

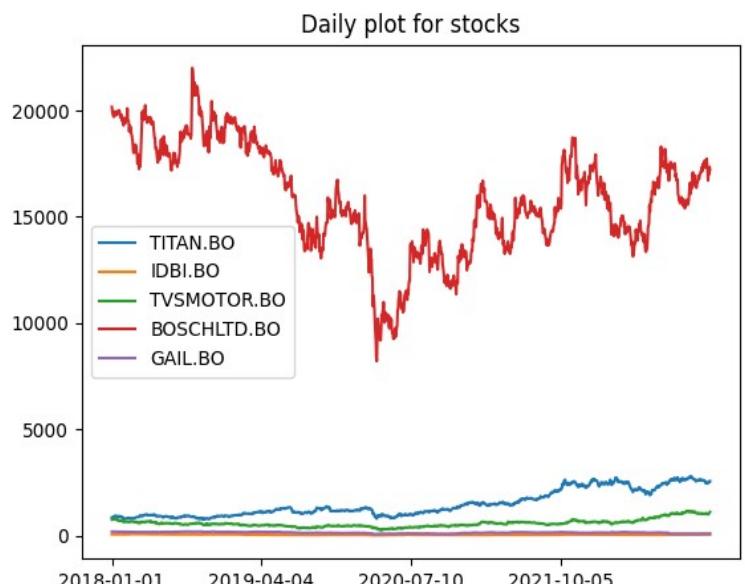
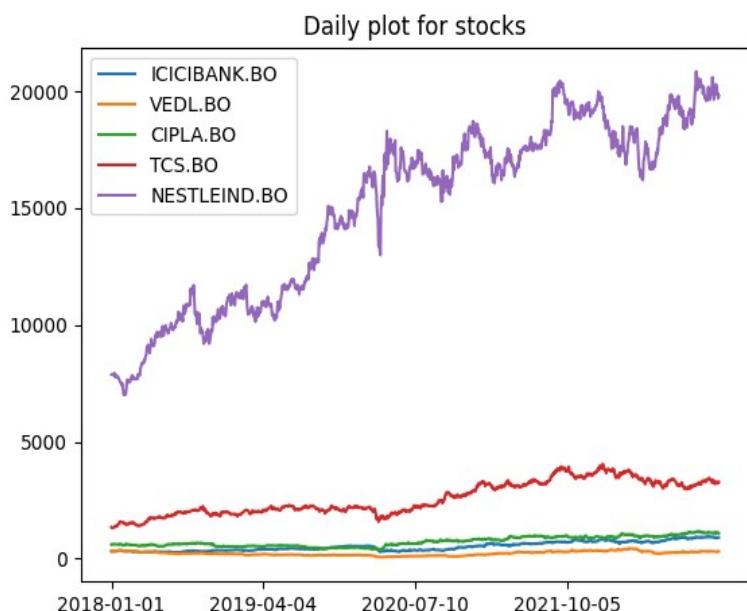
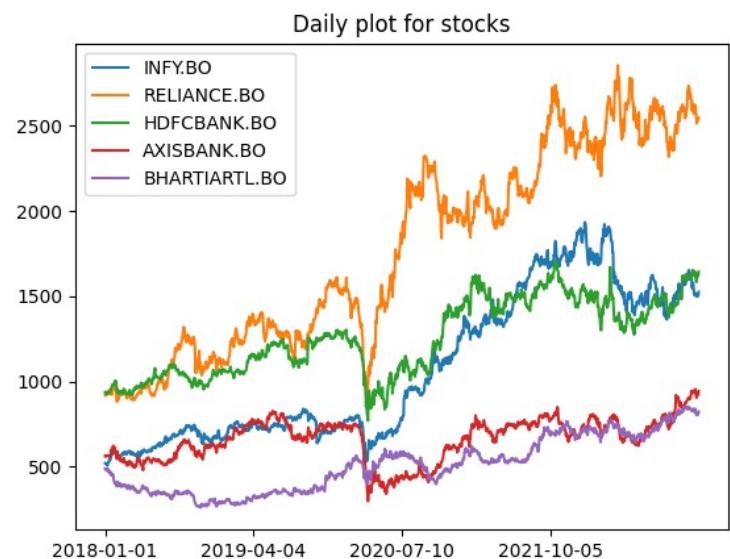
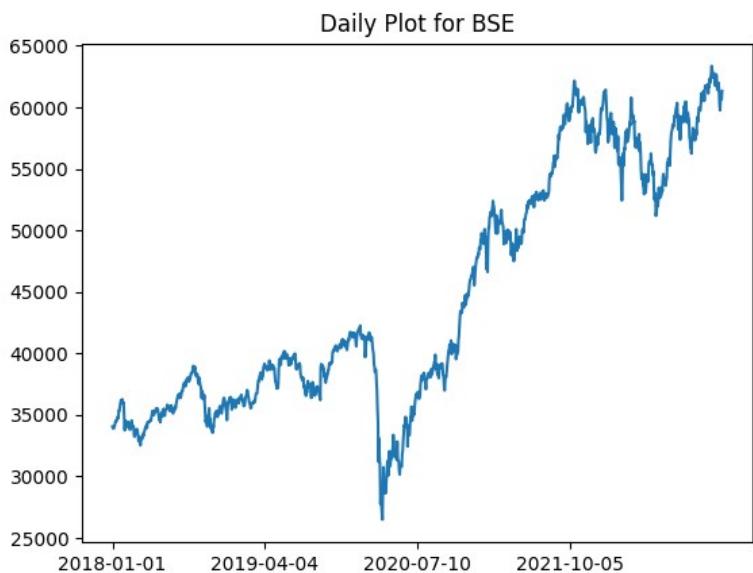
MA374 Financial Engineering Lab

Assignment - 6

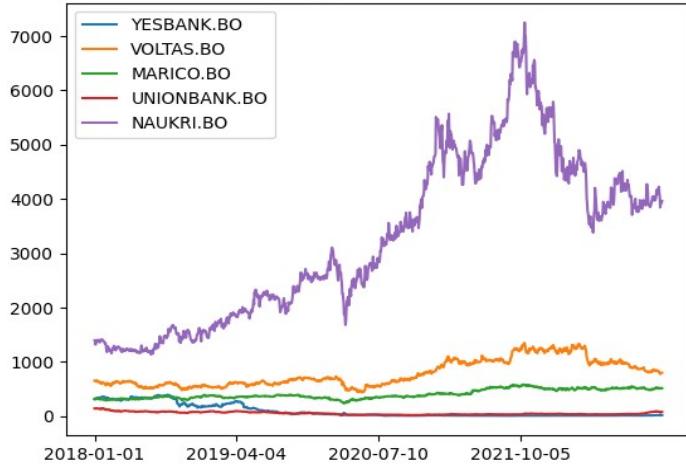
Name - Shivendu Mishra
Roll Number - 200123050
email - m.shivendu@iitg.ac.in

Question - 1

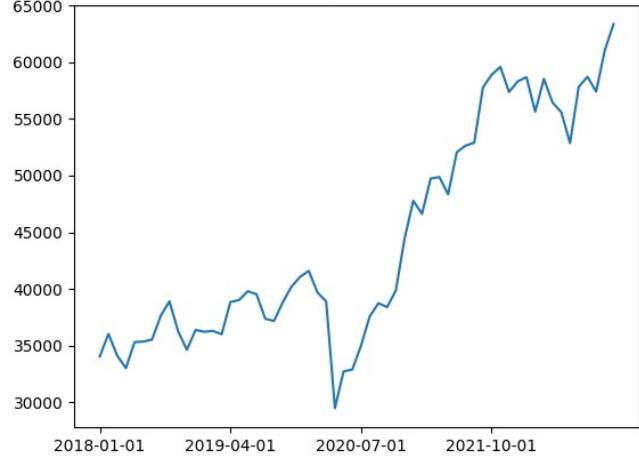
Below are the screenshots of the stock prices and index values for the given period . Note that I have plotted five stocks at once in order to reduce the number of plots:-



