

Prediction of Stock Returns

FIN 6392 - Financial Technology and Blockchain
Project 1

Group Members

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Introduction

For the project, we chose three companies stocks whose headquarters are located near Dallas.

AT&T (Traded in NYSE, Ticker Symbol - T)

AT&T Inc. is an American multinational conglomerate, headquartered at Whitacre Tower in Downtown Dallas. It is the world's largest telecommunications company, the largest provider of mobile telephone services, and largest provider of fixed telephone services in United States. According to recent speculations, AT&T is close to announcing a deal to acquire Time Warner, a rough transaction of \$85 billion that would create world's largest entertainment company. The deal could be made public in coming days, according to a report from Reuters. The deal may come just 2 years after AT&T paid \$48.5 billion to acquire DirecTV, a satellite-TV provider that has been at the center of AT&T's efforts to offset a sluggish, though sprawling, telecom business. AT&T was prepared to pay \$110 per share for Time Warner, one of the world's largest media conglomerate which includes the Warner Bros. movie studio in Los Angeles, the Turner networks led by TBS and CNN, and a headquarters in New York where HBO is based. The deal will be structured in cash and stock, valued at 23% premium to its latest closing price.

Southwest Airlines (Traded in NYSE, Ticker Symbol - LUV)

Southwest Airlines Co. is a major commercial airlines company headquartered in Dallas, Texas. With latest issue of Boeing flights being grounded Southwest got a massive hit as the airlines majorly operates on Boeing 737 Max planes in its fleet. The grounding resulted in Southwest cancelling thousands of flights as it works with a smaller fleet than expected. According to the Southwest Airlines Pilots Association, the grounding led to lost wages of \$100 million for pilots. Southwest recently extended Max-related cancellations until February 2020, meaning the carrier will be hampered by the grounding well into the 2020 first quarter. The saga has had marked financial implications for Southwest with the company saying that the grounding had \$175 million impact on 2019 2nd quarter operating income. Southwest was downgraded from "buy" to "hold" by an investment bank based on speculation that it might look to solve its 737 Max issue through an acquisition. Southwest is famous for its all-737 fleet and if the grounding persists, it could be forced to buy another airline to add a mix of Airbus planes to existing fleet.

Exxon Mobil (Traded in NYSE, Ticker Symbol - XOM)

Exxon Mobil Corporation is an American multinational oil and gas corporation headquartered in Irving, Texas, and it is one of the largest of the world's Big Oil companies. In the first quarter of 2019, Exxon Mobil and Qatar Petroleum announced that they are making a big investment in American natural gas exports. The deal is designed in part to strengthen Qatar's ties with the United States nearly two years after Saudi Arabia and its allies launched a trade embargo against US. The companies said they would spend more than \$10 billion to turn Golden Pass, a terminal in Texas originally built to import gas, into an export hub for gas extracted from shale fields in Texas, New Mexico and elsewhere. Qatar Petroleum partnered up with Exxon Mobil so that a deeper push into the United States would give state-owned Qatar Petroleum, quicker and cheaper access to Latin America, freeing its domestic production to Asian markets.

Data and Charts

We extracted the below variables for the 3 stocks for a period from April 2014 to March 2019.

Data: Fundamentals

Extracted and used the following fundamentals in order to predict the returns on stocks. All variables are available on quarterly level and we have selected fundamental data points like Revenue, Capital Expenditures, Margin, Equity per Share, Dividend per Share, Cash Flow per Share, ROE, ROA, PB Ratio, PE Ratio, Equity to Assets Ratio, Debt to Equity Ratio, Dividend Pay Ratio.

Data: Daily Trading

Open, High, Low, Close and Adjusted prices for each day. Using the adjusted price, we have calculated the logarithmic Return for the stock when compared to the previous day. Using the Close price, we calculated few Technical Indicators like SMA(20), EMA(14), RSI(14) and MACD.

Charts: Bollinger Bands

Bollinger Band chart with confidence intervals, Relative Strength Index, Volume Traded and Moving Average Convergence Divergence. The moving average is important in understanding stocks technical charts. It smooths out daily price fluctuations by averaging stock prices and is effective in identifying potential trends. Bollinger Band chart plots two standard deviations away from moving average and is used to measure the stock's volatility. The Volume chart shows how its stocks are traded on the daily. The Moving Average Convergence Divergence gives technical analysts buy/sell signals. The thumb rule that everyone usually follow is, if it falls below line, it is time to sell, if it rises above the line, it is experiencing upward momentum.

