Systematic Investing
Professor Dhar
Spring 2025

Assignment on Risk Parity using ETFs
(Data available on class website)

You are provided daily data for three ETFs: XLF, XOP, XLK between January 2014 and January 2024. Your exercise is to combine their daily returns in two ways.

In the first method, you average their returns every day, which means that your bets are "equal sized" in terms of dollars.

In the second method, you will combine the three returns so that you take "equal risk" in each ETF, where equal risk is calculated using trailing volatility. Intuitively, what this means is that you'll invest fewer dollars if something is more volatile and vice versa. This is commonly referred to in the industry as "risk parity."

Calculate the combination of returns by combining the ETFs in the two ways described above. For the former, give the returns equal weights. For the latter, you will weight the ETFs in inverse proportion to their 20-day trailing volatility of daily returns. So, for every day, calculate the 20-day trailing volatility of daily returns for each instrument, and size (or weight) each instrument it in inverse proportion to its 20-day volatility. For example, if the volatility of two things is 1 and 2 respectively, the first one will have double the weight of the second one to achieve risk-parity. The weights of the three assets every day should add up to one. They will change slightly every day.

IMPORTANT. Note that the returns are based on close-to-close prices and you are calculating the weights at the ***end*** of each day, meaning that the sizing of positions is done at the end of the day, and the weights are therefore applied to the returns realized the ***next*** day. That is how you calculate your "volatility-weighted average returns" for each day.

Requirements:

- Plot the two Equity Graphs for the equal and vol-weighted returns (start them at 100).Which is better? Why?
- Plot the weights of the three ETFs over time. Do they look relatively smooth to you? When would you expect sudden changes, like we see between 12/08/2014 and 1/27/2015?

If you feel like the challenge, calculate the worst ***drawdowns*** of the two strategies. A drawdown is essentially a "peak to trough" return. Which of the two exhibits better drawdown behavior?