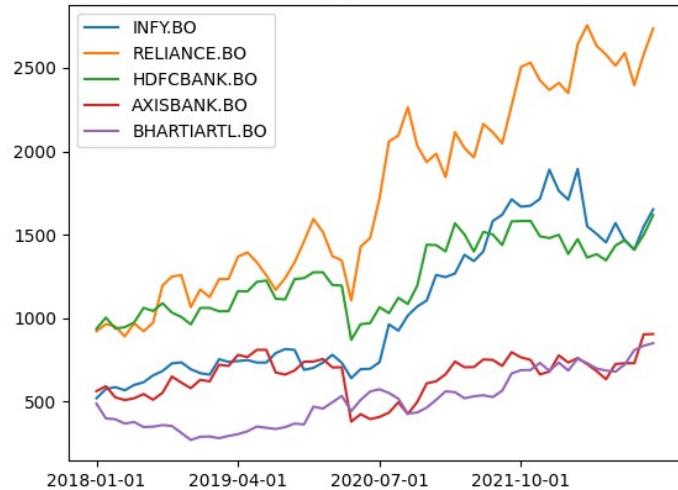
Daily plot for stocks



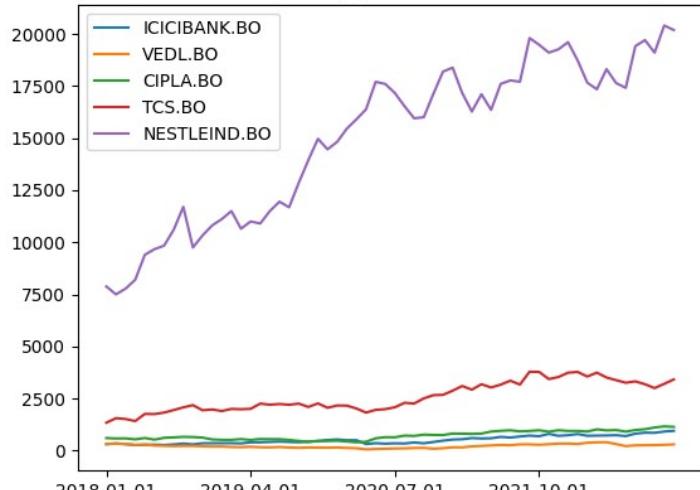
Monthly Plot for BSE



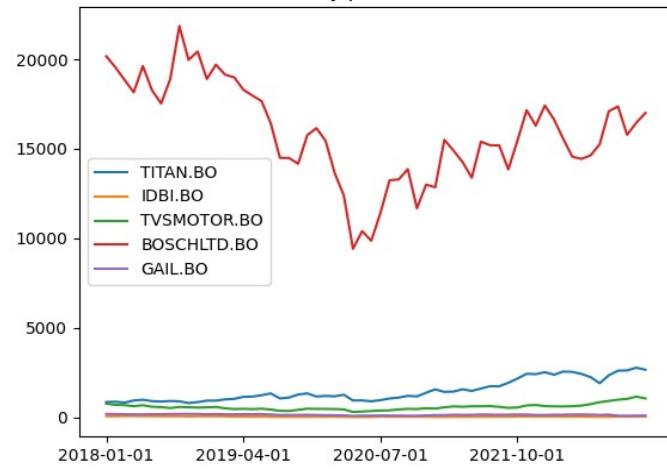
Monthly plot for stocks



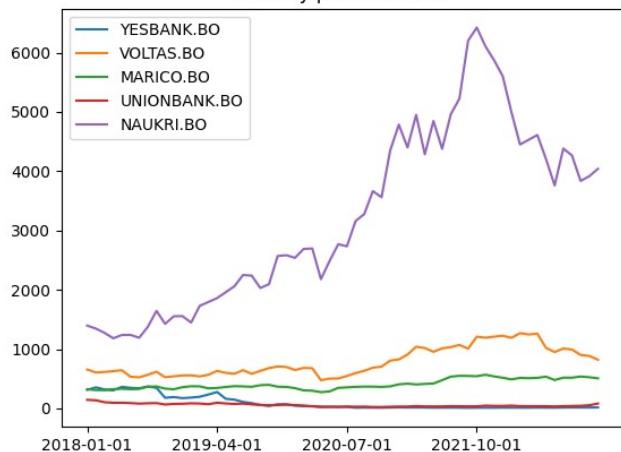
Monthly plot for stocks



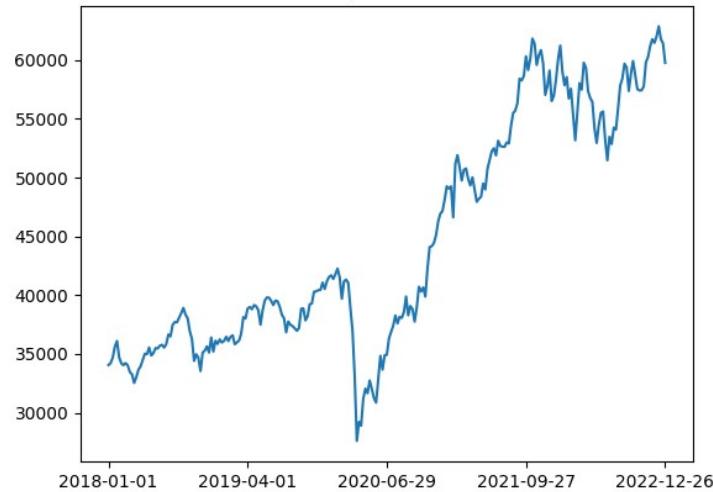
Monthly plot for stocks



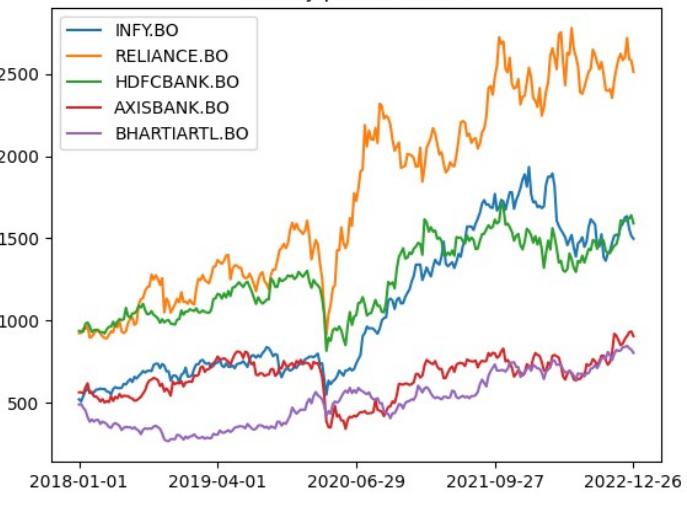
Monthly plot for stocks



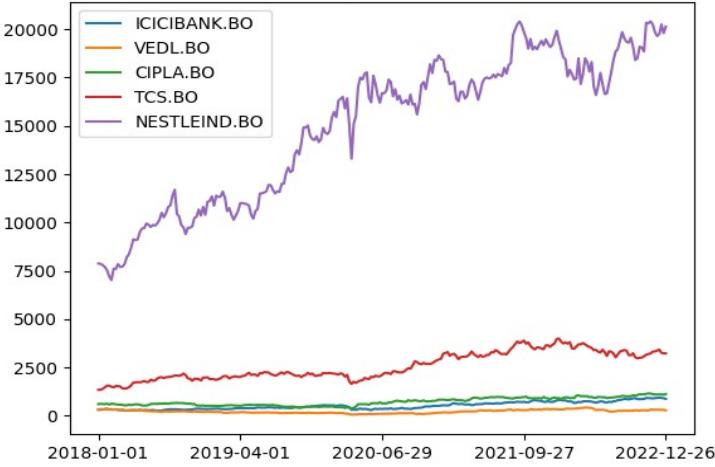
Weekly Plot for BSE



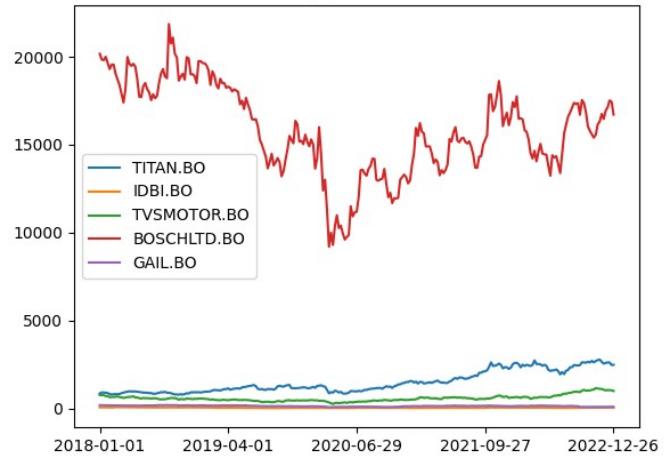
Weekly plot for stocks



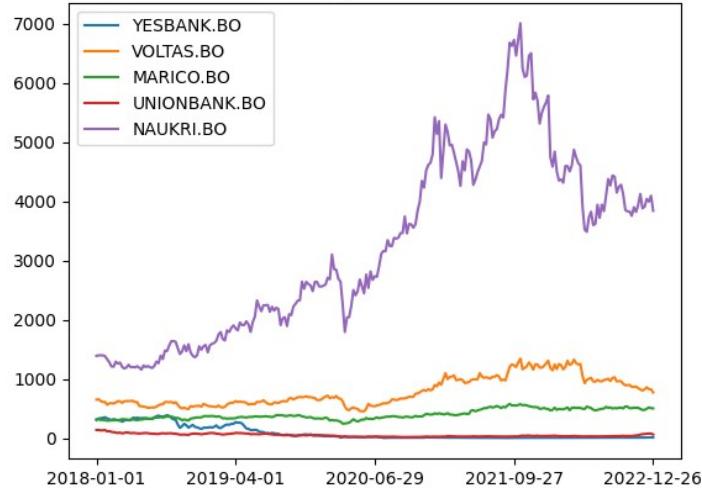
Weekly plot for stocks



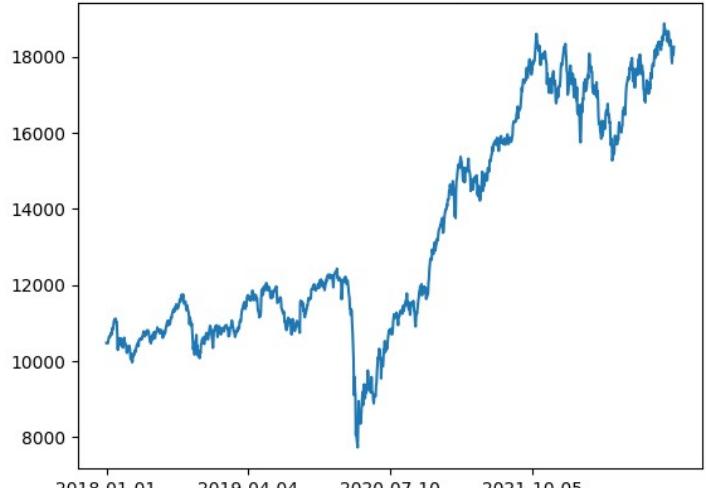
Weekly plot for stocks



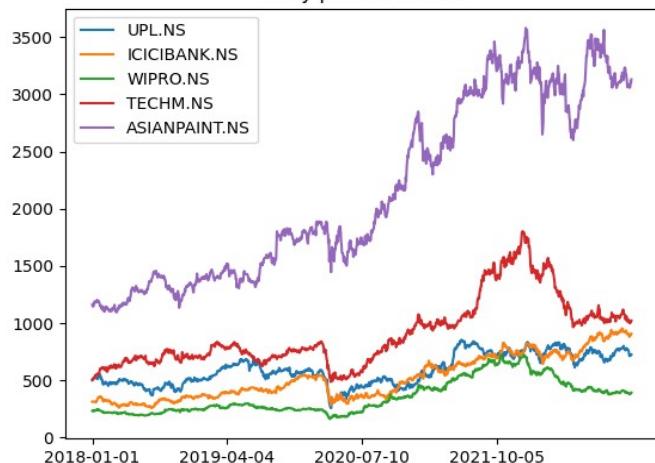
Weekly plot for stocks



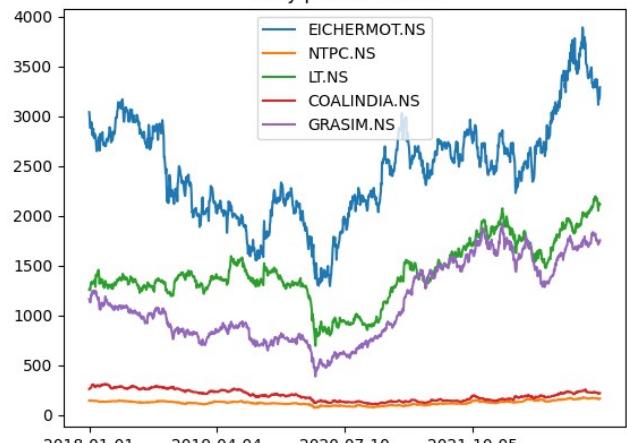
Daily PPlot for Nifty30



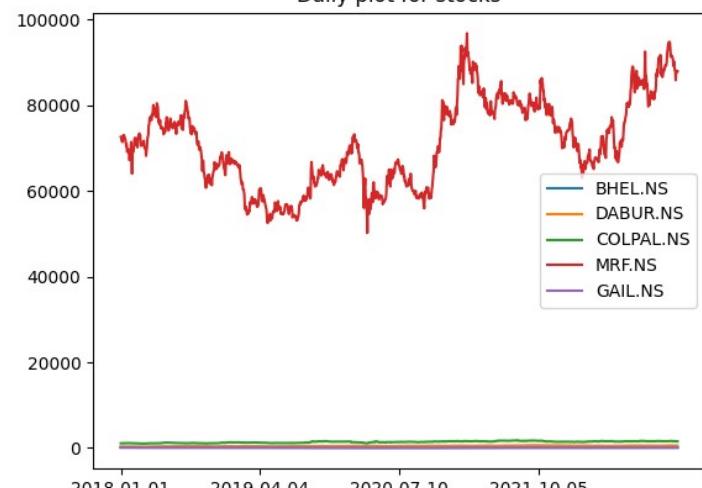
Daily plot for stocks



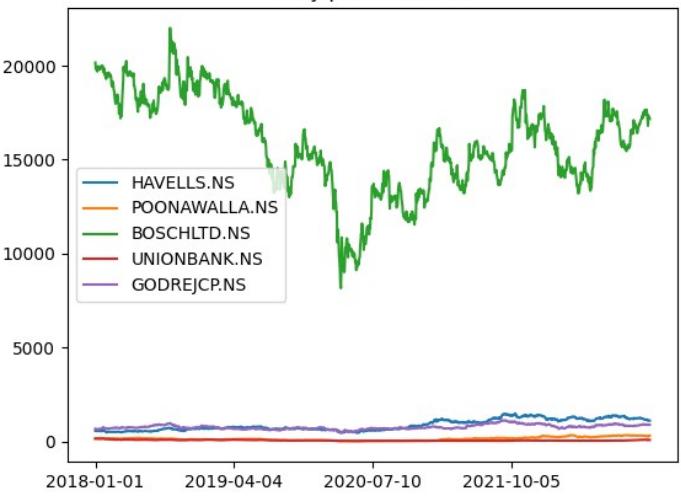
Daily plot for stocks



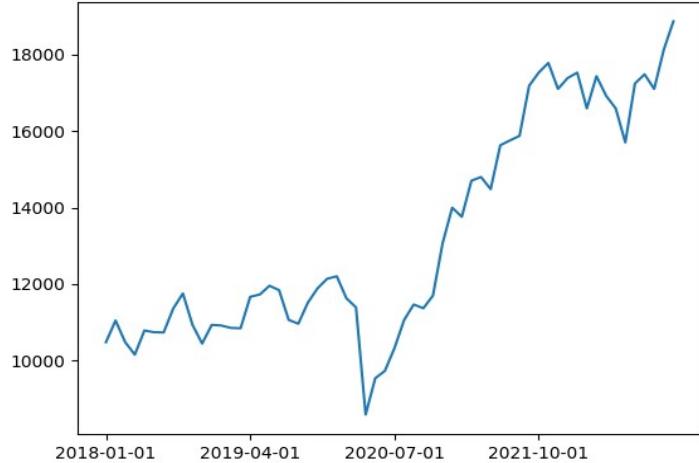
Daily plot for stocks



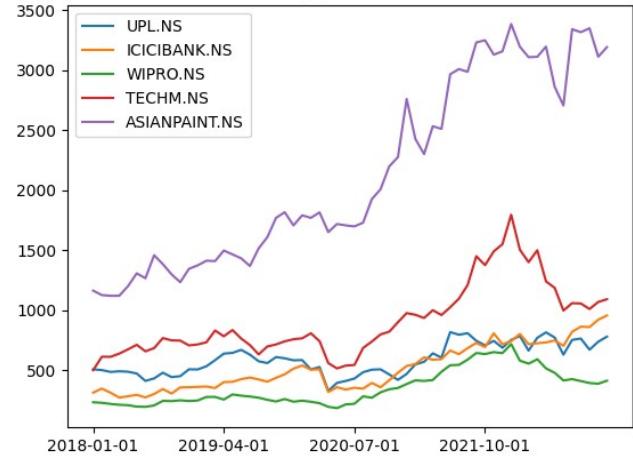
Daily plot for stocks



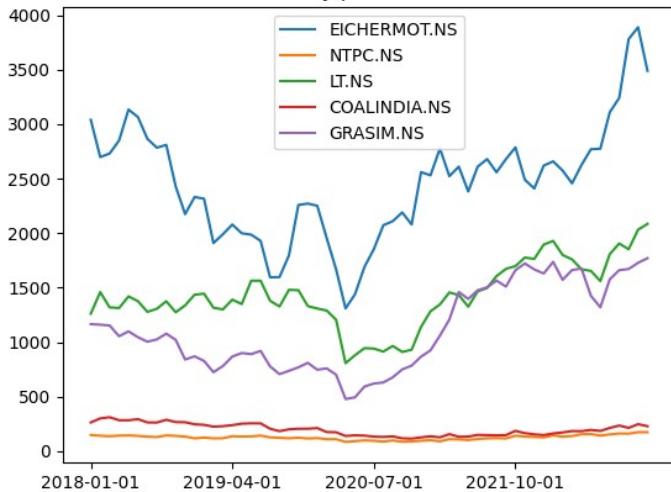
Monthly PPlot for Nifty30



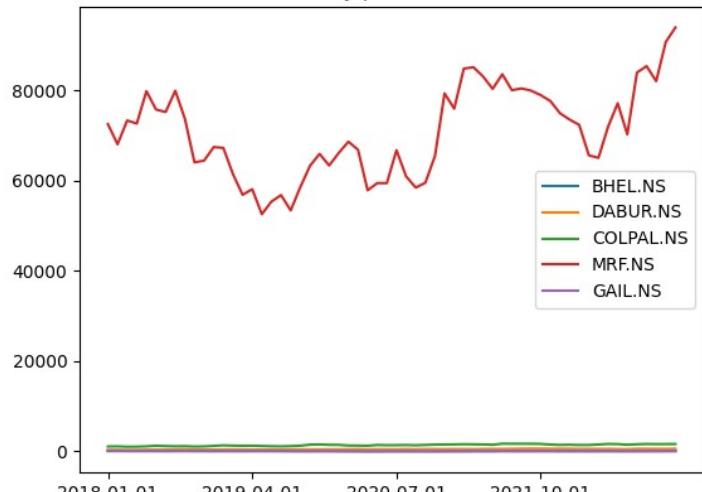
Monthly plot for stocks



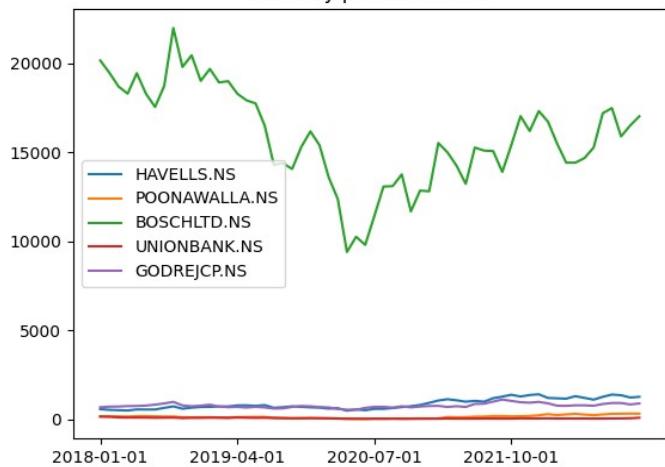
Monthly plot for stocks



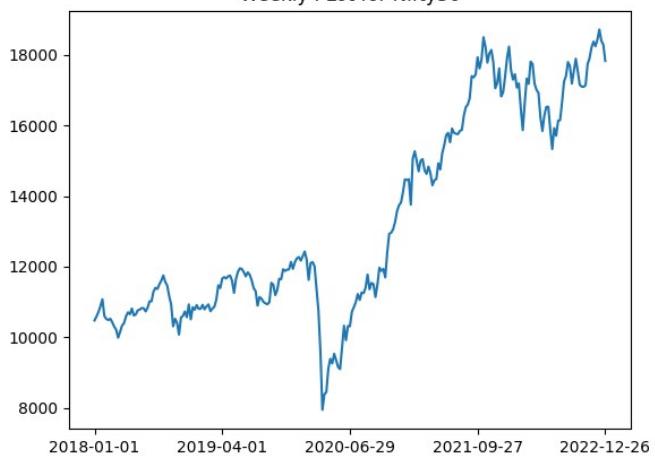
Monthly plot for stocks



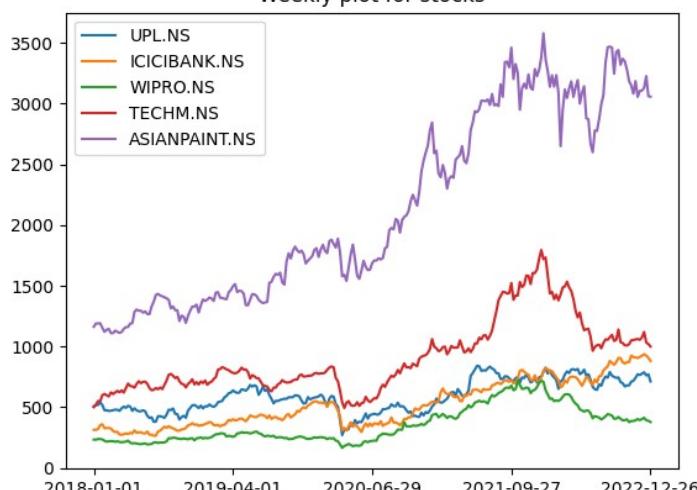
Monthly plot for stocks



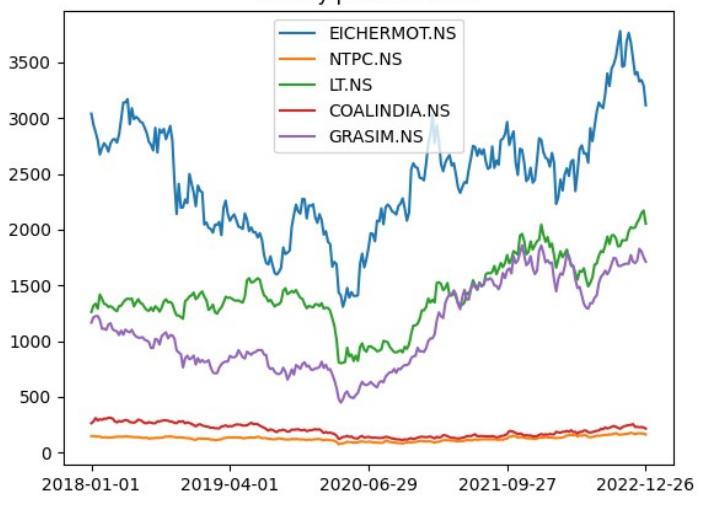
Weekly PPlot for Nifty30



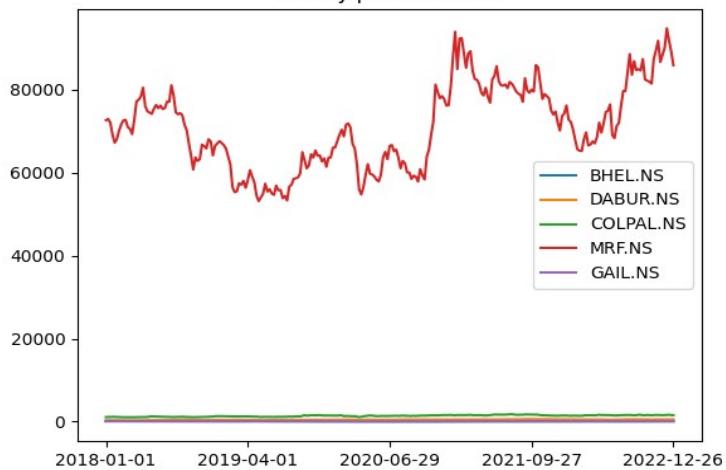
Weekly plot for stocks



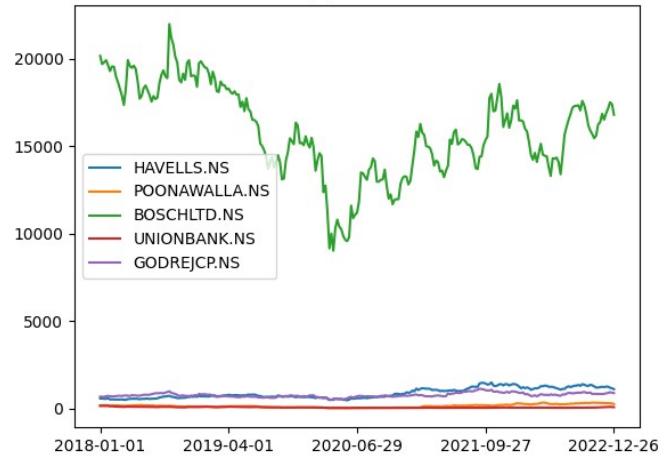
Weekly plot for stocks



Weekly plot for stocks



Weekly plot for stocks



Question - 2

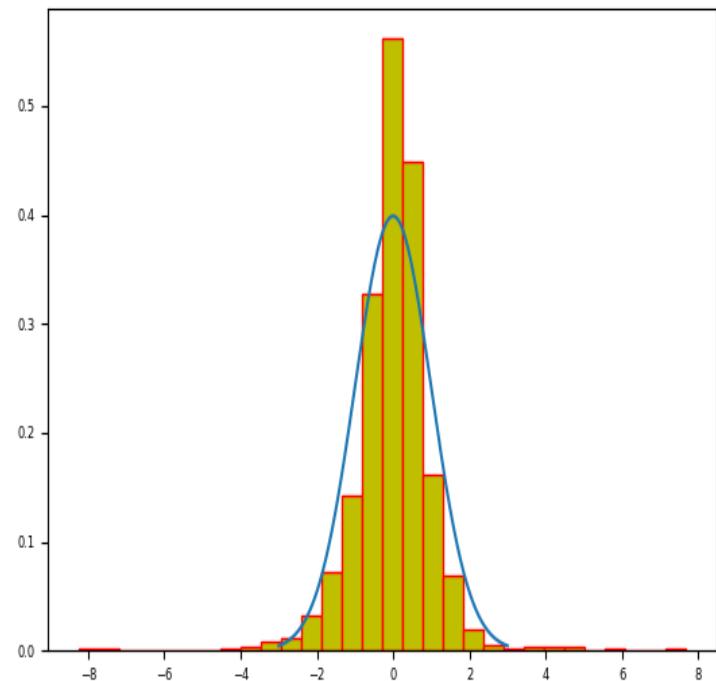
Histograms of Normalized Returns

The screenshots of the plots of histograms of normalized returns

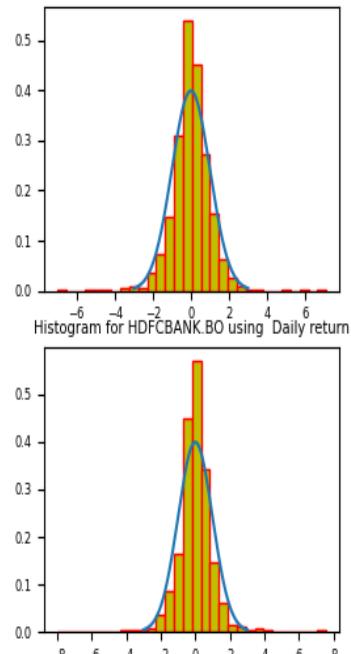
$\hat{R}_i = \frac{R_i - \mu}{\sigma}$ are given below. They are also superimposed with the pdf of $N(0,1)$ curve . Moreover the histogram is Normalized such that the area under it is 1:-

Daily Returns for bsedata1

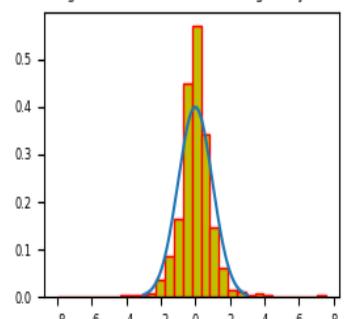
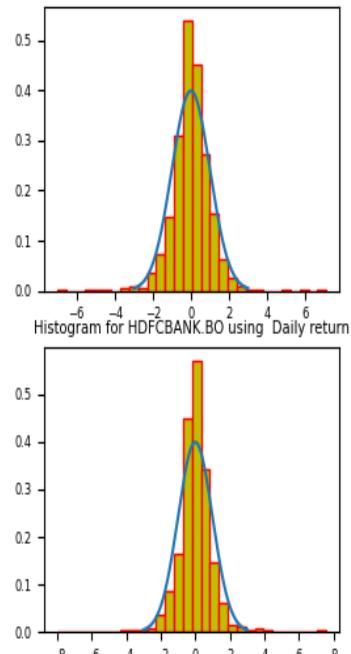
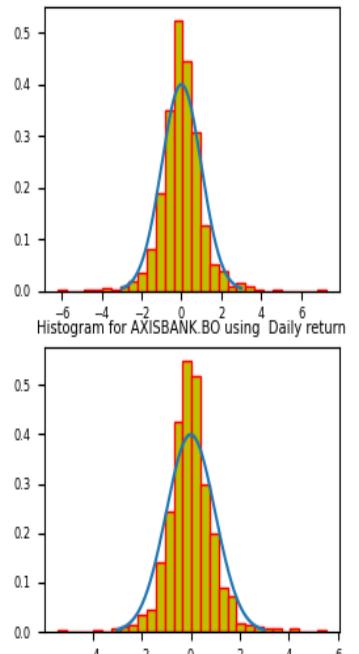
Histogram for Sensex using Daily return



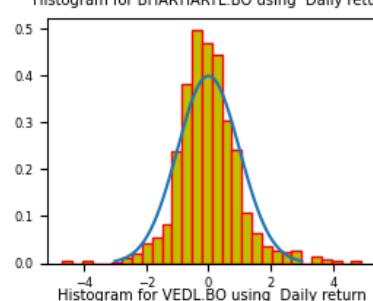
Histogram for INFY.BO using Daily return



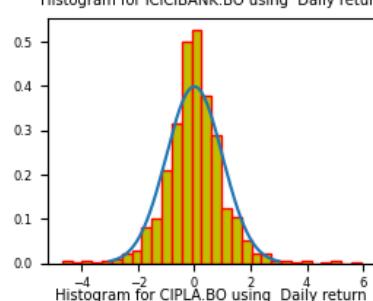
Histogram for RELIANCE.BO using Daily return



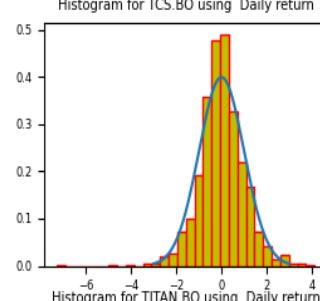
Histogram for BHARTIARTL.BO using Daily return