Charts: Moving Average Convergence Divergence

In a moving average crossovers strategy two averages are computed, a slow moving average and a fast moving average. The difference between fast moving average and the slow moving average is called MACD line. And third average called signal line, a 9 day exponential moving average of MACD signal, is also computed. If the MACD line crosses above the signal line then it is a bullish sign and we go long. If MACD line crosses below the signal line then it is a bearish sign and we go short. We chose the closing prices of our stocks data to calculate the averages. One can choose varying parameters for fast, slow and signal averages depending upon the trading requirements. MACD is a function in quantmod that calculates the moving average convergence divergence, nFast is the fast moving average, nSlow is the slow moving average, maType indicates type of moving average. For our charts, we stick to the standard parameters like 12 days fast moving average, 26 days slow moving average and the simple moving average.

Charts: Candlesticks

Candlestick charts visually represent size of price moves to make trading decisions based on regularly occurring patterns that help forecast short term direction of the price. Patterns are separated into bullish and bearish. Bullish patterns indicate that price is likely to rise, while bearish patterns indicate that price is likely to fall. No pattern works always, as the candlestick patterns show tendencies in price movement and we can't make conclusions with guarantee.

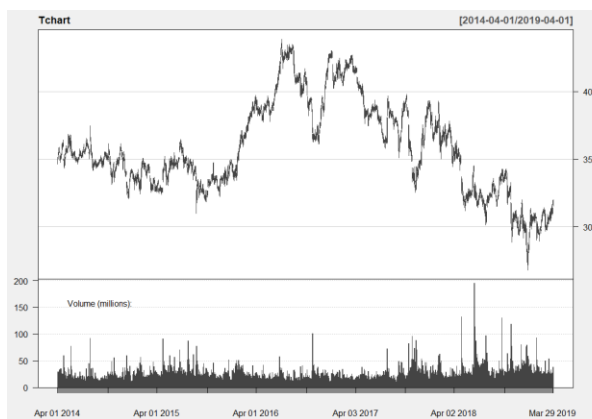
AT&T



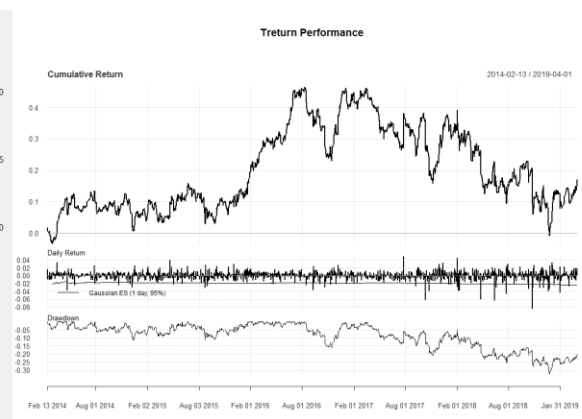
Bollinger Bands (BB)



Moving Average Convergence Divergence (MACD)

