Market Analysis using Python

Dataset:

The dataset is from the Ken French website containing data on 17 different industries from 1926 till 2020. I have chosen 4 industries for my analysis: Food, Oil, Cars and Finance; with a special focus on the Oil industry. The dataset is in "17_Industry_Portfolios.csv".

Note: There is no recommendation for investing from this analysis. This is a self-study project and to showcase that I am aware of the following concepts.

Executive Summary:

The returns of the 4 industries are non-Normally distributed, which goes with the fact that asset returns are rarely normally distributed as there is always a possibility of extreme returns. Having constructed a wealth index from 1995 with an initial investment of $1,000, the Food industry does well with a compound return of 9.5% and the least amount of volatility of 13.2% per year. It has the maximum Sharpe Ratio of 7.4 which measures the ratio of the excess return to the volatility (risk).

My focus is on the Oil industry as it has a lot of volatility. If you invested $1,000 in Oil in 1995, today your investment would be around $4,000 compared to $8,400 for Finance and $10,000 for Food. The maximum drawdown (the longest time the industry was below its previous peak) for Oil was around 65% during the 2020 COVID-19 crash. Looking at the Value at Risk (Var), the VaR for Oil is the highest at around 10% for a 95% confidence level. We can interpret this as saying: once we exclude the worst 5% outcomes, the maximum expected loss we can expect is 10% in a given month.

I have also done Mean-Variance Analysis to see how much to invest in which industry. The optimizer suggested investing everything into the Oil industry for a target return of 15% in one year while minimizing our risk; which contradicts with our findings of low compound returns and high volatility. Mean Variance Analysis is not used much in practice and most likely any investor would not want to invest in Oil right now considering the lockdown situation and how much uncertainty there is with Saudi and Russia. A better way to allocate resources would be to use Global Minimum Variance or CPPI (Constant Proportion Portfolio Investment).

Analysis is down below.

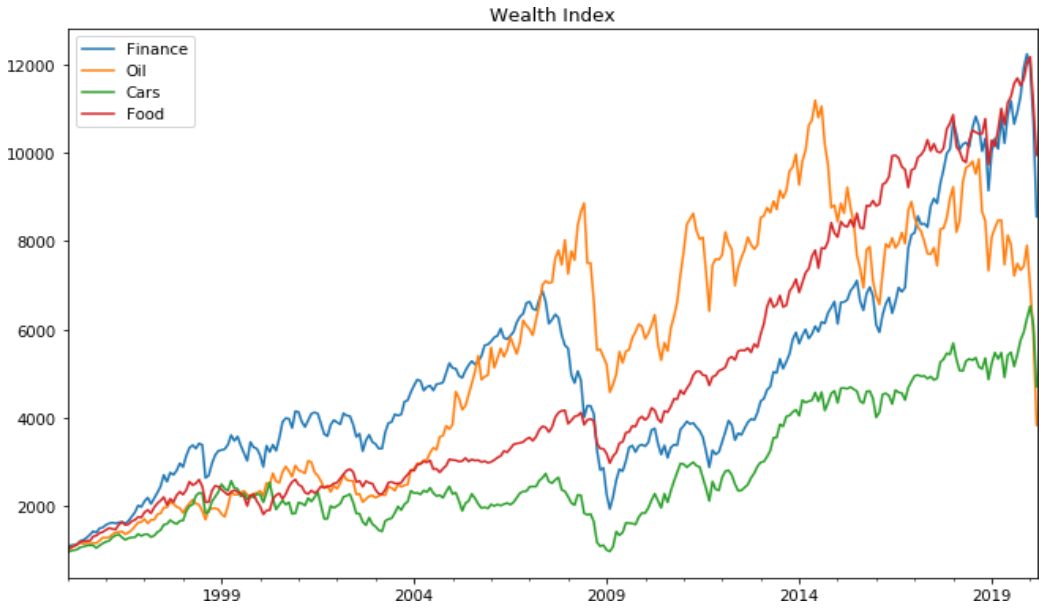
Analysis:

1- **Are returns Normal?** None of the industry returns are normally distributed as there is always a possibility of extreme returns. The test was done using the Jarque-Bera test.