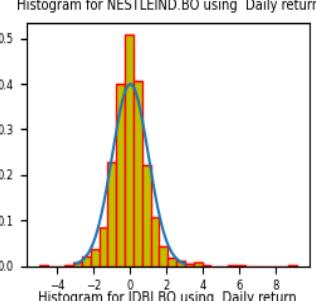
Histogram for ICICIBANK.BO using Daily return



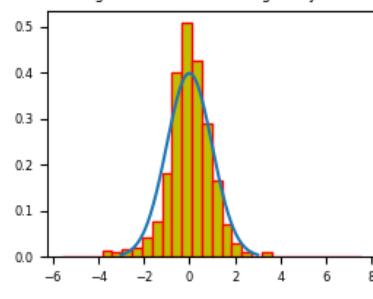
Histogram for TCS.BO using Daily return



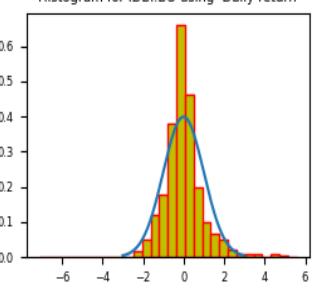
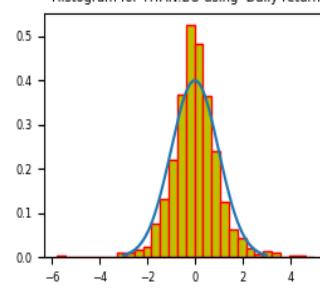
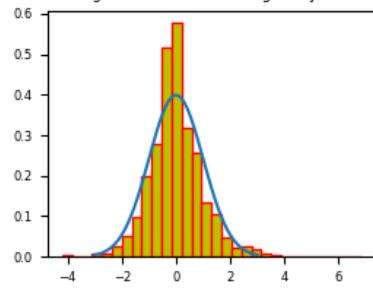
Histogram for NESTLEIND.BO using Daily return



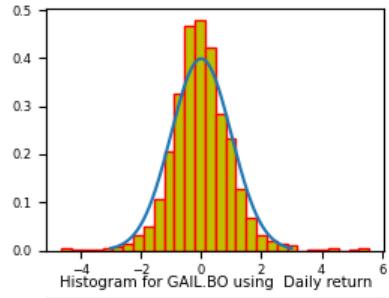
Histogram for VEDL.BO using Daily return



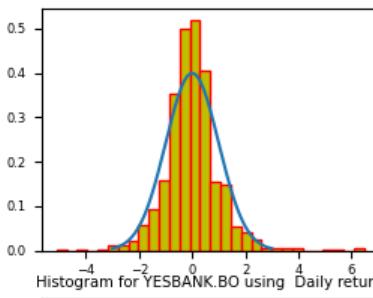
Histogram for CIPLA.BO using Daily return



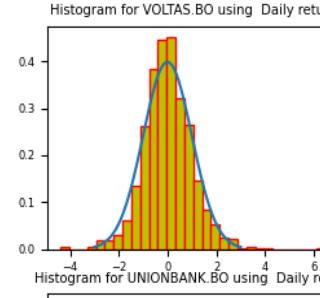
Histogram for TVSMOTOR.BO using Daily return



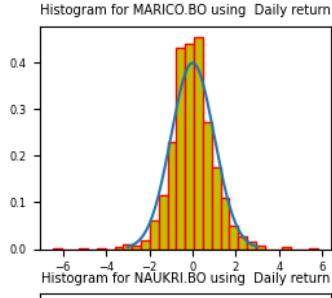
Histogram for BOSCHLTD.BO using Daily return



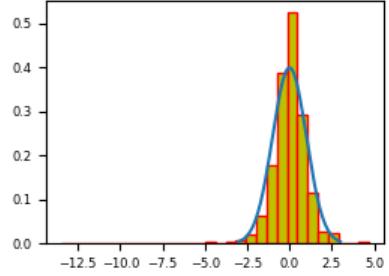
Histogram for VOLTAS.BO using Daily return



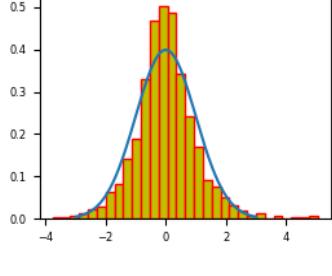
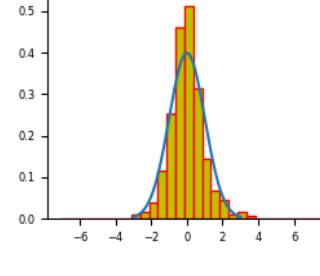
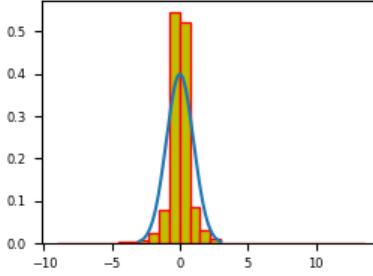
Histogram for MARICO.BO using Daily return



Histogram for GAIL.BO using Daily return

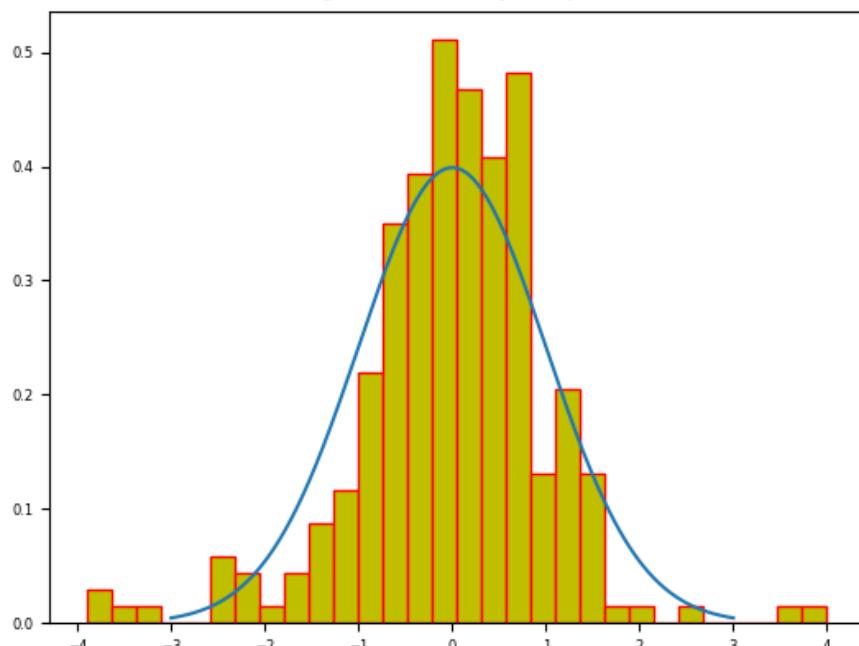


Histogram for YESBANK.BO using Daily return

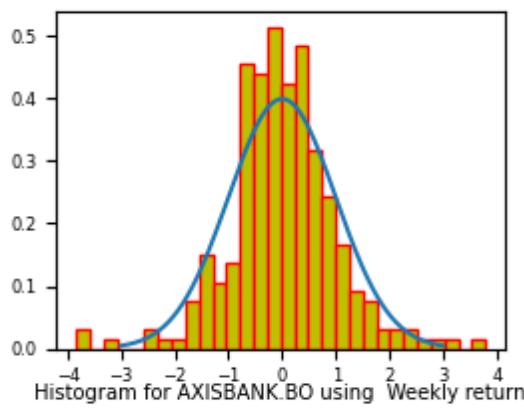


Weekly Returns for bsedata1 (Only a few plots are attached)

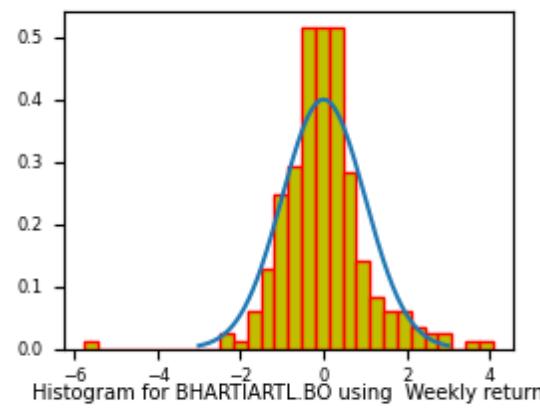
Histogram for Sensex using Weekly return



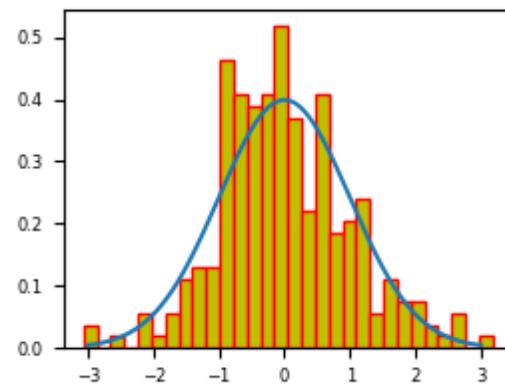
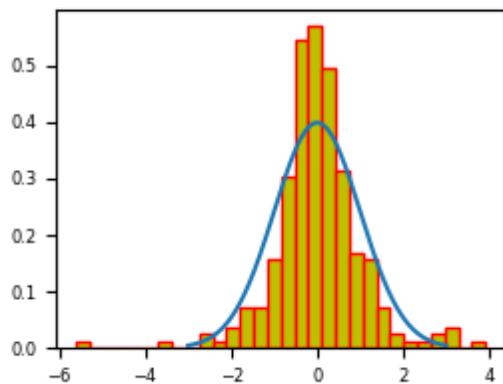
Histogram for RELIANCE.BO using Weekly return



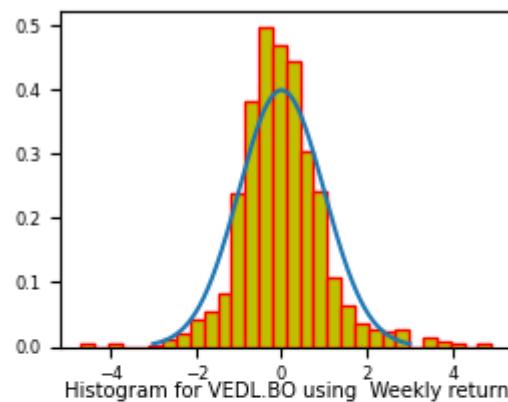
Histogram for HDFCBANK.BO using Weekly return



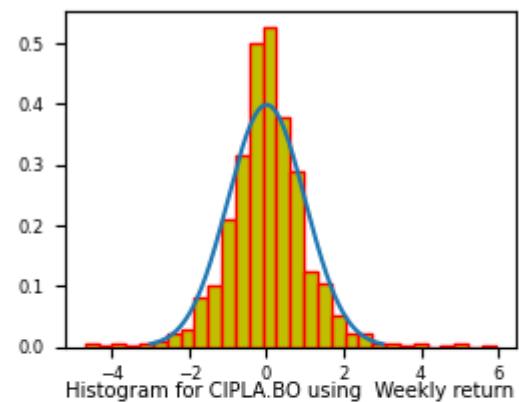
Histogram for AXISBANK.BO using Weekly return



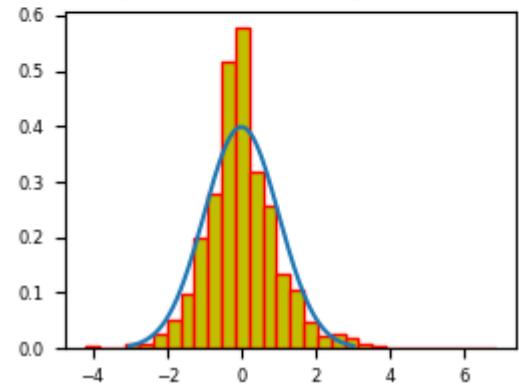
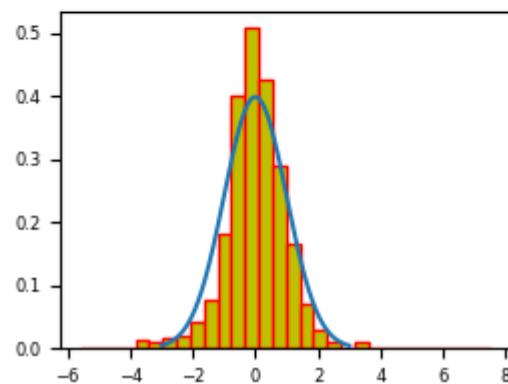
Histogram for BHARTIARTL.BO using Weekly return



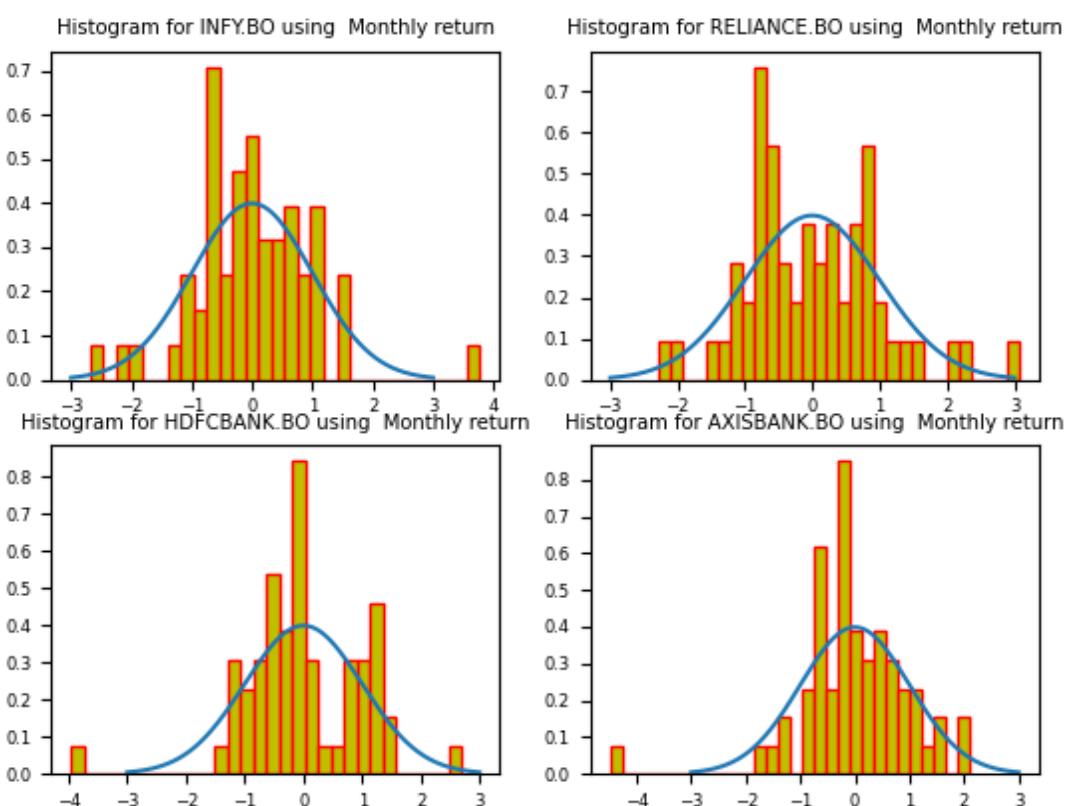
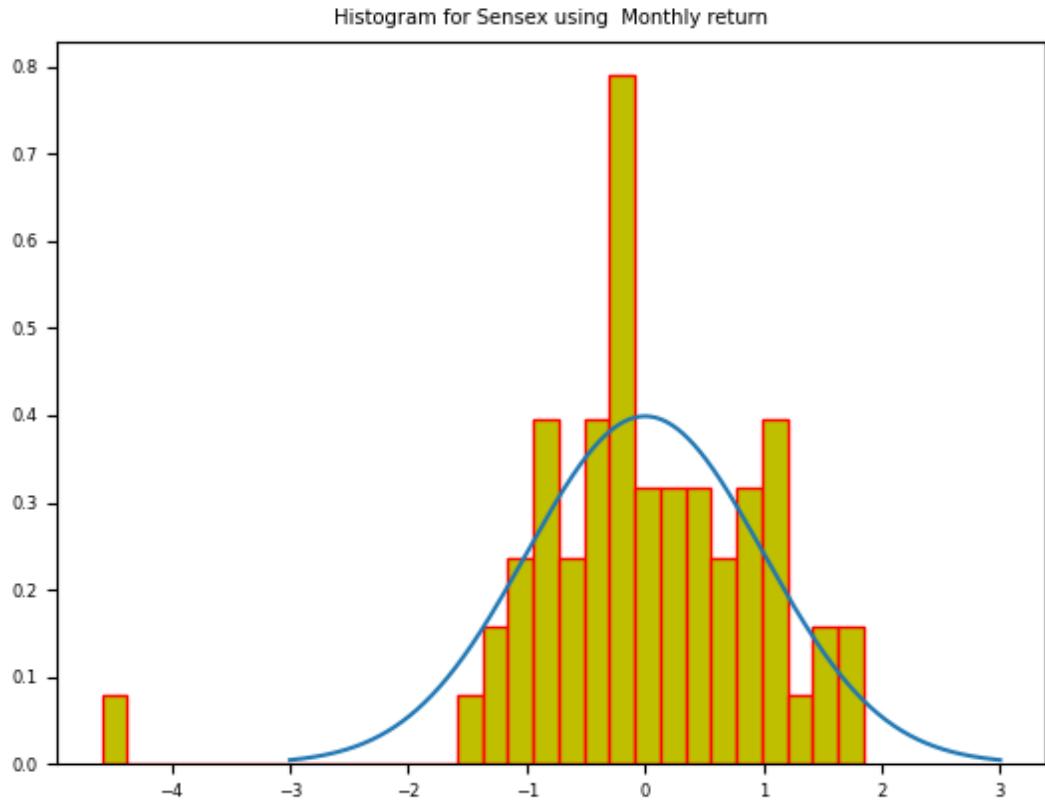
Histogram for ICICIBANK.BO using Weekly return