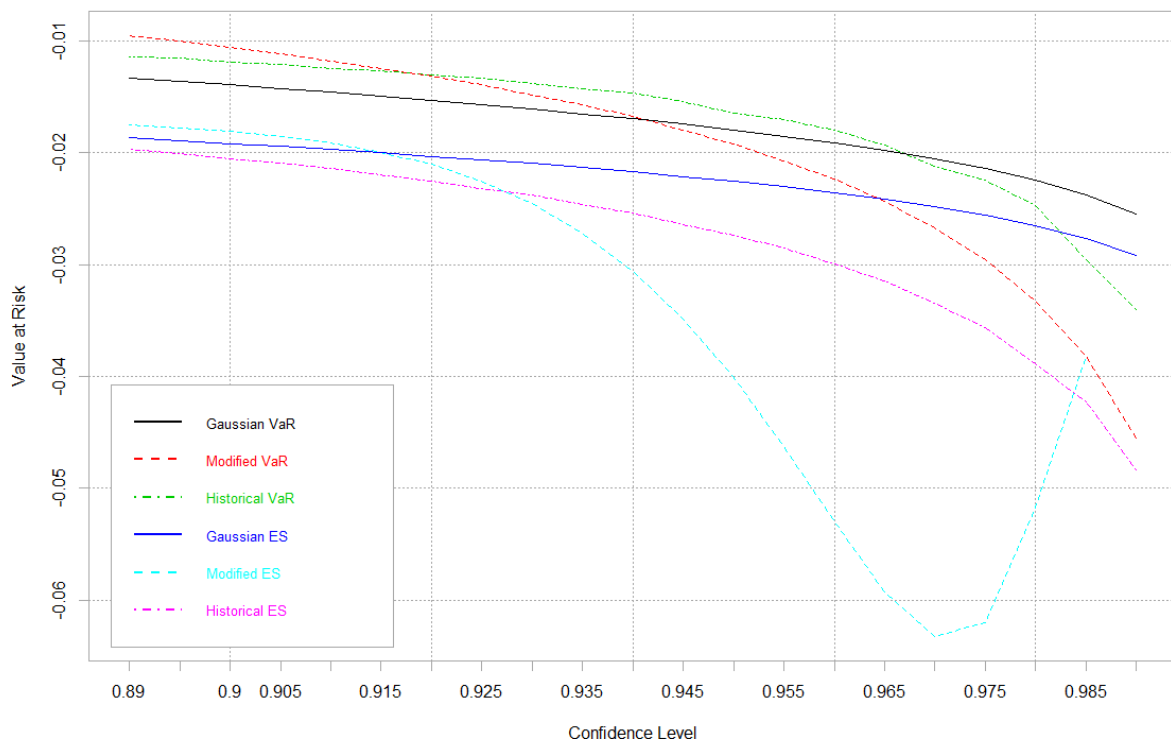


Candlesticks



Return Performance

Risk Confidence Sensitivity of Treturn



Alpha Model

```
Call:
lm(formula = logReturn ~ MarketReturn, data = att)

Residuals:
    Min       1Q   Median       3Q      Max
-0.067892 -0.004165  0.000047  0.005004  0.048670

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -8.171e-05  2.752e-04  -0.297   0.767
MarketReturn  6.224e-01  3.275e-02  19.008 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.009752 on 1256 degrees of freedom
Multiple R-squared:  0.2234,    Adjusted R-squared:  0.2228
F-statistic: 361.3 on 1 and 1256 DF,  p-value: < 2.2e-16
```

CAPM claims alpha close to 0 but generates negative alpha and beta equals 0.6224

Returns Prediction

```
Call:
lm(formula = logReturn_future ~ Close + logReturn + SMA20 + EMA14 +
    RSI14 + macd + signal + P.B.ratio + P.E.ratio + ROE + ROA +
    Dividend.payout.ratio + Long.term.debt.to.equity.ratio +
    Equity.to.assets.ratio, data = att)

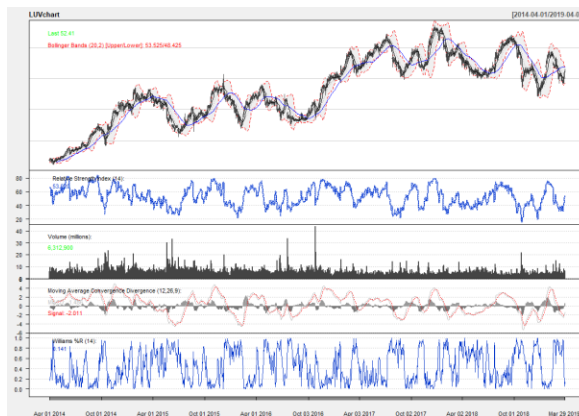
Residuals:
    Min       1Q   Median       3Q      Max
-0.083118 -0.005409  0.000408  0.005986  0.046288

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  3.145e-02  1.893e-02   1.661 0.096928 .
Close       -2.841e-03  1.775e-03  -1.600 0.109852
logReturn    4.201e-02  4.023e-02   1.044 0.296570
SMA20       -4.915e-03  4.801e-03  -1.024 0.306138
EMA14        6.943e-03  5.680e-03   1.222 0.221832
RSI14        7.643e-05  9.997e-05   0.765 0.444705
macd       -1.211e-03  1.381e-03  -0.877 0.380631
signal       6.034e-04  1.027e-03   0.587 0.556998
P.B.ratio    6.920e-03  3.062e-03   2.260 0.023998 *
P.E.ratio   -4.825e-05  6.939e-05  -0.695 0.486984
ROE         2.301e-02  9.074e-02   0.254 0.799872
ROA        -1.900e-01  3.033e-01  -0.626 0.531207
Dividend.payout.ratio -7.852e-03  2.189e-03  -3.588 0.000347 ***
Long.term.debt.to.equity.ratio  5.318e-03  5.503e-03   0.966 0.334058
Equity.to.assets.ratio -3.543e-02  4.224e-02  -0.839 0.401760
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01104 on 1243 degrees of freedom
Multiple R-squared:  0.01789,    Adjusted R-squared:  0.006826
F-statistic: 1.617 on 14 and 1243 DF,  p-value: 0.06811
```