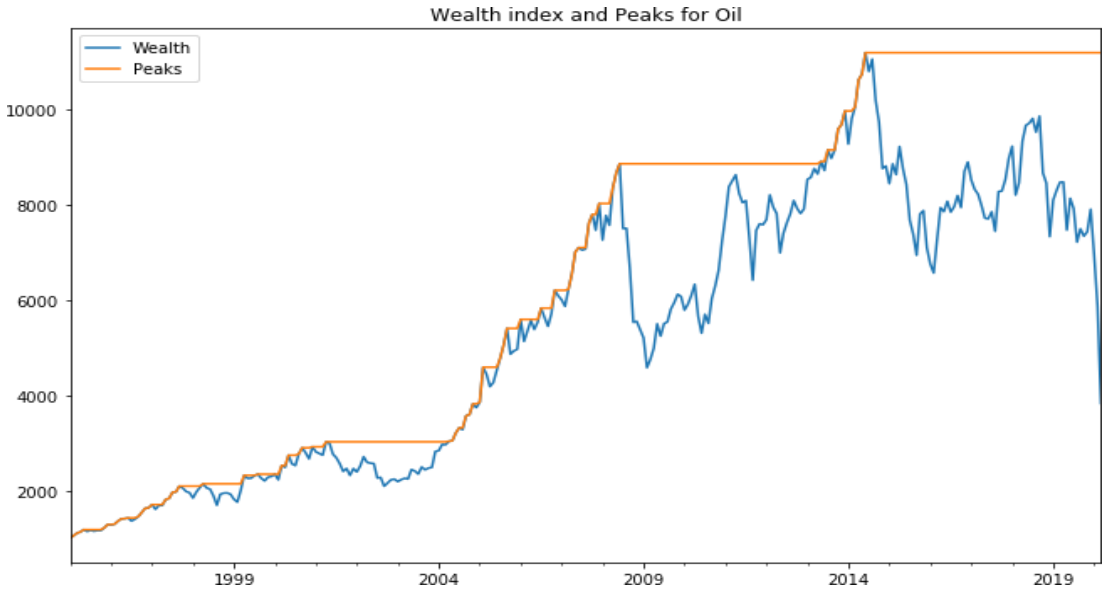
2- **Industry analysis and drawdowns:** Looking at the major statistics, Food has shown the biggest compound growth rate per year of 9.52% along with the lowest volatility (standard deviation). Standard deviation is, however, not a good indicator of non-Normal returns and therefore, I have calculated the VaR later on. It also has the highest Sharpe Ratio. Compare that with Oil, and we see the lowest compound return per year and highest volatility.

	Exp_Ret	Exp_Vol	Sratio
Food	1.095242	0.132162	7.351655
Oil	1.054612	0.214544	4.358352
Cars	1.063226	0.231198	4.077645
Finan	1.088716	0.197082	4.899718