Histogram for VEDL.BO using Weekly return

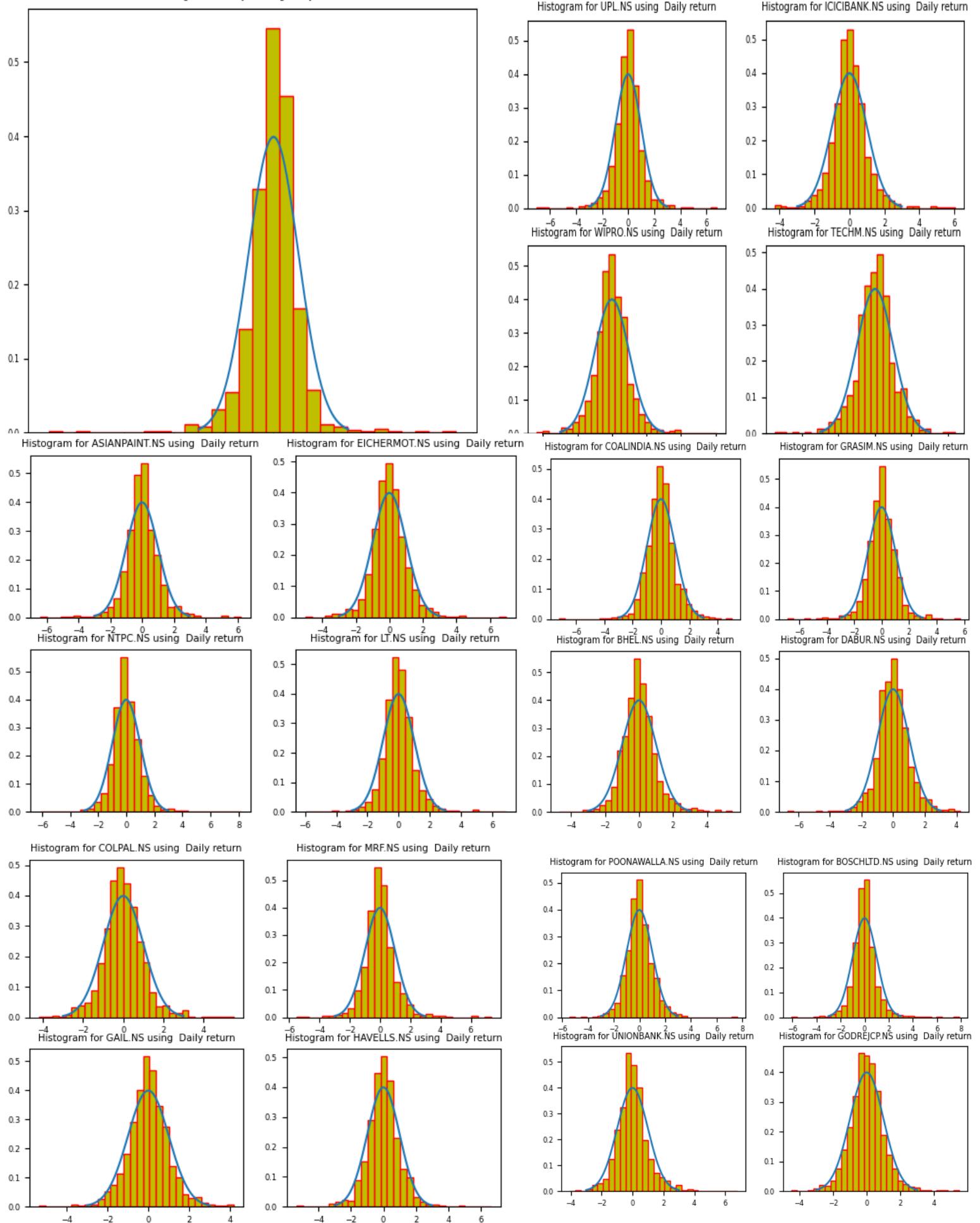


Monthly Returns for bsedata1 (Only a few plots are attached)

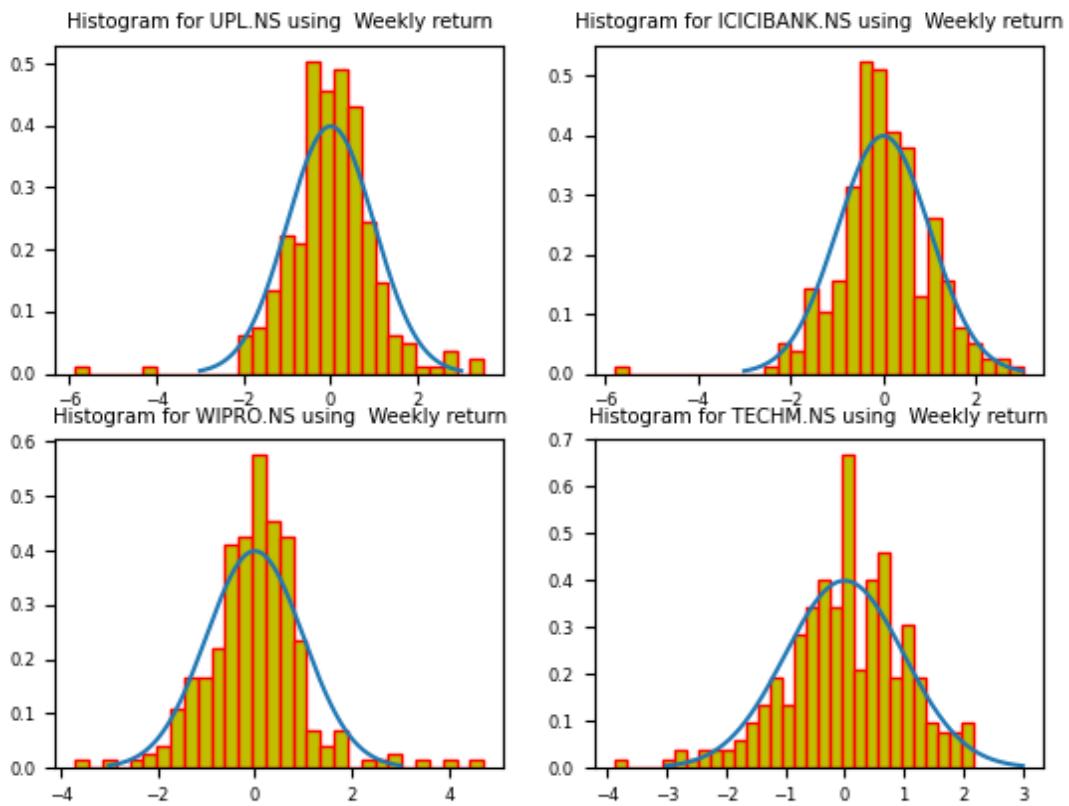
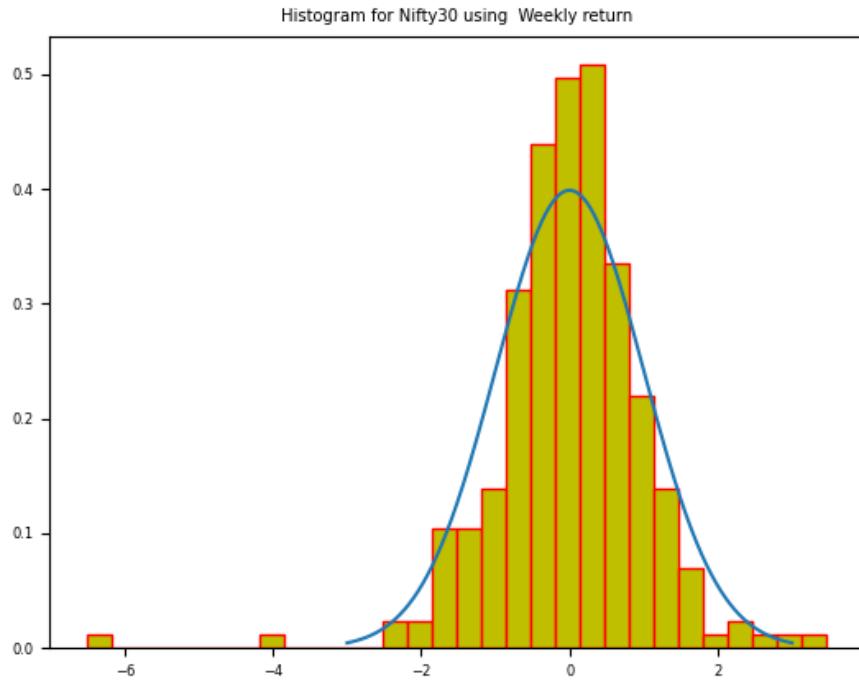


Daily Returns for nsedata1

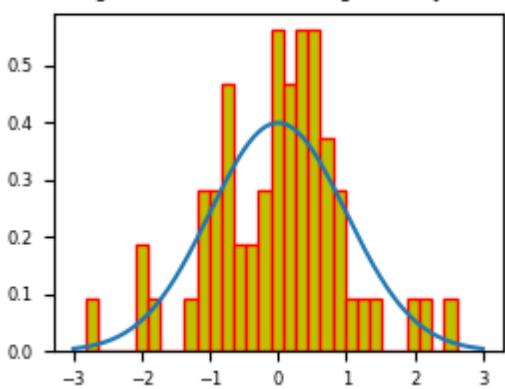
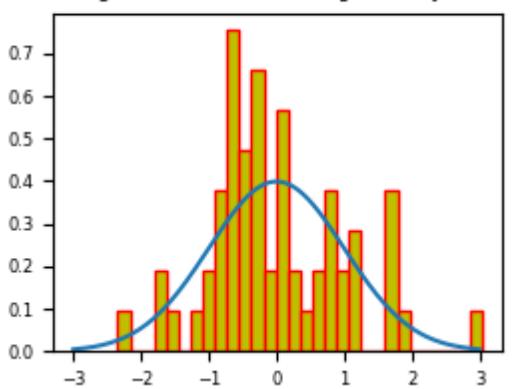
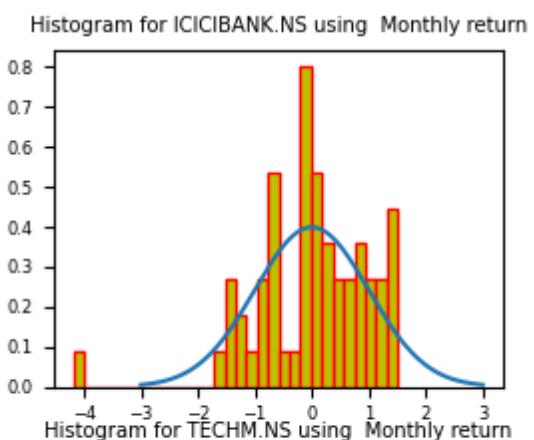
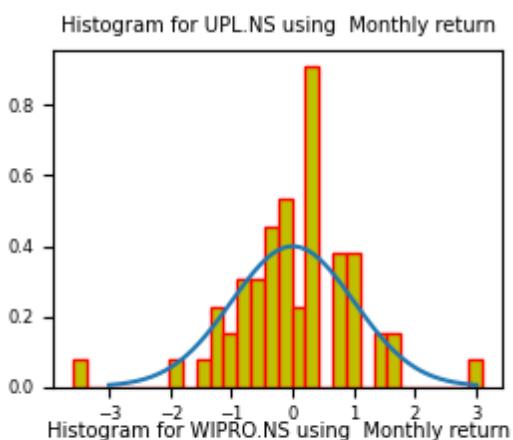
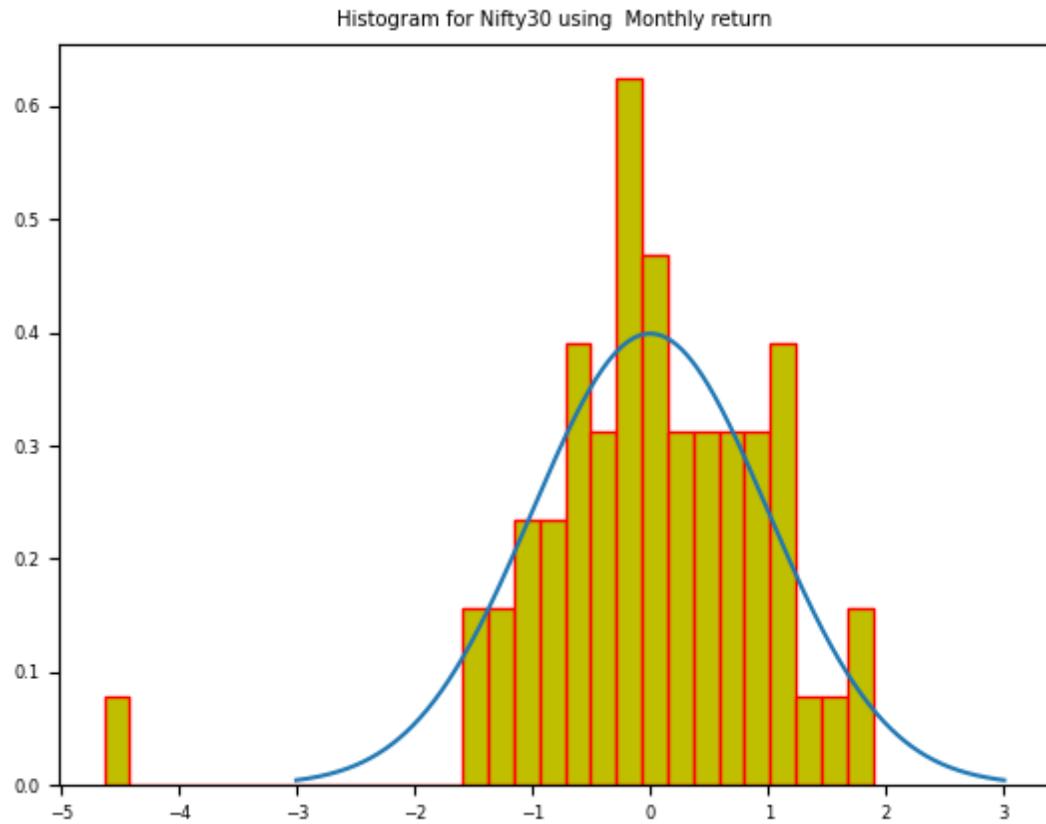
Histogram for Nifty30 using Daily return



Weekly Returns for nsedata1 (Only a few plots are attached)



Monthly Returns for nsedata1 (Only a few plots are attached)

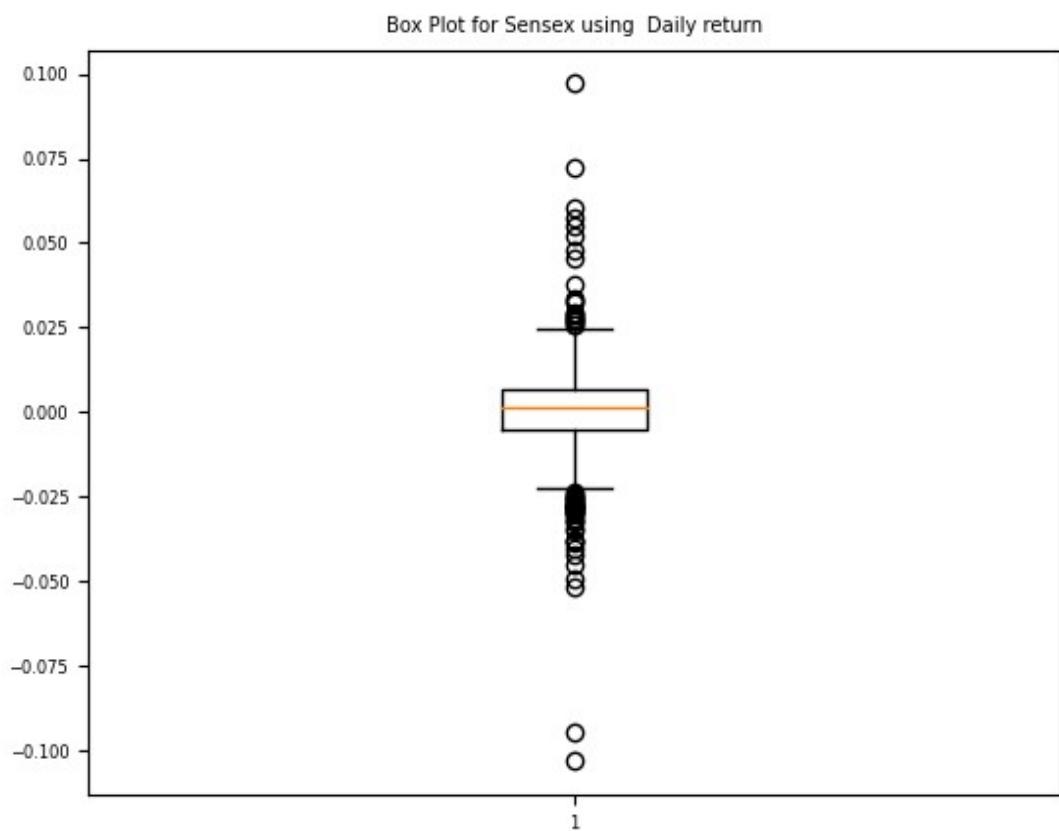


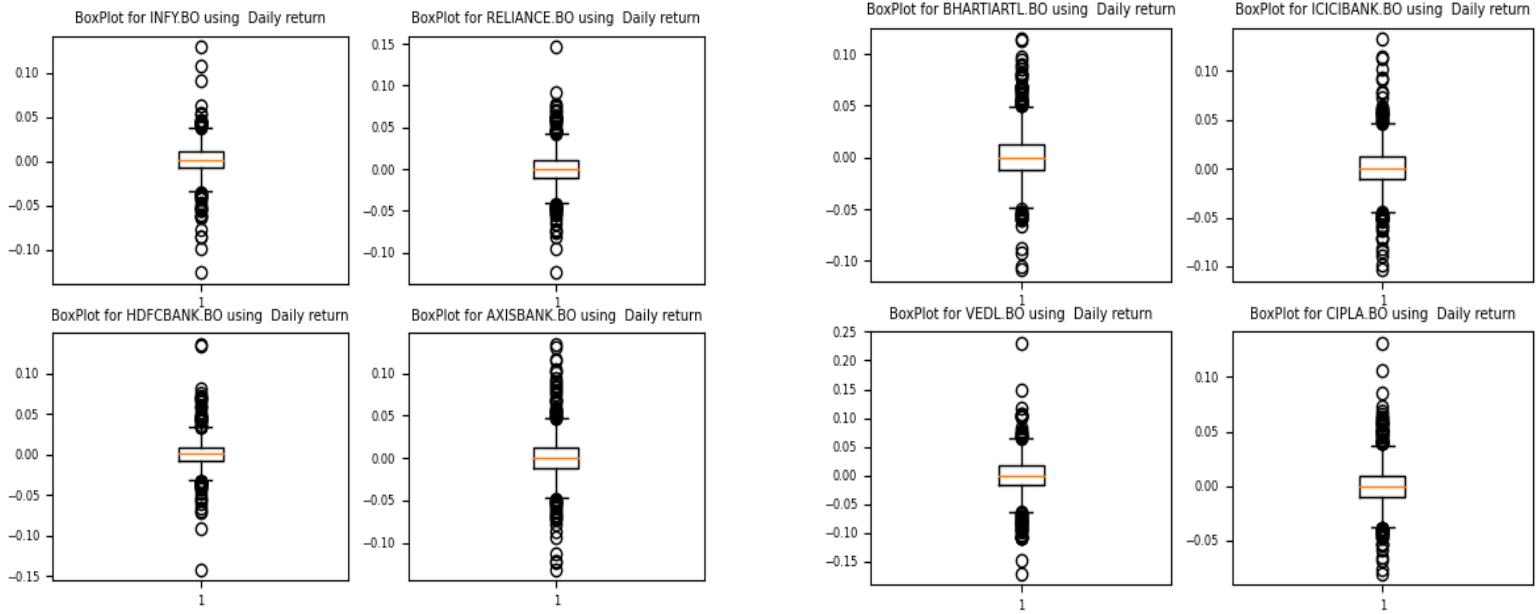
Observations

- We can observe that the $N(0, 1)$ roughly estimates the normalized returns, which is more accurate if the returns are computed on daily basis instead of weekly or monthly.
- The deviations are due to the random fluctuations in the real world market, so, naive Gaussian distribution can't completely model it.
- It is more evident when a closer look is taken at the tails of these plots. The curve for $N(0, 1)$ steeply decreases to 0, but the returns on the prices does not. At the tails, there seem to be more deviations, and more proper model using a mix of different distributions is required to capture those changes.