Only fundamentals like P/B Ratio and Dividend Payout Ratio seem to be significant.

Southwest Airlines



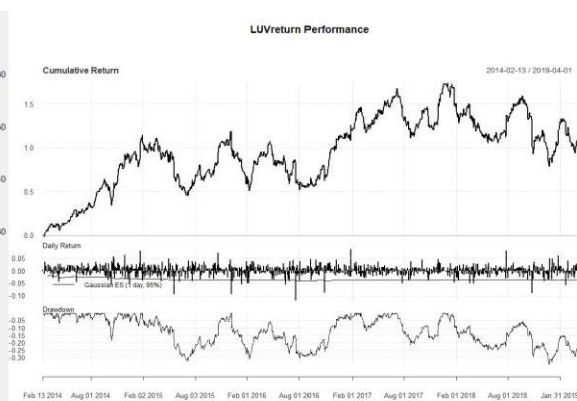
Bollinger Bands (BB)



Moving Average Convergence Divergence (MACD)

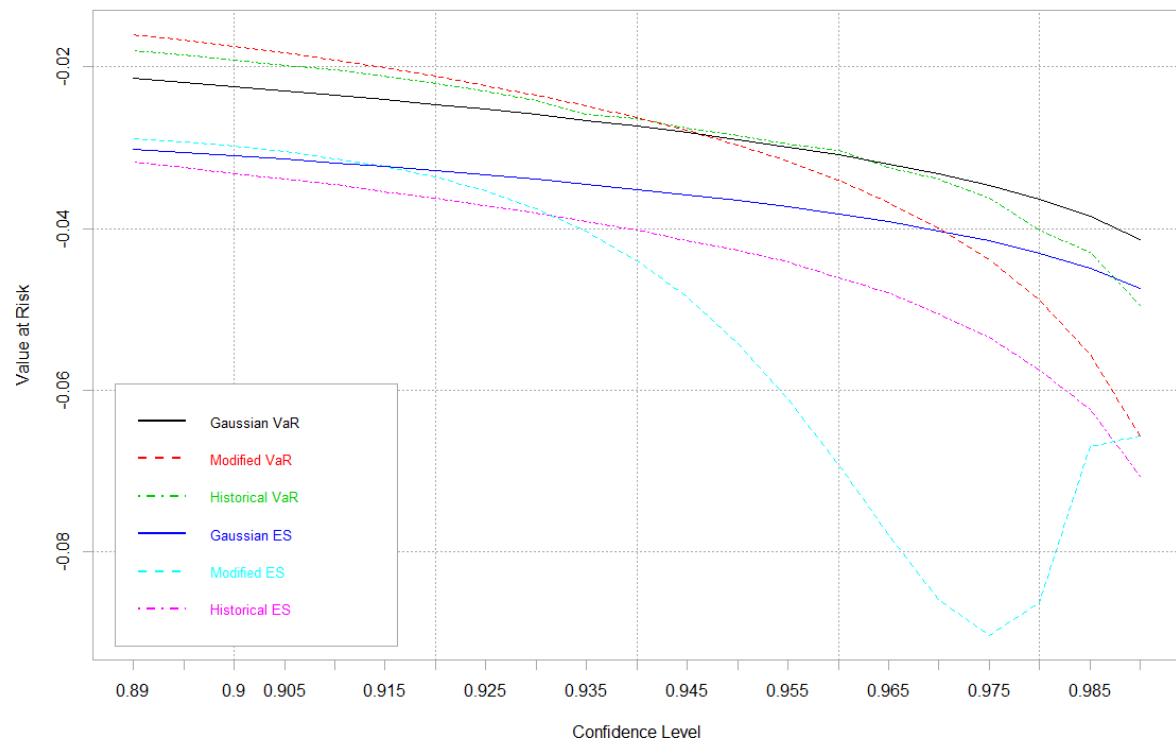


Candlesticks



Return Performance

Risk Confidence Sensitivity of LUVreturn



Alpha Model

```
call:
lm(formula = logReturn ~ MarketReturn, data = southwest)

Residuals:
    Min       1Q   Median       3Q      Max
-0.115435 -0.007574  0.000003  0.008430  0.086777

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.0003202  0.0004519   0.709   0.479
MarketReturn 1.0332775  0.0537773  19.214 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01602 on 1256 degrees of freedom
Multiple R-squared:  0.2272,    Adjusted R-squared:  0.2265
F-statistic: 369.2 on 1 and 1256 DF,  p-value: < 2.2e-16
```

CAPM claims alpha close to 0 but generates positive alpha and beta equals 1.0333

Returns Prediction

```
call:
lm(formula = logReturn_future ~ Close + logReturn + SMA20 + EMA14 +
    RSI14 + macd + signal + P.B.ratio + P.E.ratio + ROE + ROA +
    Dividend.payout.ratio + Long.term.debt.to.equity.ratio +
    Equity.to.assets.ratio, data = southwest)

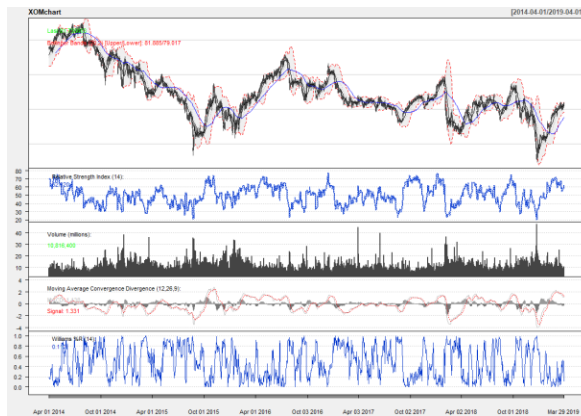
