Portfolio Analysis

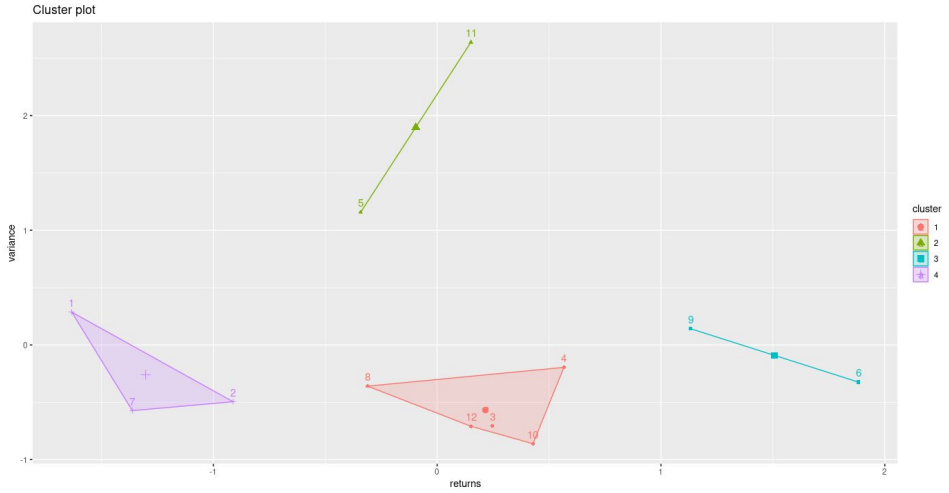
Rohan Pandit, Ekow Andoh, Nancy Jarman

Introduction

- Identify behavior, evaluate performance and predict stock prices with ml techniques
- Stock close prices from 12 companies
- Stock data from 2009 to 2019
- Assign weights to each stock

K-means Clustering

- Calculated the annual average returns and annual return variance of each stock
- Used silhouette method to find best number of clusters



	symbols	returns	variance	clusters$cluster
1	GE.Close	-1.6622714	728.3684	4
2	IBM.Close	2.0981530	385.4285	4
3	WMT.Close	8.1411734	292.8340	1
4	SPG.Close	9.8104529	516.9260	1
5	MS.Close	5.0727877	1110.2682	2
6	DIS.Close	16.6721013	460.5551	3
7	XOM.Close	-0.2498678	351.2173	4
8	CVX.Close	5.2315626	445.0435	1
9	JPM.Close	12.7647583	664.5505	3
10	JNJ.Close	9.0890094	224.4224	1
11	TMUS.Close	7.6432631	1761.2087	2
12	VZ.Close	7.6439272	291.2959	1

Performance Analytics

Compare portfolio performance to the S&P 500

Beta = 0.907

Alpha = -0.46

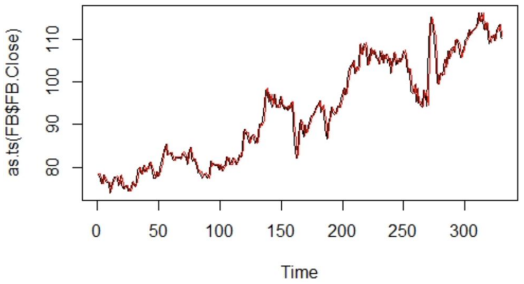
Sharpe Ratio = -0.145

Time-Series

- Used ARIMA model which is one of the most useful and accurate models in making predictions about future trends.

- Our objective is to forecast the entire returns series from breakpoint onwards
  - This initialized a series in which it stored the actual returns and another series to store the forecasted returns.

- So the ARIMA model fits the time series of the close price
- After the model is built, to forecast future stock prices, forecast.arima was used to
  - Predict the future price of stock
  - And stored our prediction in a variable, fit.forecast



Time Series Takeaways

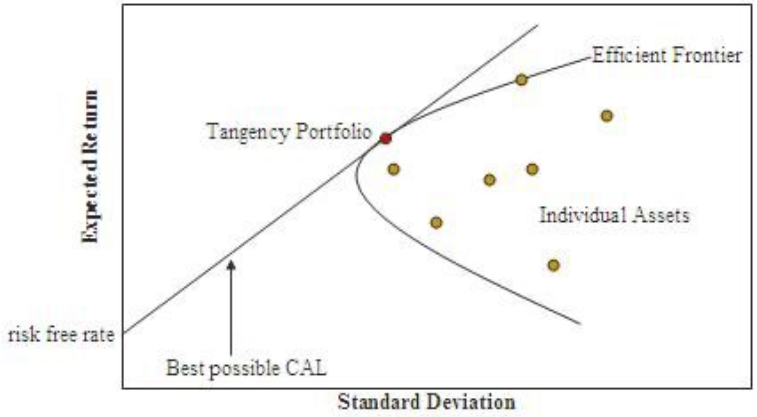
- We need to be careful when using this result as it is most likely dominated by a number of influential observations and is not reflective of the general trend.
- Our main source came from yahoo finance
  - Might not provide a comprehensive list of all important factors that took place over the past 10 years.
- There are limitations and shortcomings that can be improved on through our data collection and further analysis.