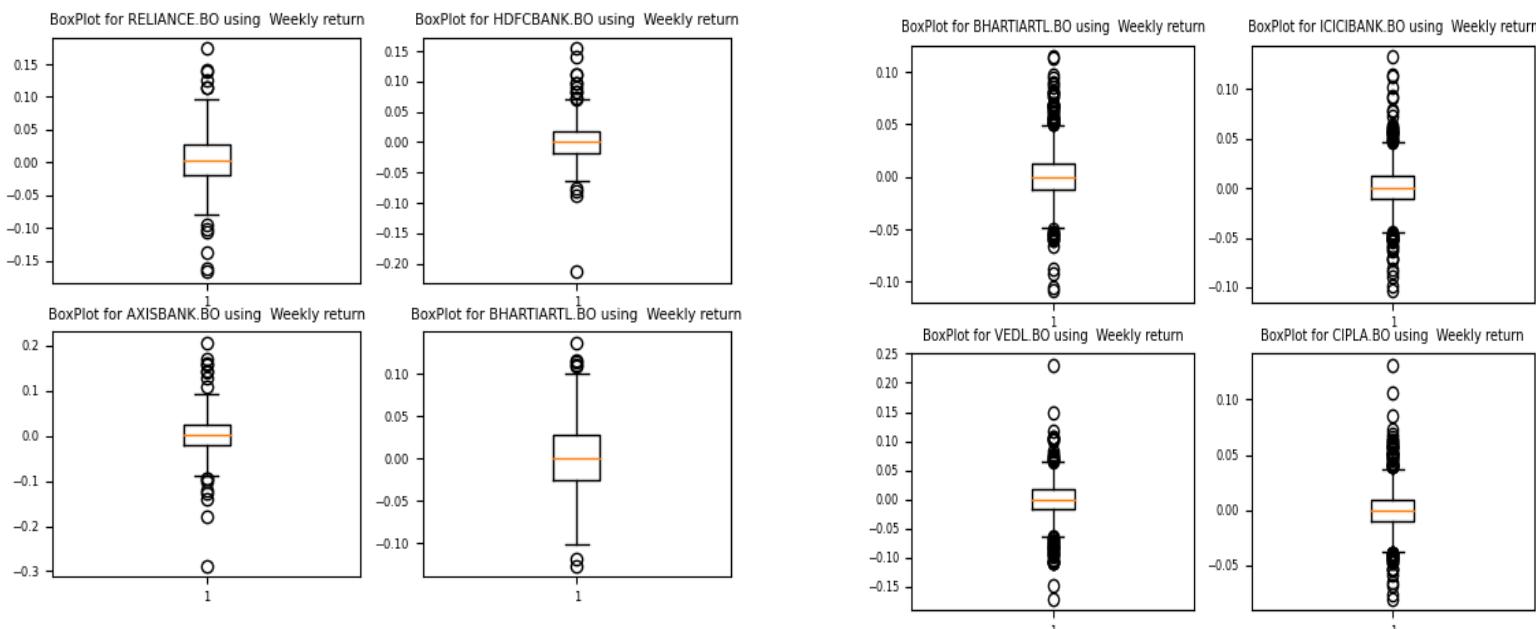
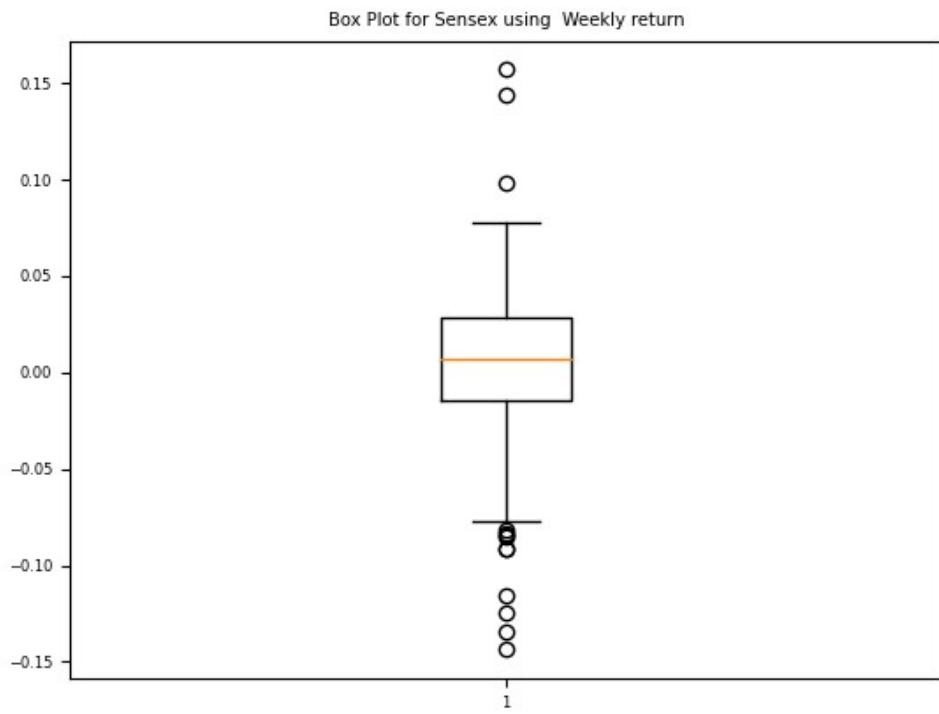
Boxplots

bsedata1 using daily returns (only few plots shown)

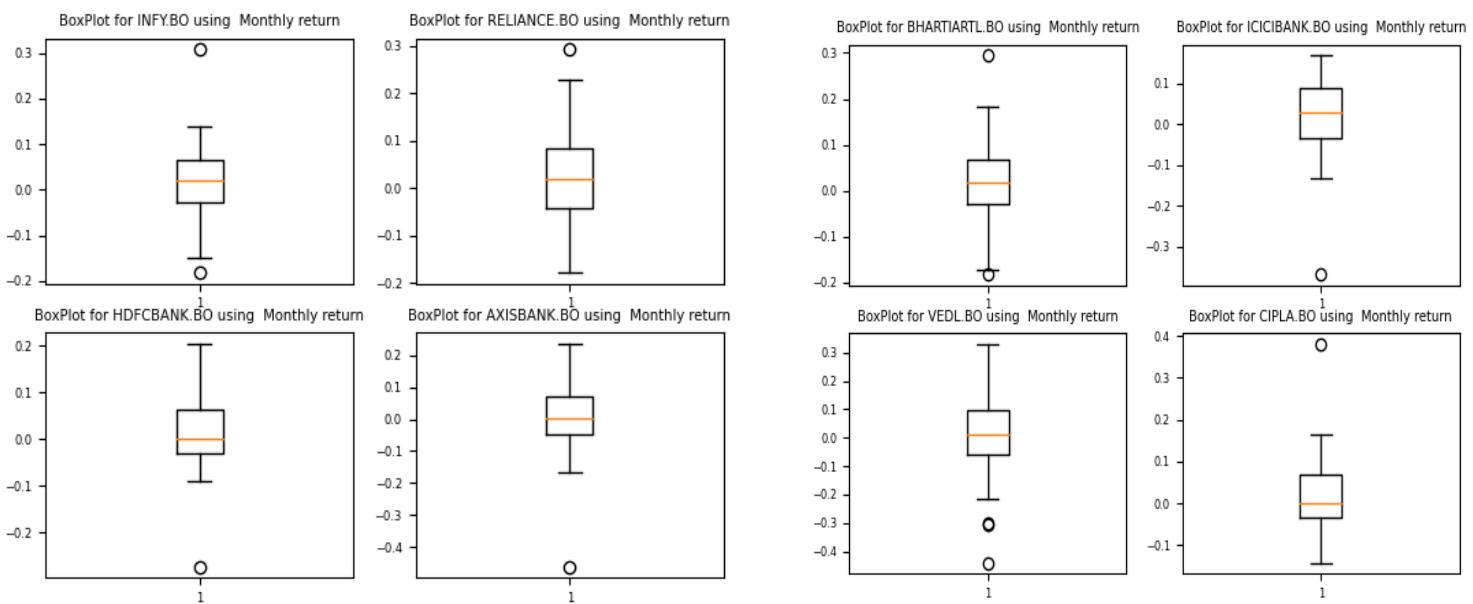
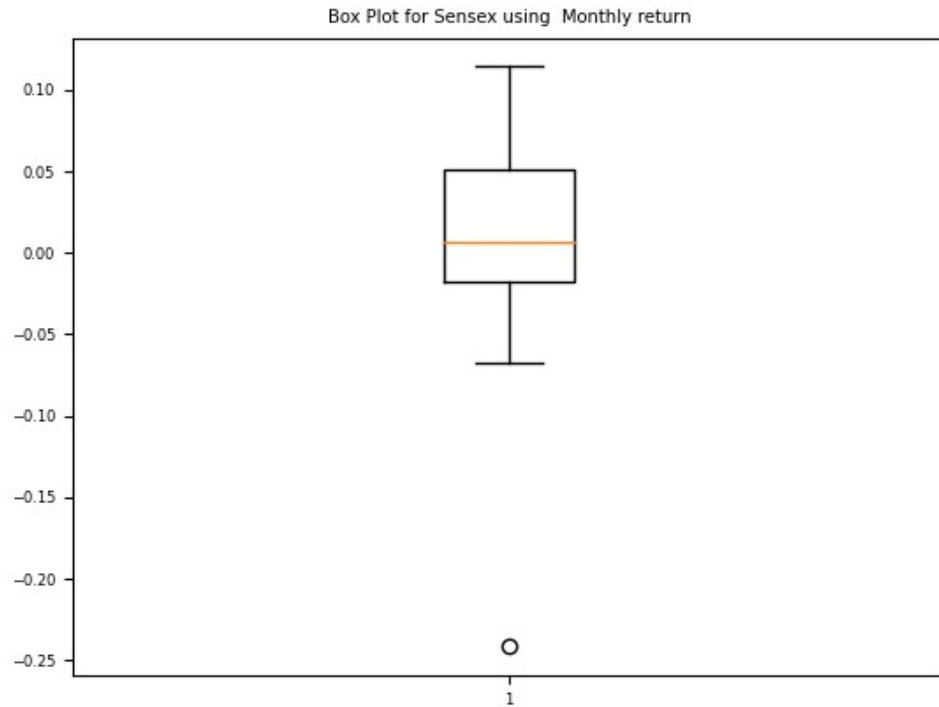




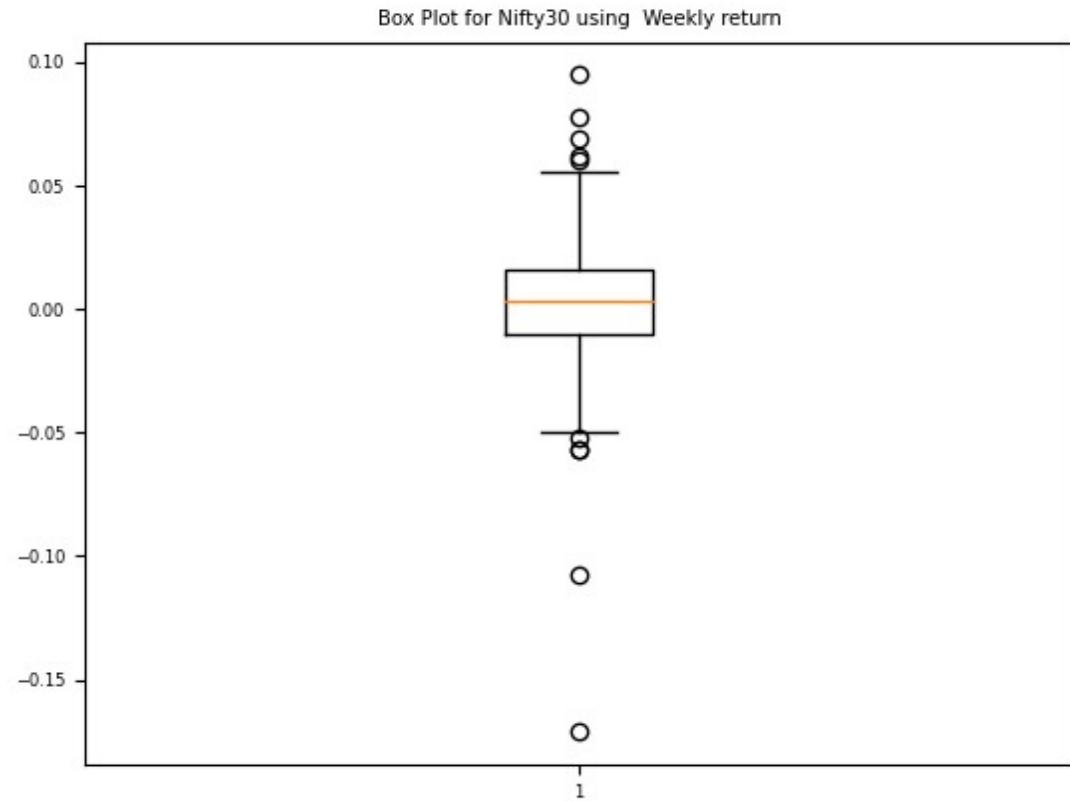
bsedata1 using weekly returns (only few plots shown)



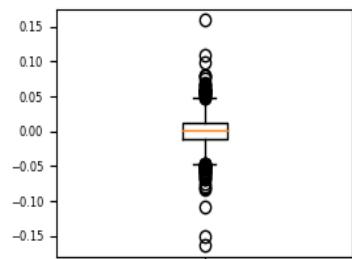
bsedata1 using monthly returns (only few plots shown)



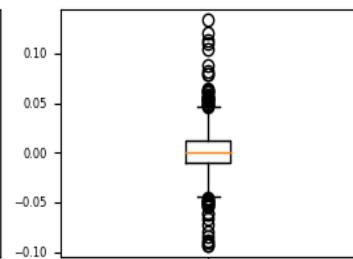
nsedata1 using daily returns (only few plots shown)



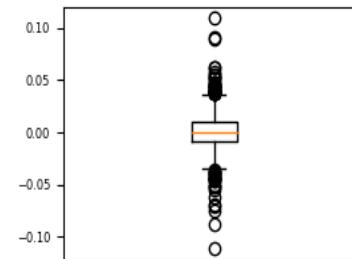
BoxPlot for UPL.NS using Daily return



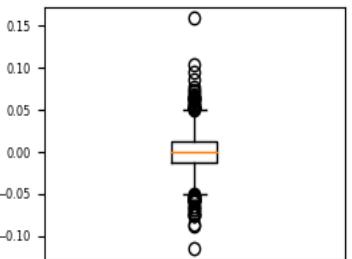
BoxPlot for ICICIBANK.NS using Daily return



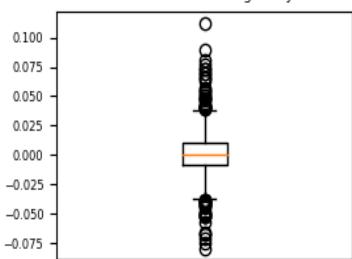
BoxPlot for ASIANPAINT.NS using Daily return



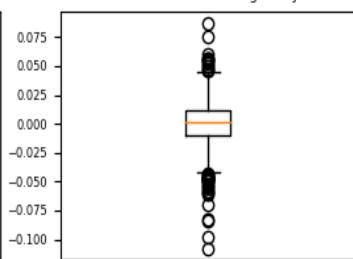
BoxPlot for EICHERMOT.NS using Daily return



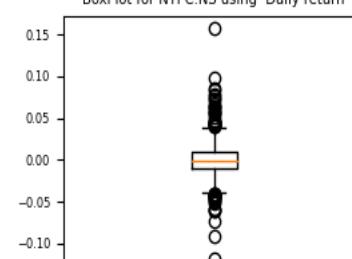
BoxPlot for WIPRO.NS using Daily return



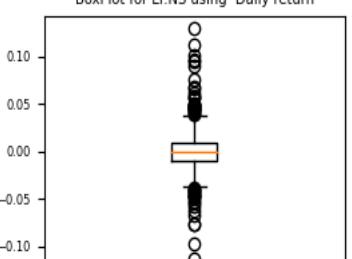
BoxPlot for TECHM.NS using Daily return



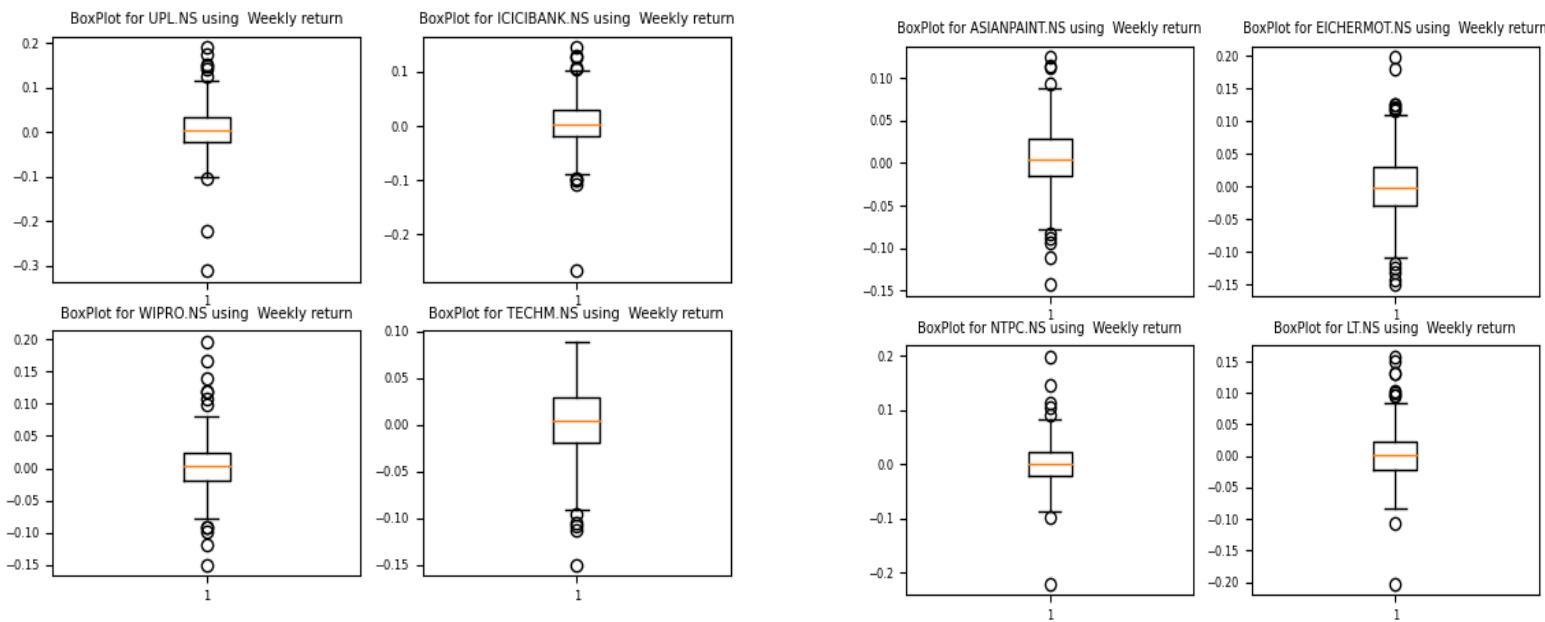
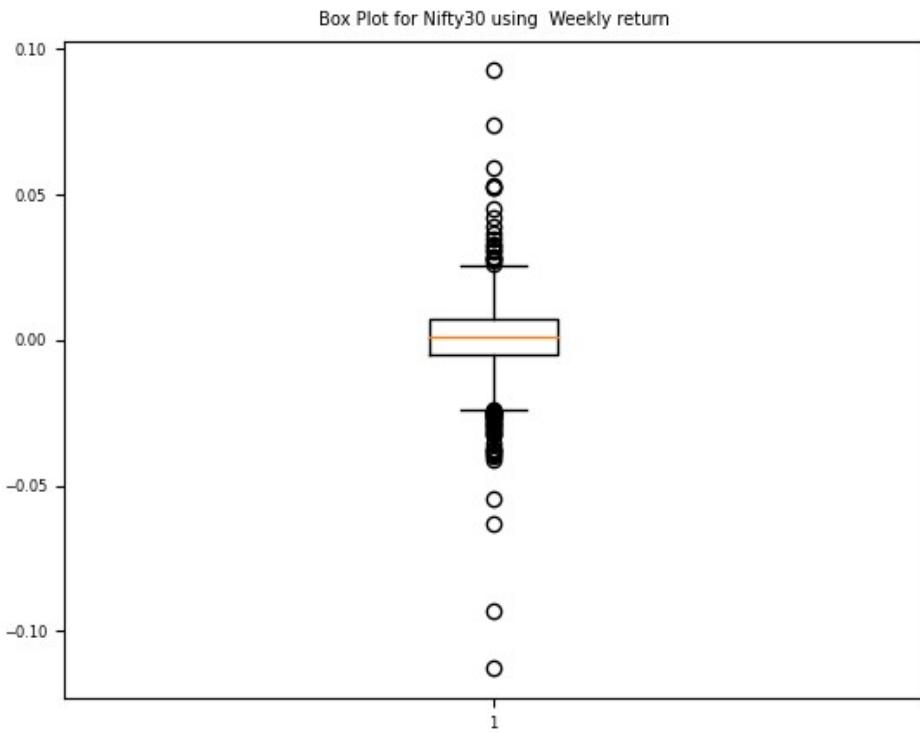
BoxPlot for NTPC.NS using Daily return