Residuals:
    Min       1Q   Median       3Q      Max
-0.117208 -0.008749  0.000324  0.010108  0.084124

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.0829391  0.0279340  -2.969 0.003044 **
Close        -0.0018130  0.0013124  -1.381 0.167394
logReturn     0.0194718  0.0392788   0.496 0.620169
SMA20        -0.0023729  0.0030345  -0.782 0.434376
EMA14         0.0031518  0.0038221   0.825 0.409745
RSI14         0.0001529  0.0001481   1.032 0.302264
macd         -0.0006997  0.0011404  -0.614 0.539637
signal        0.0006167  0.0008412   0.733 0.463615
P.B.ratio     0.0074388  0.0033565   2.216 0.026857 *
P.E.ratio     0.0000520  0.0003653   0.142 0.886820
ROE          -0.0491219  0.0996881  -0.493 0.622272
ROA           0.5435166  0.2392311   2.272 0.023261 *
Dividend.payout.ratio 0.4044336  0.1039443   3.891 0.000105 ***
Long.term.debt.to.equity.ratio 0.0377001  0.0348159   1.083 0.279088
Equity.to.assets.ratio 0.0054857  0.0561223   0.098 0.922150
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01804 on 1243 degrees of freedom
Multiple R-squared:  0.02948,    Adjusted R-squared:  0.01855
F-statistic: 2.697 on 14 and 1243 DF,  p-value: 0.0006472
```

Only fundamentals like P/B Ratio, ROA and Dividend Payout Ratio seem to be significant.