Portfolio Optimization

- After analyzing, we want to optimize our portfolio to have the highest expected return and lowest risk.
- This was accomplished using the PortfolioAnalytics library in R.
- We used the Efficient Frontier to analyze the risk-reward ratio.

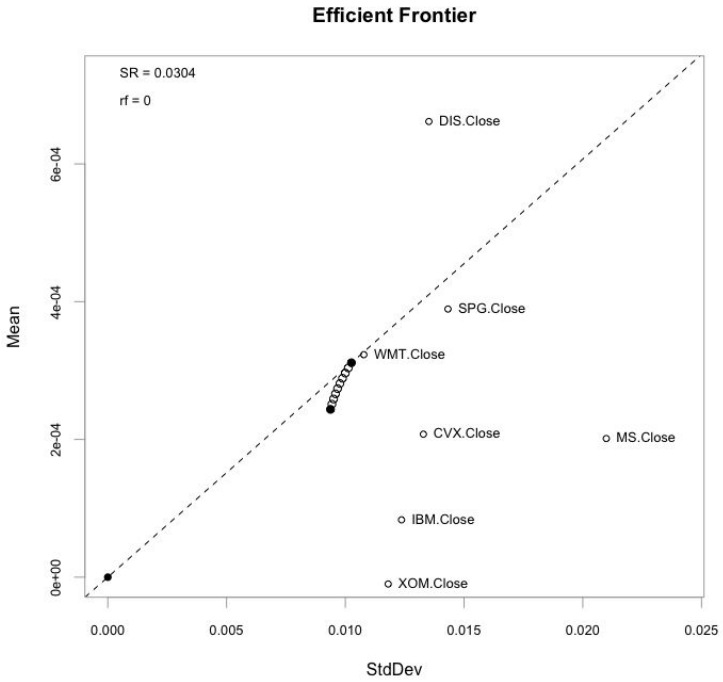
Efficient Frontier

- Introduced by Nobel Laureate Harry Markowitz,
- Common metric used by many investors to try and optimize a selected portfolio.
- Quantifies risk vs. return.
- Creates an optimal set of portfolios that give you the lowest level of risk for a selected value of expected return.
- Risk is shown on the x-axis, while the expected returns are shown on the y-axis.



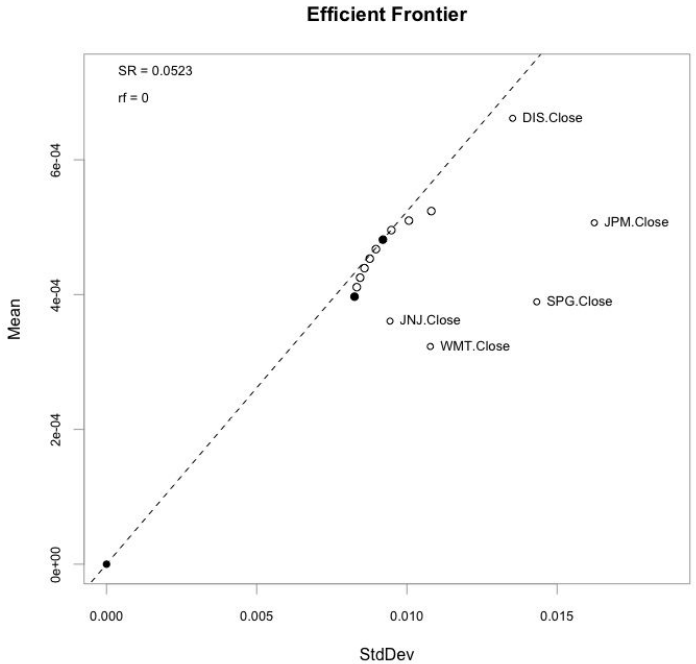
Initial Optimization

- Included all stocks
- Expected Return: 0.0003113
- Risk Factor: 0.01026
- Weights:
  - DIS: 0.3
  - GE, WMT, SPG, MS, CVX, IBM, XOM: 0.1
- Takeaways:
  - DIS -> highest performer -> highest weight
  - Many stocks in bottom right (high risk, low reward)
  - Can we do better?



Final Optimization

- Included only highest performing stocks (DIS, JPM, JNJ, SPG, WMT)
- Expected Return: 0.0005119
- Risk Factor: 0.01017
- Weights:
  - WMT: 0.1
  - SPG: 0.1
  - JNJ: 0.1825
  - JPM: 0.2175
  - DIS: 0.4
- Takeaways:
  - Higher performers given higher weights, like before (DIS highest, then JNJ and JPM, finally WMT and SPG)
  - Expected Return almost doubled (increased by factor of about 1.7)



Conclusions

- Portfolio did not perform well
- May be worthwhile to look into other stocks
- More weight should be allocated to WMT, DIS, JPM, JNJ, SPG