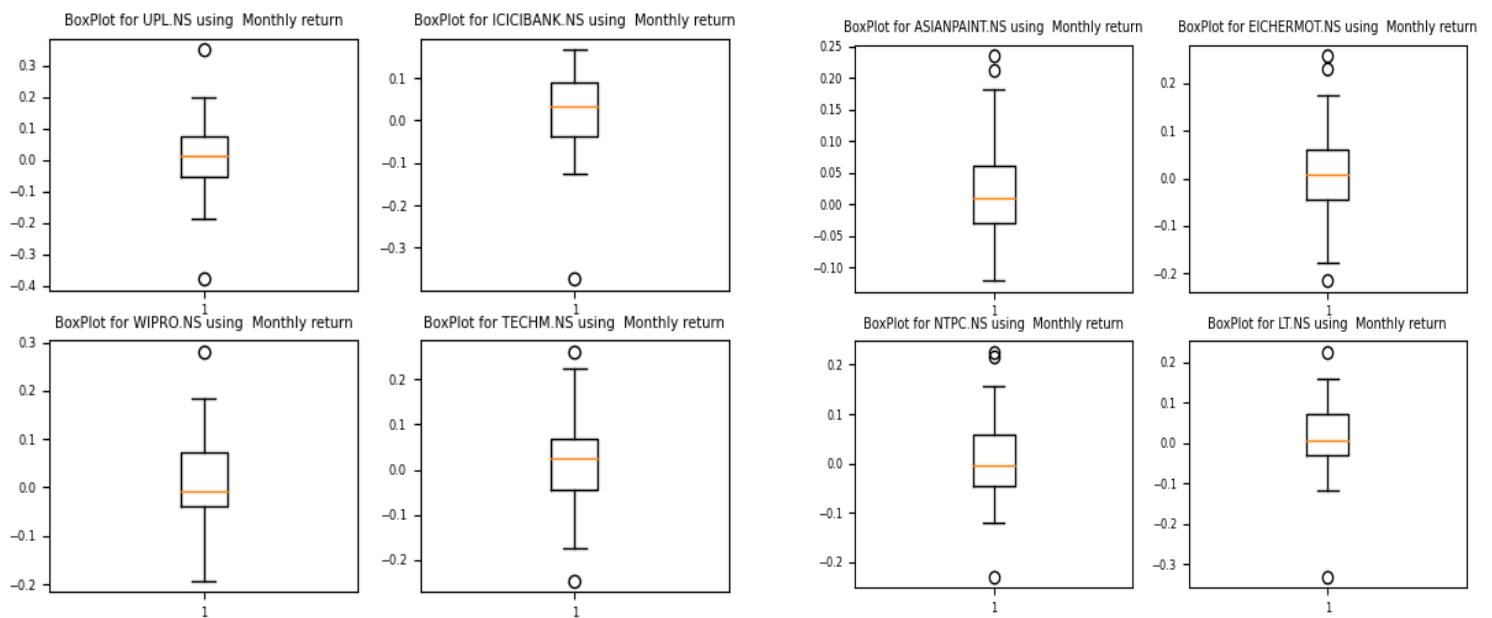
BoxPlot for LT.NS using Daily return



nsedata1 using weekly returns (only few plots shown)



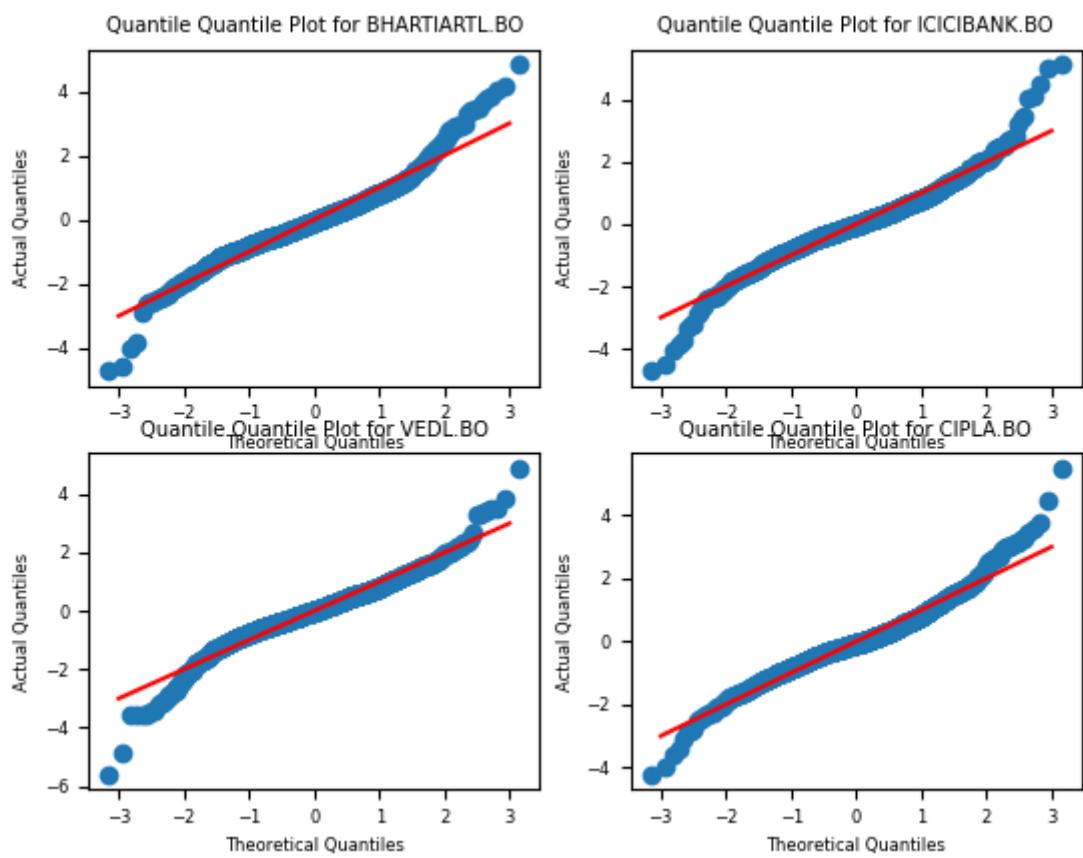
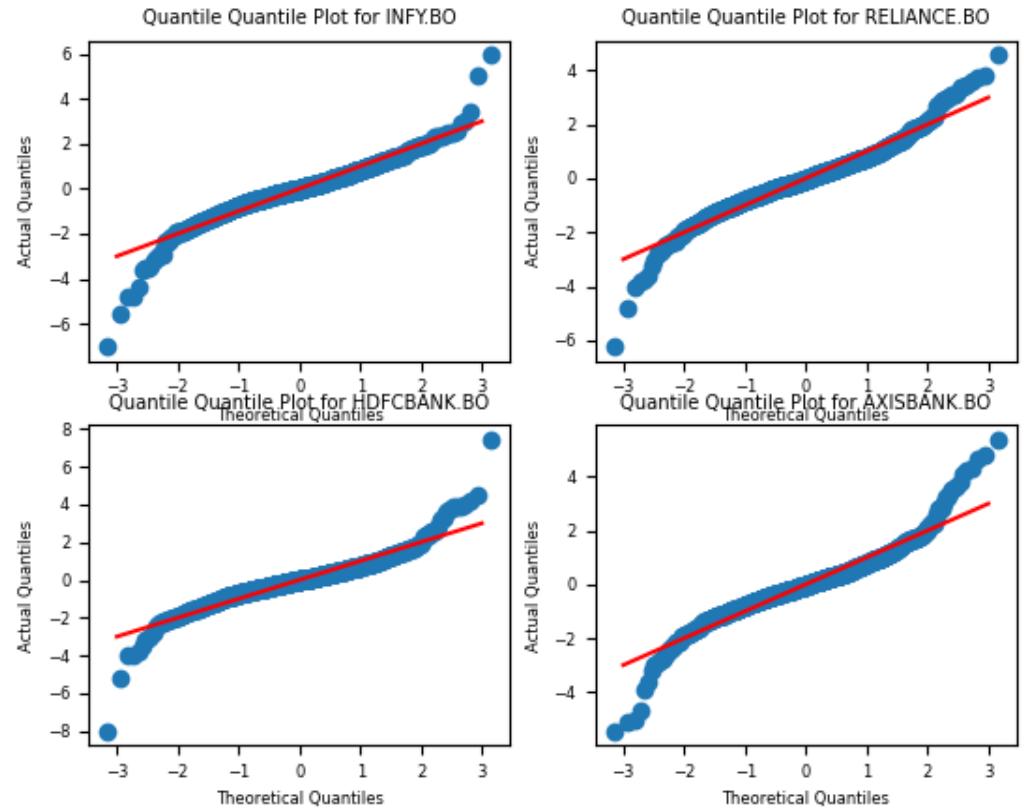
nsedata1 using monthly returns (only few plots shown)



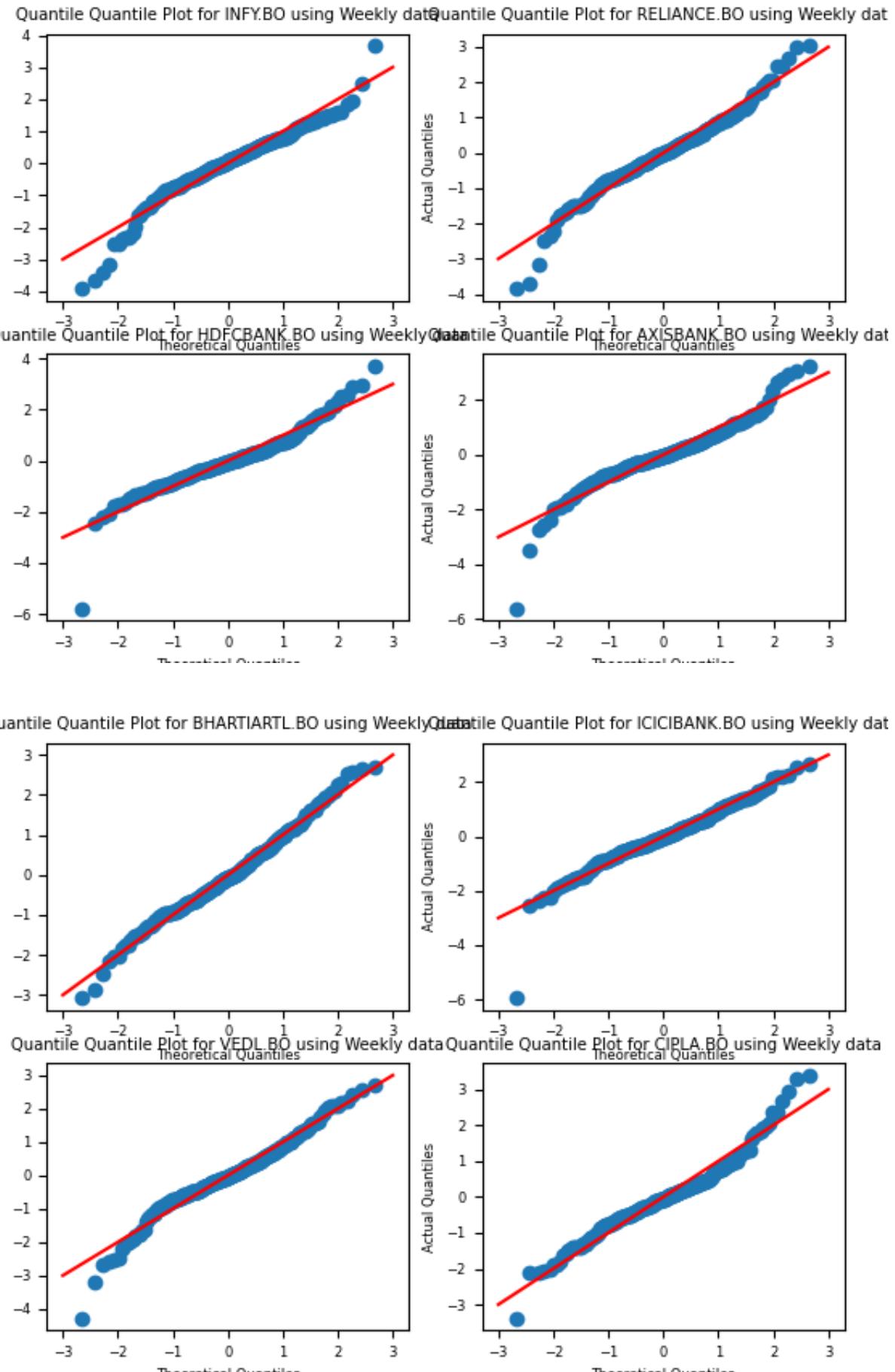
Observations

- We can observe that the maximum return is between 1.5 and 2 in most cases whereas the minimum return is between -1 and -1.5.(If computed annually)
- The density of values lying in the first and third quartiles decreases uniformly
- The distribution is somewhat symmetric about 0 in some cases. It resembles normal distribution with some error especially for daily and weekly returns

Quantile quantile plots bsedata1 using daily returns (only few plots shown)

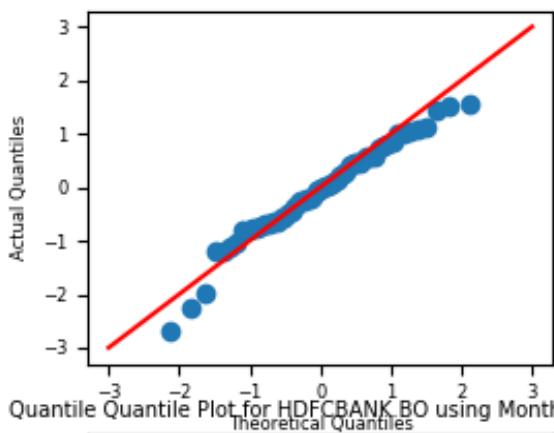


bsedata1 using weekly returns (only few plots shown)

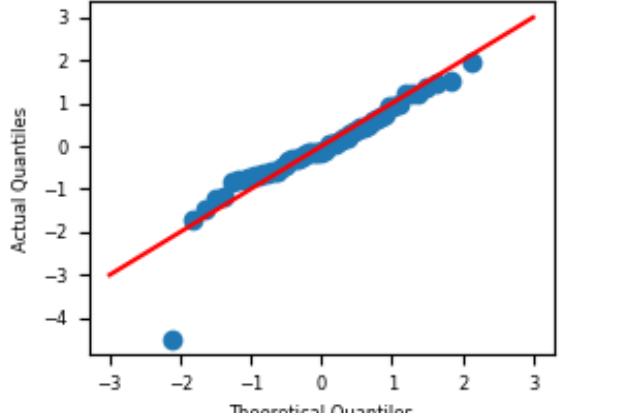
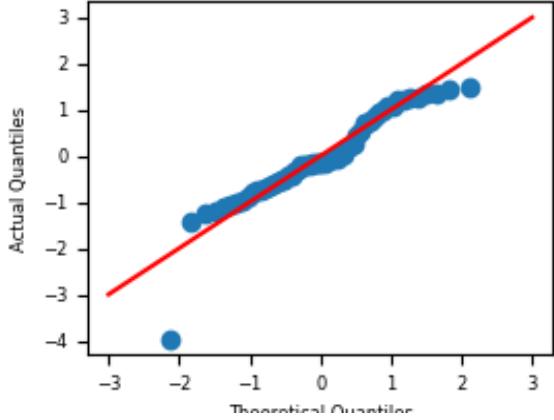
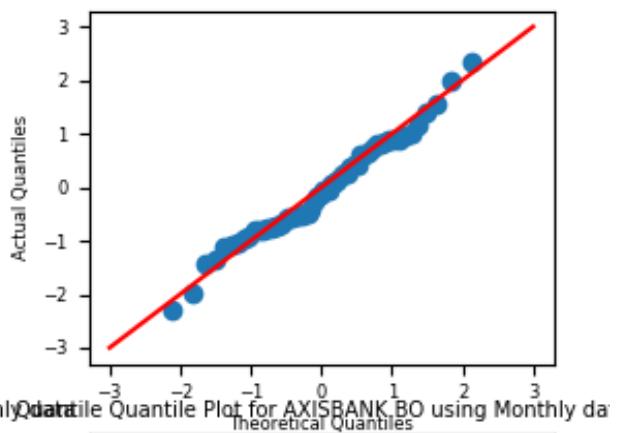


bsedata1 using monthly returns (only few plots shown)

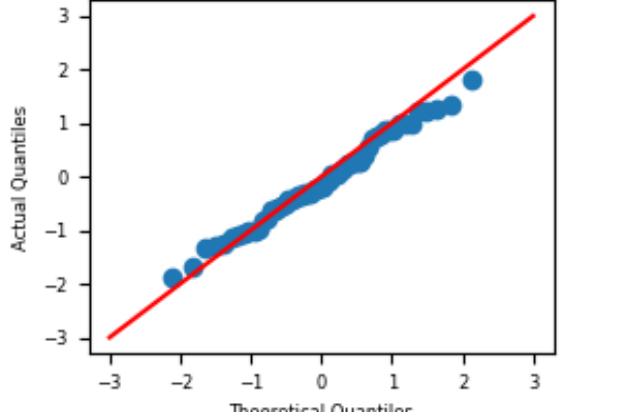
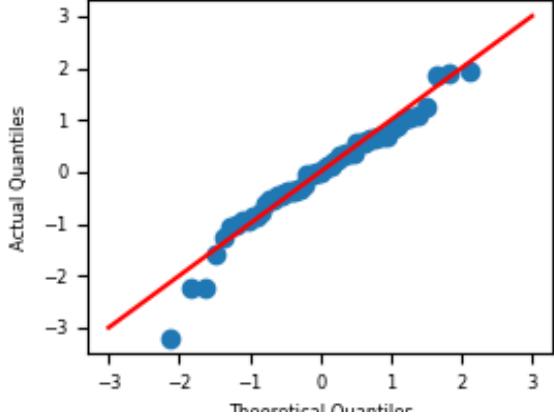
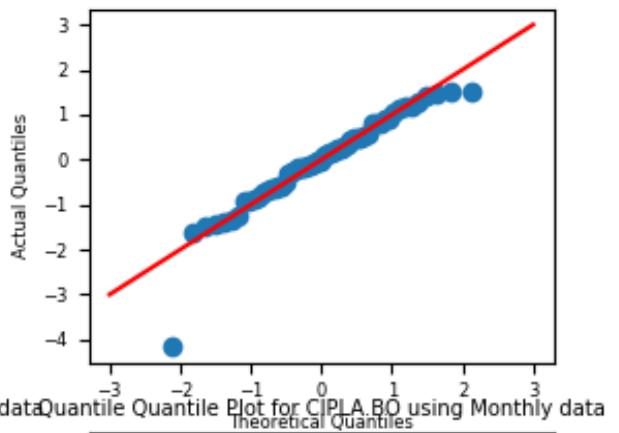
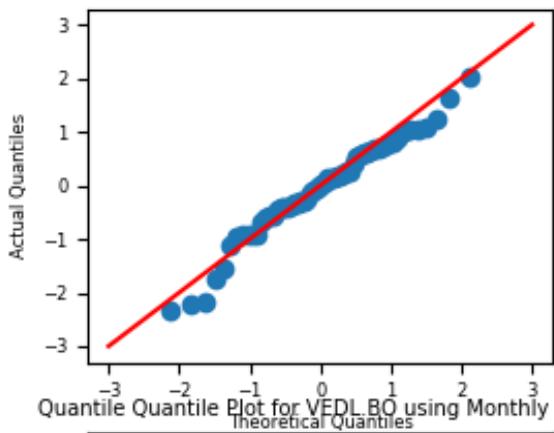
Quantile Quantile Plot for INFY.BO using Monthly data