Exxon Mobil



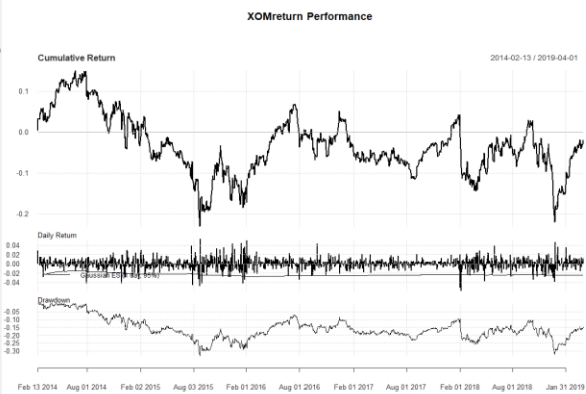
Bollinger Bands (BB)



Moving Average Convergence Divergence (MACD)

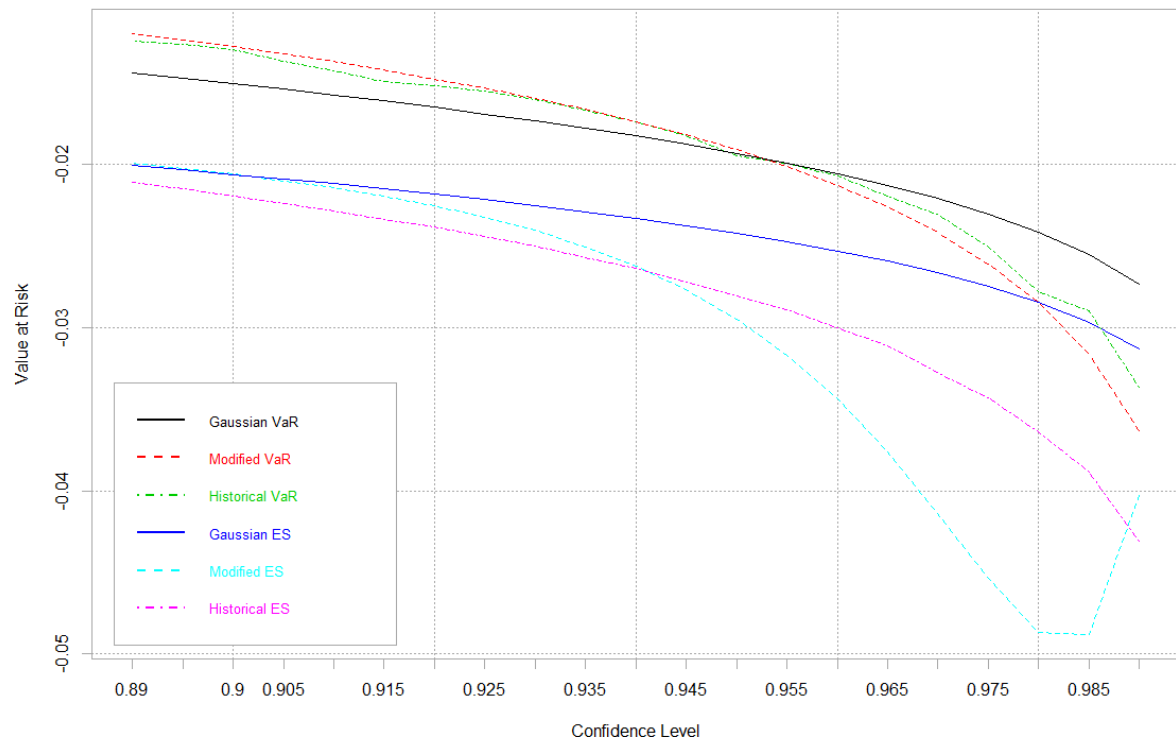


Candlesticks



Return Performance

Risk Confidence Sensitivity of XOMreturn



Alpha Model

```
call:
lm(formula = logReturn ~ MarketReturn, data = exxon)

Residuals:
    Min       1Q   Median       3Q      Max
-0.044471 -0.004900 -0.000157  0.005037  0.046599

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.0003101  0.0002529  -1.226    0.22
MarketReturn  0.9134006  0.0300999  30.346 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.008964 on 1256 degrees of freedom
Multiple R-squared:  0.423,    Adjusted R-squared:  0.4226
F-statistic: 920.9 on 1 and 1256 DF,  p-value: < 2.2e-16
```

