfolio of 55% to stocks, 35% to bonds and 10% to gold
3. Train Data Set Period: November 2004 to November 2015 (limited Gold data)
4. Test Data Set Period: December 2015 to March 2023

In this backtesting task, we weight the 3 ETFs based on 2 separate methods; using historical volatility and expected volatility. Historical volatility consists of calculating the standard deviation of the past x months of returns, while expected volatility involves the usage of the GARCH model to forecast future volatility. After retrieving our volatility numbers, we simply take 1/volatility so that bigger volatility figures will end up smaller and vice versa. Finally, we divide the aforementioned number by the sum of every ETF's 1/volatility number to get our weight.

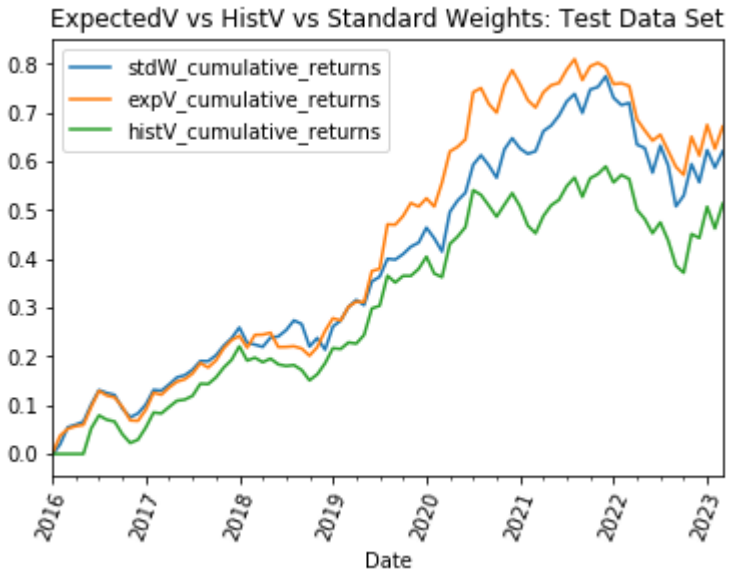
y-axis: 1 means 100% cumulative returns





Training Data Set	Cumulative Returns	Annualized Sharpe Ratio	Optimized rolling window period
Standard Weighting (55/35/10)	88.48%	1.02	-
Historical Vol Weighting	100.58%	1.06	6 months
Expected Vol Weighting using GARCH	96.49%	0.91	2 months

We can see that in both situations during the training data set, the draw down during the 2008 financial crisis was subdued substantially as we expected. Because equities have approximately three to four times the risk of bonds, the standard weighting allocation leads to a portfolio that has roughly 90% of its risk budget dedicated to equities. In other words, when viewed through the lens of risk, traditional asset allocations are highly concentrated in the equity markets (source: AQR). The risk parity portfolio has assigned much lesser weights to the SPDR S&P 500 ETF Trust as stocks took up majority of the risk budget.



Testing Data Set	Cumulative Returns	Annualized Sharpe Ratio
Standard Weighting (55/35/10)	62.08%	0.81
Historical Vol Weighting	51.33%	0.73
Expected Vol Weighting using GARCH	67.16%	0.89

At the end of the testing period, the expected volatility weighting method performed the best in terms of cumulative returns. However, the standard weighting method also performed similarly. This is due to the equity bull market run during this similar period. If I had more historical data, I would have emphasized on the 1997 Asian Financial Crisis and the Tech Bubble Burst in 2000 where risk parity portfolios would have outperformed the standard weighted portfolios.