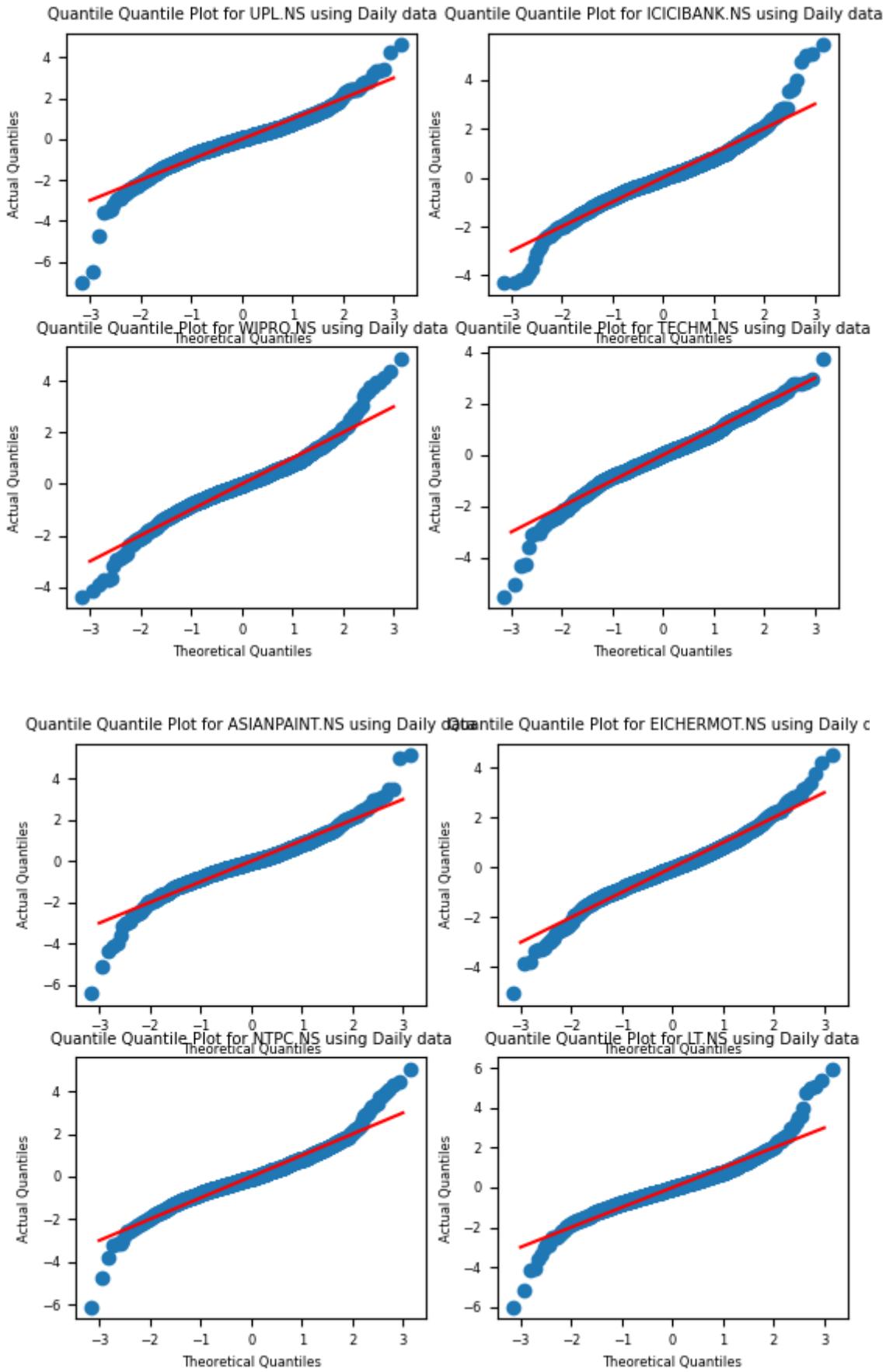
Quantile Quantile Plot for RELIANCE.BO using Monthly data



Quantile Quantile Plot for BHARTIARTL.BO using Monthly data

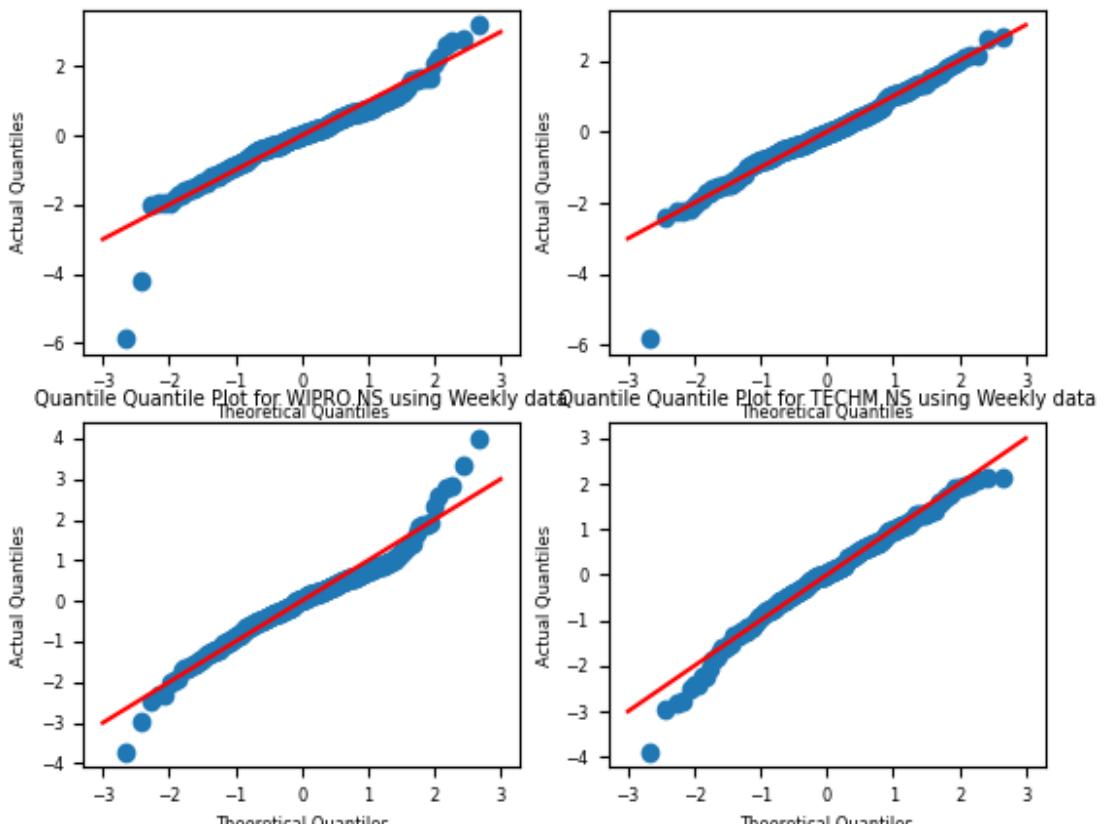


nsedata1 using daily returns (only few plots shown)

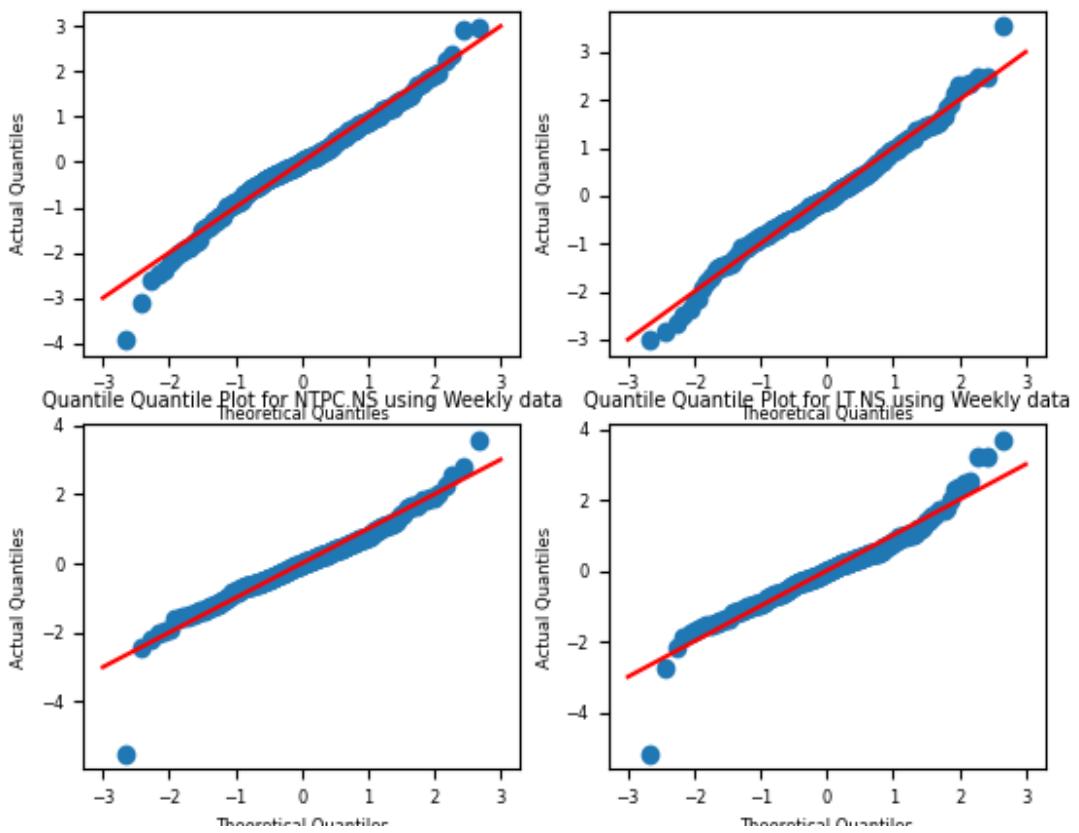


nsedata1 using weekly returns (only few plots shown)

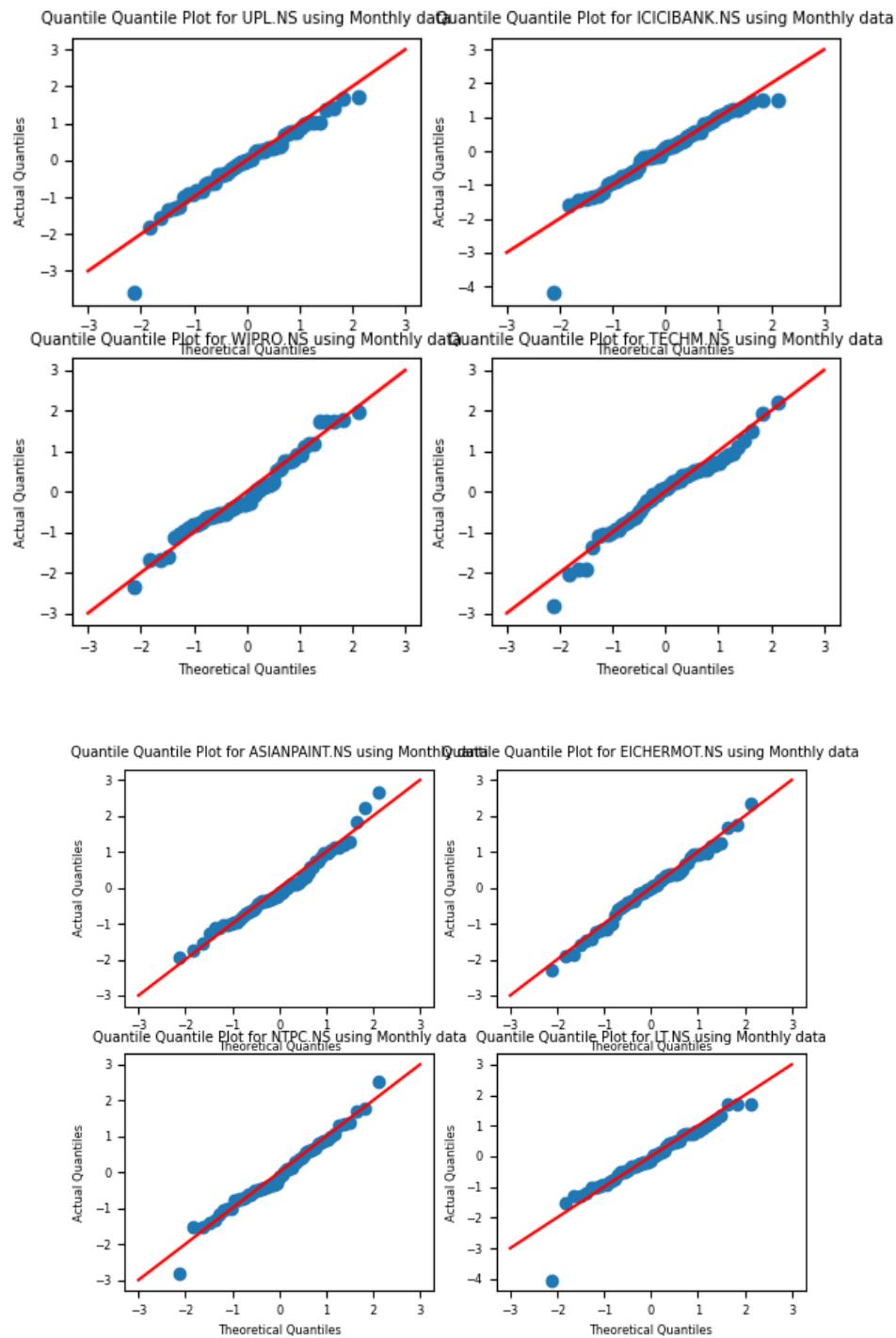
Quantile Quantile Plot for UPL.NS using Weekly data



Quantile Quantile Plot for ASIANPAINT.NS using Weekly data



nsedata1 using monthly returns (only few plots shown)

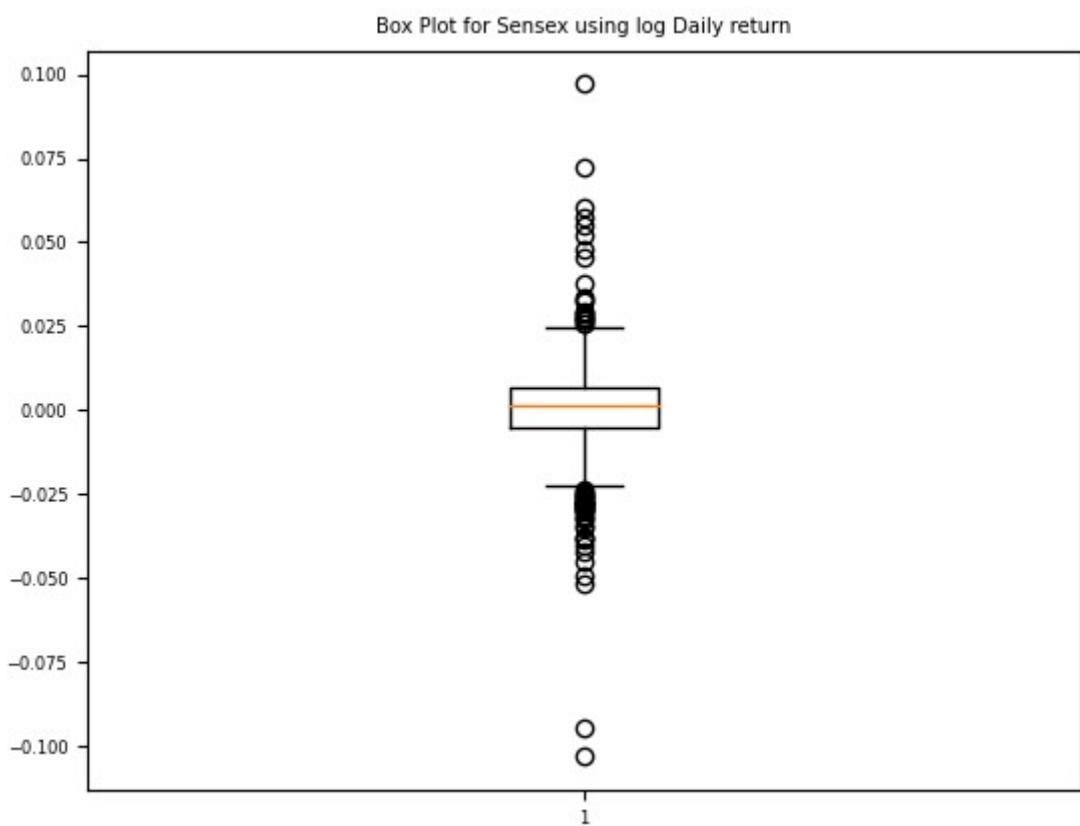
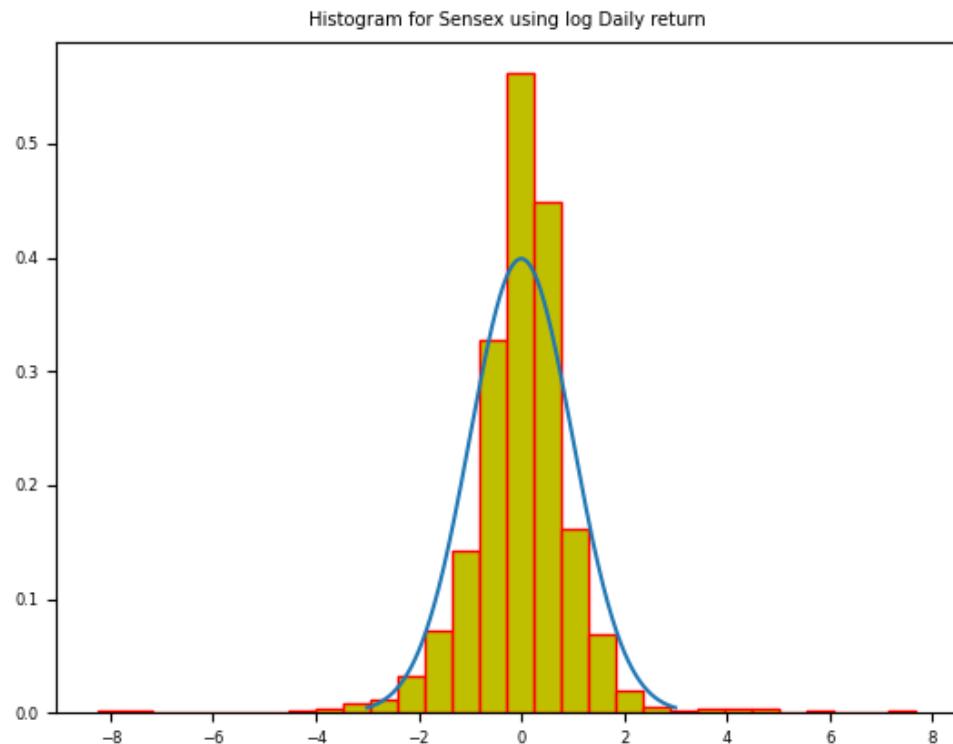


Observations

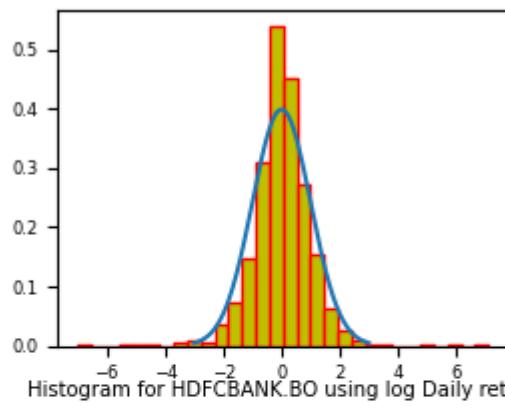
- We can observe that the distribution bears a resemblance to the Normal distribution as the theoretical and actual quantiles almost superimpose on the $y=x$ line, however this is not true for large quantiles and the distributions diverges. This is most prominent for daily return and least for weekly returns.