CAPM claims alpha close to 0 but generates negative alpha and beta equals 0.9134

Returns Prediction

```
call:
lm(formula = logReturn_future ~ Close + logReturn + SMA20 + EMA14 +
    RSI14 + macd + signal + P.B.ratio + P.E.ratio + ROE + ROA +
    Dividend.payout.ratio + Long.term.debt.to.equity.ratio +
    Equity.to.assets.ratio, data = exxon)

Residuals:
    Min       1Q   Median       3Q      Max
-0.055131 -0.005747  0.000182  0.006476  0.048335

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  4.197e-02  3.796e-02   1.106  0.26901
Close       -8.880e-04  6.552e-04  -1.355  0.17556
logReturn    2.166e-03  4.050e-02   0.053  0.95736
SMA20        2.904e-03  2.029e-03   1.431  0.15256
EMA14       -2.820e-03  2.392e-03  -1.179  0.23874
RSI14        1.474e-04  8.636e-05   1.707  0.08814 .
macd         1.478e-03  1.391e-03   1.062  0.28827
signal      -4.020e-04  1.060e-03  -0.379  0.70470
P.B.ratio    1.994e-02  6.257e-03   3.186  0.00148 **
P.E.ratio   -5.335e-05  1.123e-04  -0.475  0.63492
ROE         -4.990e-01  3.526e-01  -1.415  0.15730
ROA          1.189e+00  6.645e-01   1.790  0.07372 .
Dividend.payout.ratio  1.105e-02  5.513e-03   2.004  0.04527 *
Long.term.debt.to.equity.ratio -4.624e-03  3.075e-02  -0.150  0.88048
Equity.to.assets.ratio -7.740e-02  6.892e-02  -1.123  0.26164
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

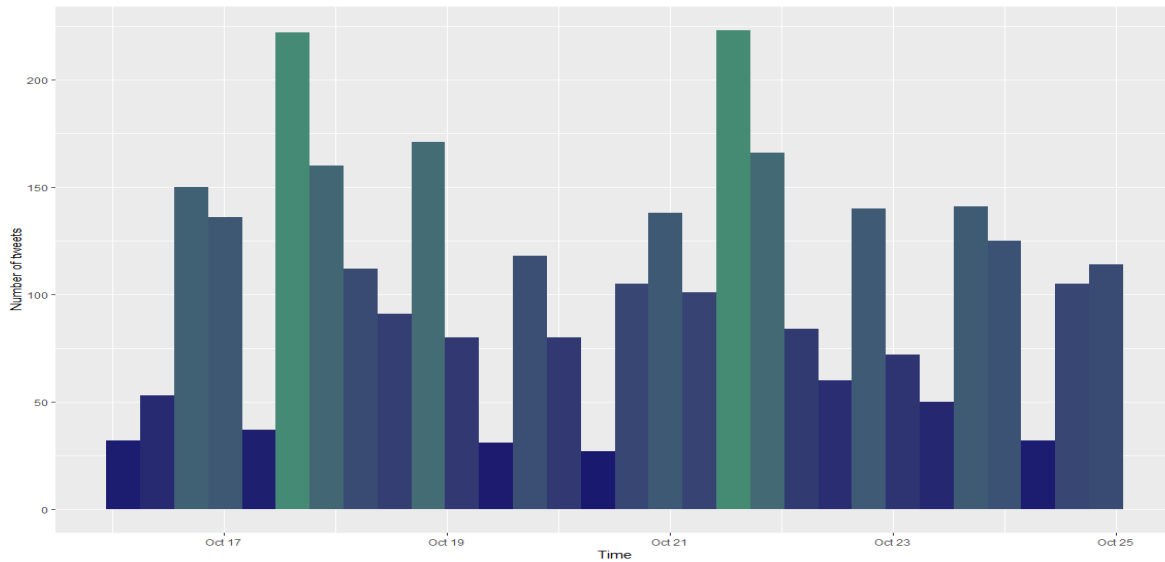
Residual standard error: 0.01166 on 1243 degrees of freedom
Multiple R-squared:  0.03532,    Adjusted R-squared:  0.02446
F-statistic: 3.251 on 14 and 1243 DF,  p-value: 4.212e-05
```

Only fundamentals like P/B Ratio and Dividend Payout Ratio seem to be significant.