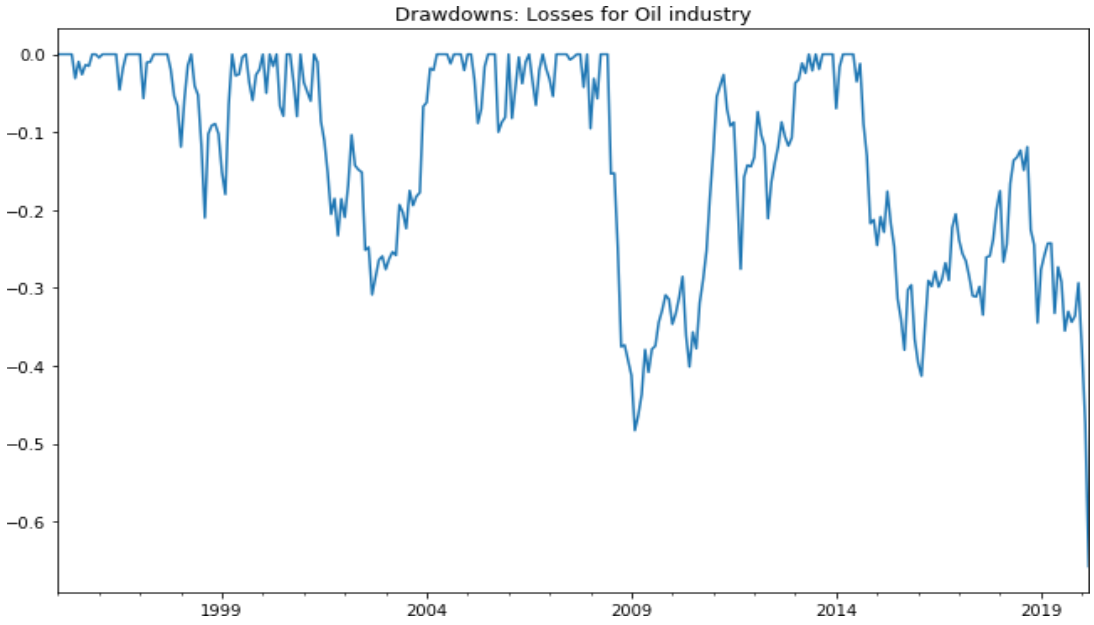
Food and Auto industries show relatively stable growth compared to Oil and Finance. The Finance industry had a big dip during the 2008 crash, while Oil has had major drawdowns during the 2008, 2016 and 2020 crashes.



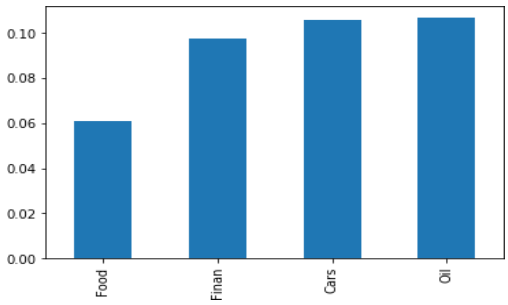
Looking at the graph down below for Oil, during the 2008 crash, it took the industry 5 years to recover to its previous level. When it crashed in 2016, it still has not recovered to it's previous peak, having been severely affected in 2019 again due to COVID-19.



Examining the drawdown effects in the Oil industry, we can see how it was affected during these crashes. The industry went close to 50% below its previous peak in 2008 and above 60% below its previous peak due to the COVID situation and the oil war between Saudi Arabia and Russia.



3- **Risk Analysis:** Since the returns are non-Normal, we cant find normal standard deviation or variance of the returns. We need to find Value at Risk (VaR) using the Cornish-Fisher Method. This has been done for a 95% confidence level. VaR for Oil is 10%. We can interpret this as saying: once we exclude the worst 5% outcomes, the maximum expected loss we can expect is 10% in a given month.



4- **Portfolio Optimization:** Using Mean-Variance Analysis, the solver suggests we invest everything in Oil which I feel is a bad decision, first of all because there is no diversification, and secondly, no investor would want to invest everything into Oil given the current market environment. This shows a purely quantitative approach is not the best idea. The Global Minimum Variance or the CPPI approach are better ways to do asset allocation; and Mean-Variance analysis is barely used in practice anymore as it is extremely sensitive to changes in model parameters. The quadratic program is:

$$min \sum_{i=1}^{n} . \sum_{k=1}^{n} . w_i . w_j . \sigma_{ij}$$

$$\sum_{i=1}^{n} . w_i = 1$$

$$\sum_{i=1}^{n} . r_i . \bar{w}_i = z$$

$$w_i > 0 \; for \; all \; i = 1, 2, \ldots . n$$

I have found the efficient frontier as well which shows the trade-off between risk and return. Anything on the curve is an efficient allocation, with investments towards the left most corner being the best as they show that you can get higher returns for the same amount of risk or lower risk for the same amount of return.