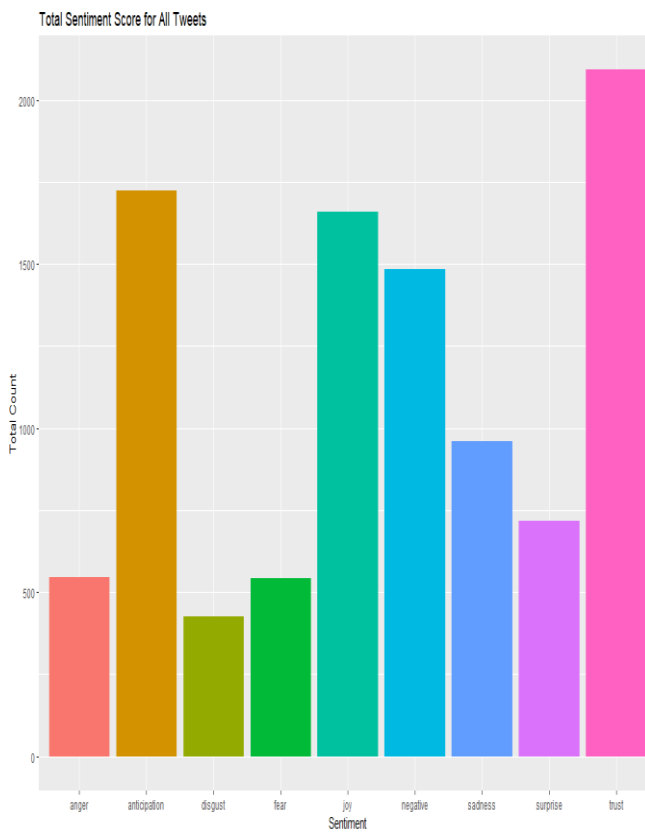
Twitter Sentimental Analysis

We were only able to retrieve one week of data from twitter so conducted the analysis without including it in the original dataset with fundamentals and daily trading

LUV – Southwest Airlines



LUV_senti_category		
Negative	Neutral	Positive
2416	1654	5018



Performance Analytics

Portfolio Risk: Standard deviations and covariances of each stock in portfolio are calculated

	AT&T	Southwest	Exxon
SD	0.1751	0.2872	0.1868

$\text{Cov}(T, \text{LUV}) = 0.0104$, $\text{COV}(\text{LUV}, \text{XOM}) = 0.0121$, $\text{COV}(T, \text{XOM}) = 0.0101$

Asset allocation: Aim of diversification is to avoid each extreme, allowing investors to achieve high returns while reducing volatility along the way and making it unlikely that they will suffer from a permanent loss of capital. The primary means of accomplishing this is through asset allocation, the practice of dividing investment money into different classes of assets. Such as stocks, bonds, real estate, and cash that will act independently of each other. Some more exotic asset classes include cryptocurrencies, gold, fine art, commodities, and much more. The best way to allocate assets in the portfolio is largely a personal choice, dependent upon many factors including age, risk tolerance, and financial goals. Our own personal situation plays a huge role too. Each individual investment policy and portfolio asset allocation will be unique. It will be based on one's situation, needs today and in the future, and ability to stay the course during adverse market conditions. Monitoring and adjusting is an important part. In other words, there is no perfect asset allocation, there is only a perfect asset allocation for an individual. And not only is asset allocation personal, but it is also dynamic. It changes over time as our age, our financial situation changes, and our goals keep evolving.

Information Ratio (IR) is calculated for each stock with benchmark as market return i.e., GSPC

AT&T : -0.3662

Southwest : 0.20883 – has the better value of IR in the portfolio

Exxon Mobil : -0.66777

Value at Risk

AT&T – 5% chance of losing \$179.64 over the next day with \$10K position

Southwest – 5% chance of losing \$290.20 over the next day with \$10K position

Exxon Mobil – 5% chance of losing \$193.05 over the next day with \$10K position

Expected Shortfall

T – 5% chance the losses exceed VaR, and when it occurs, on average, then loss is \$229.403

LUV – 5% chance the losses exceed VaR, and when it occurs, on average, then loss is \$380.5

XOM – 5% chance the losses exceed VaR, and when it occurs, on average, then loss is \$243.31

	AT&T	Southwest	Exxon Mobil
Annualized Return	0.031224	0.1547738	-0.003788
Max Drawdown	0.323526	0.3478414	0.3300986
Sharpe Ratio	0.178284	0.5389614	-0.020277
Value at Risk	-0.01796	- 0.029008	-0.019298
Kelly Ratio	0.7527922	1.124076	0.195798

After a lot of consideration, weights are given as follows for each individual stock

AT&T: 0.20, Southwest: 0.30, Exxon Mobil: 0.50. Using these constraints, Portfolio Risk = 0.155