Question - 3 (Using log returns)

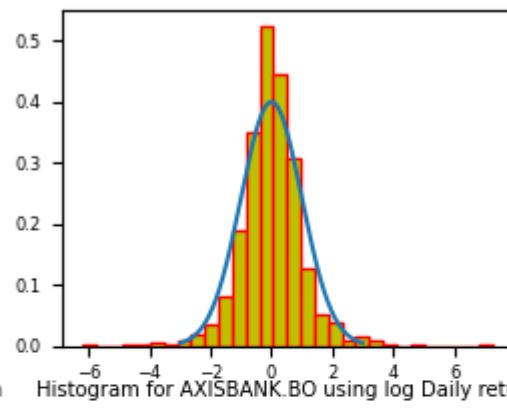
Attached below are plots for the log returns $L = \log(1+K)$. Note that I am attaching only one sample for each type of plot in order to reduce the length of this report.



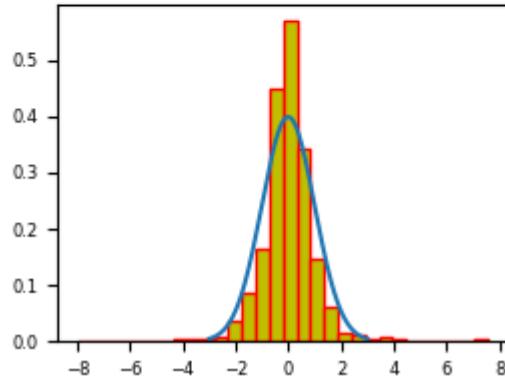
Histogram for INFY.BO using log Daily return



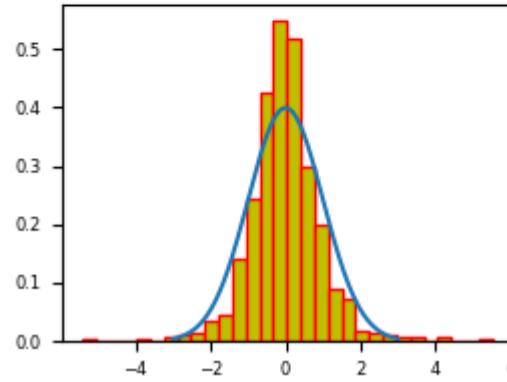
Histogram for RELIANCE.BO using log Daily return



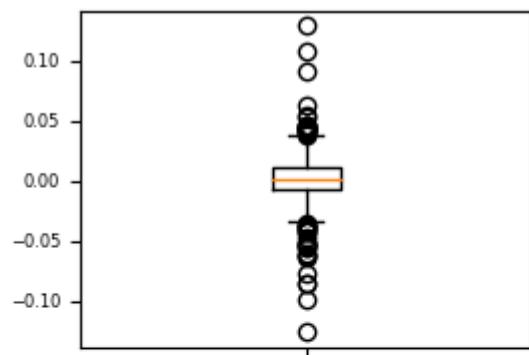
Histogram for HDFCBANK.BO using log Daily return



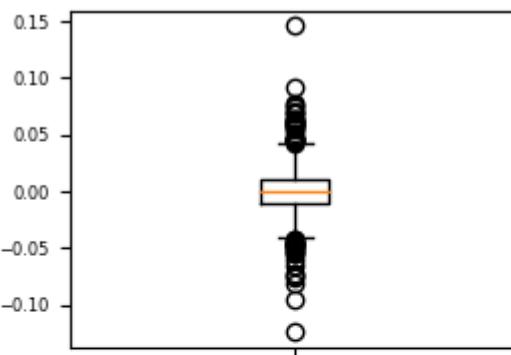
Histogram for AXISBANK.BO using log Daily return



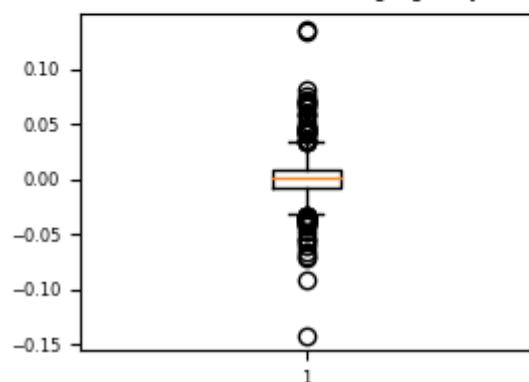
BoxPlot for INFY.BO using log Daily return



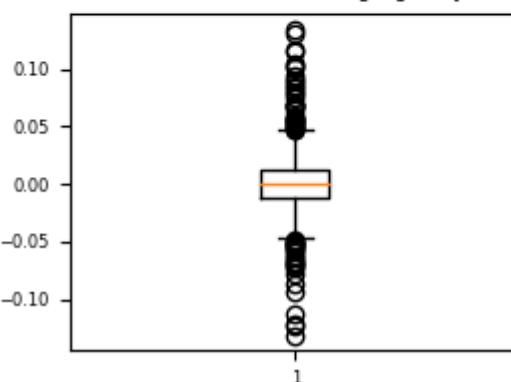
BoxPlot for RELIANCE.BO using log Daily return



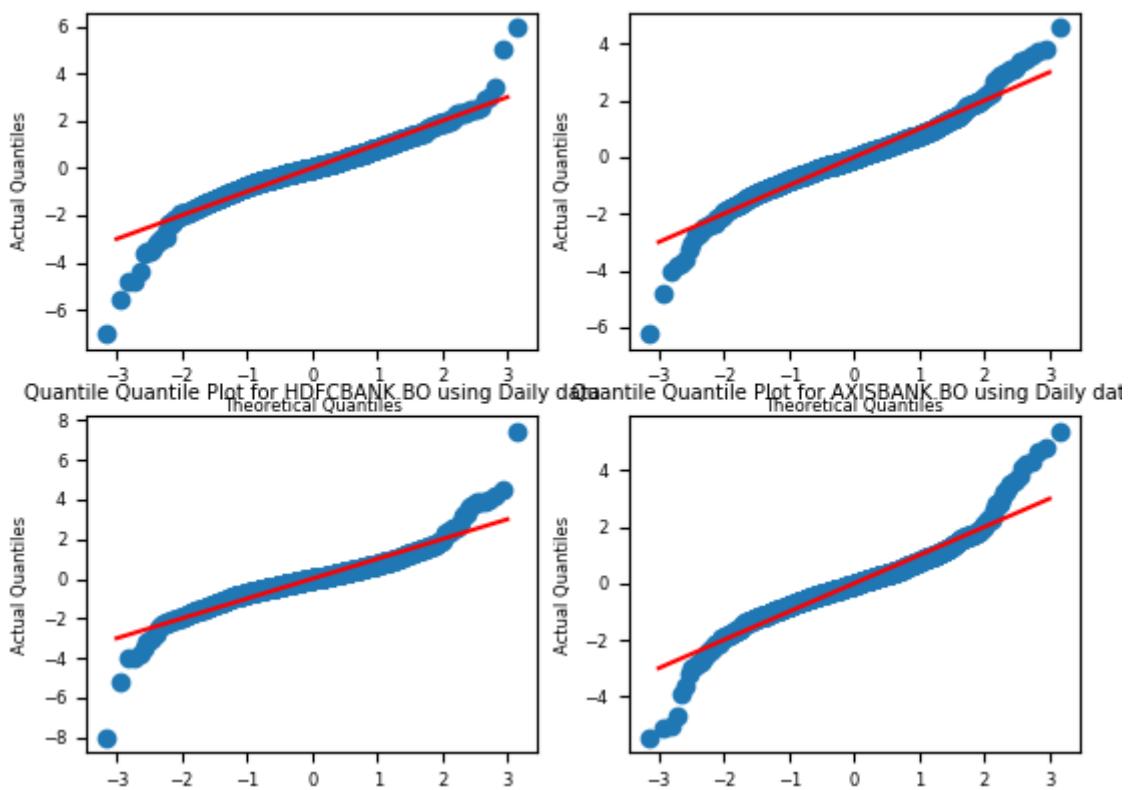
BoxPlot for HDFCBANK.BO using log Daily return



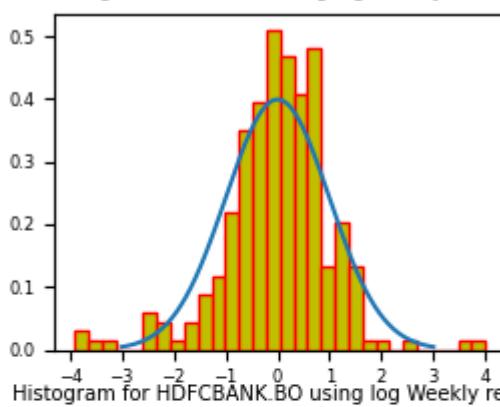
BoxPlot for AXISBANK.BO using log Daily return



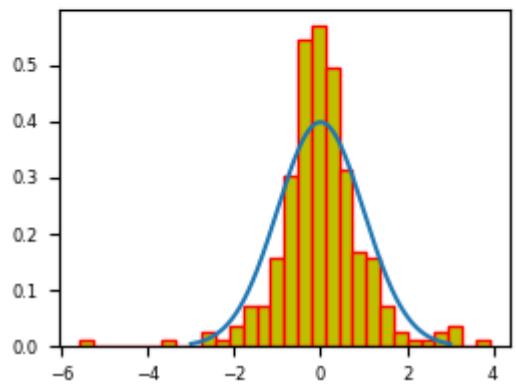
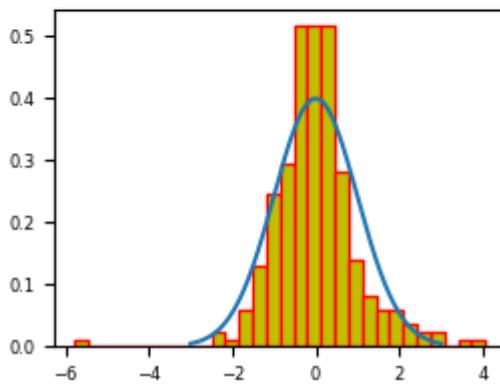
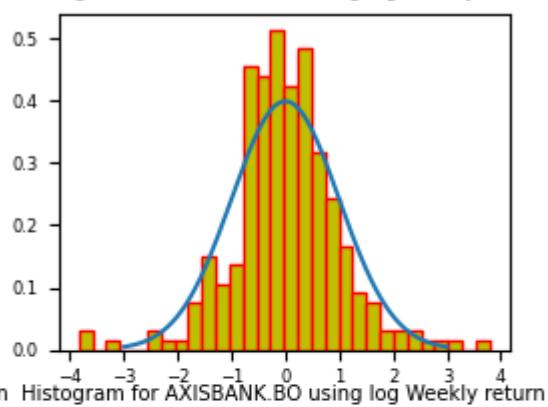
Quantile Quantile Plot for INFY.BO using Daily data Quantile Quantile Plot for RELIANCE.BO using Daily data

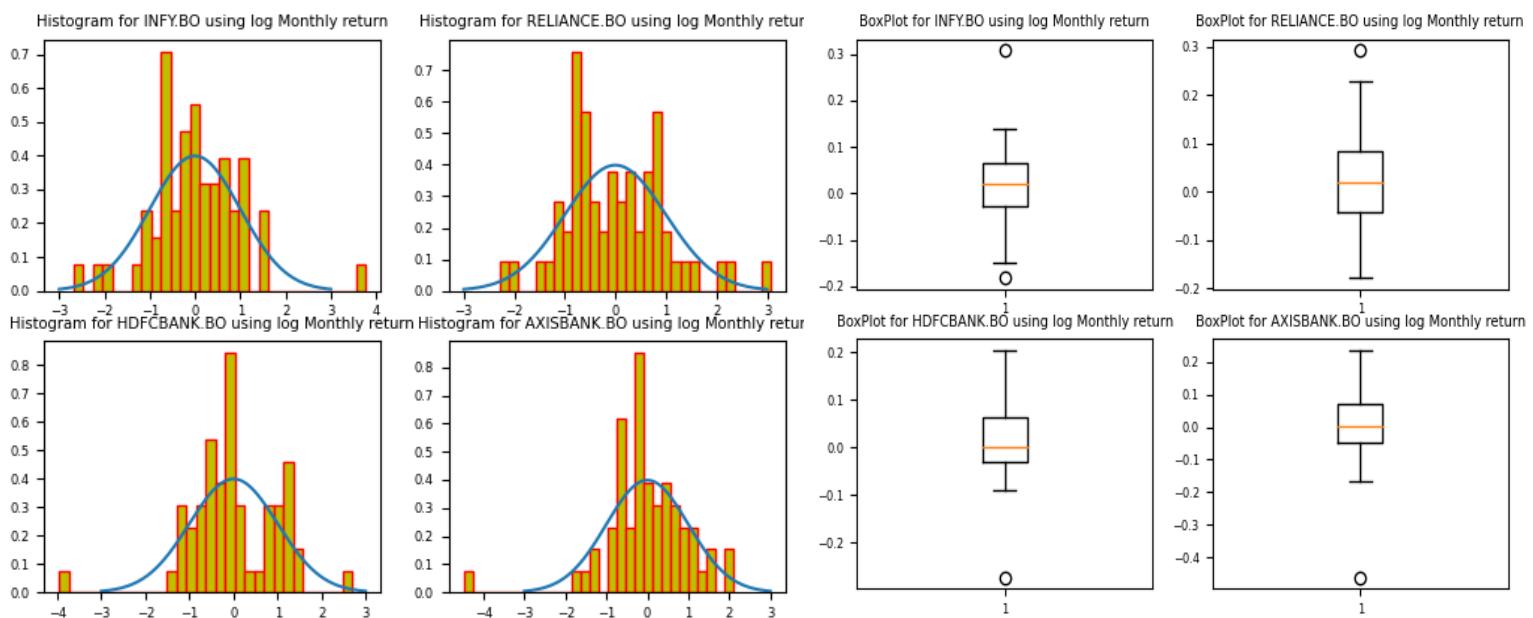
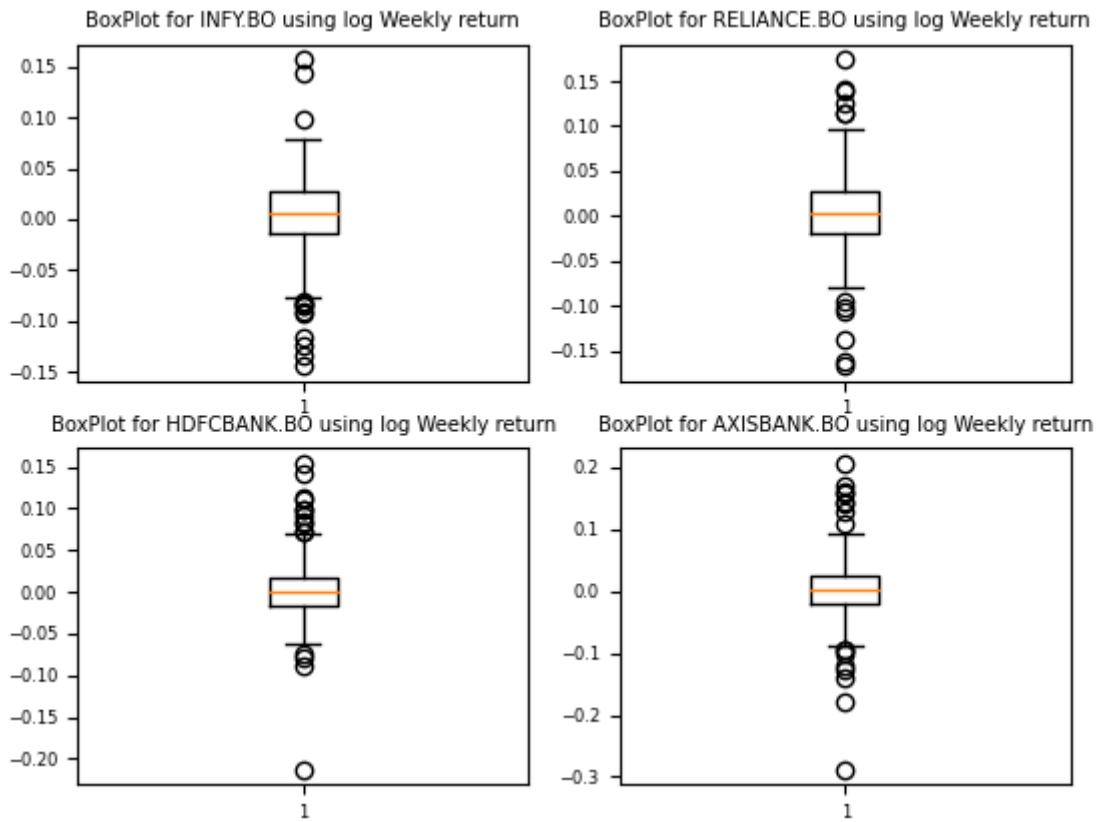


Histogram for INFY.BO using log Weekly return



Histogram for RELIANCE.BO using log Weekly return





Observations

- The observations are exactly similar to question 2, but in this case, we see less deviation between the $N(0,1)$ curve and the histograms.

Question - 4&5

In order to predict the stock prices under the classical BSM setup, I followed the below steps:-

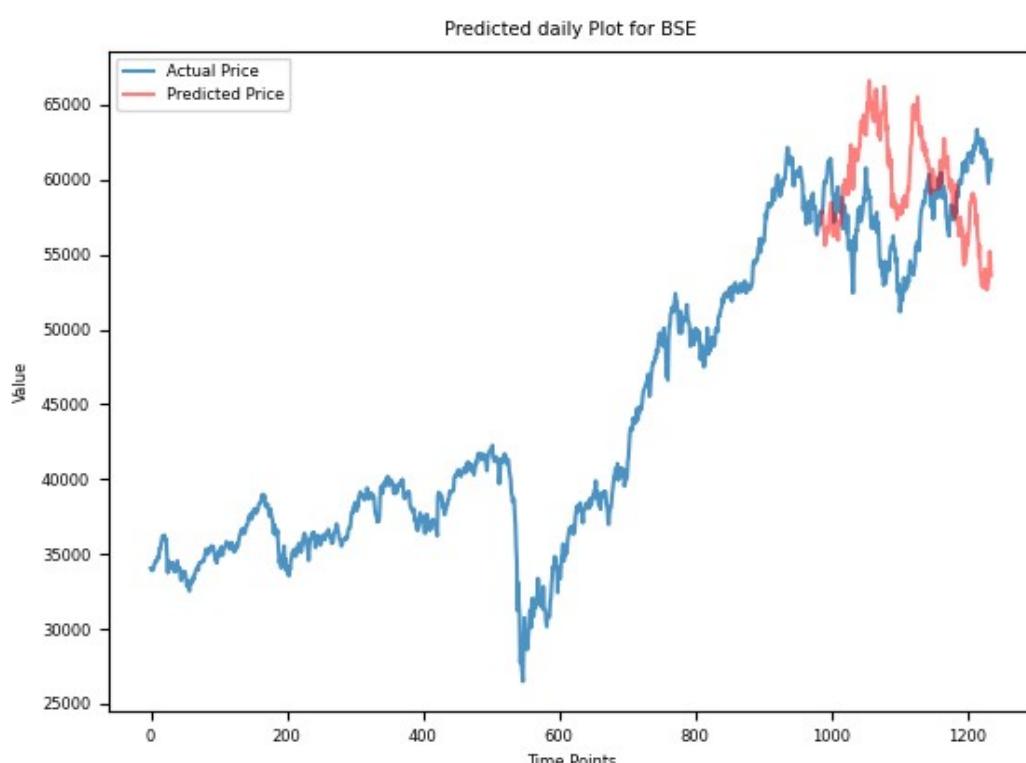
- Since $S(t)$ follows geometric brownian motion in classical BSM set up we have for two time points T and t :-

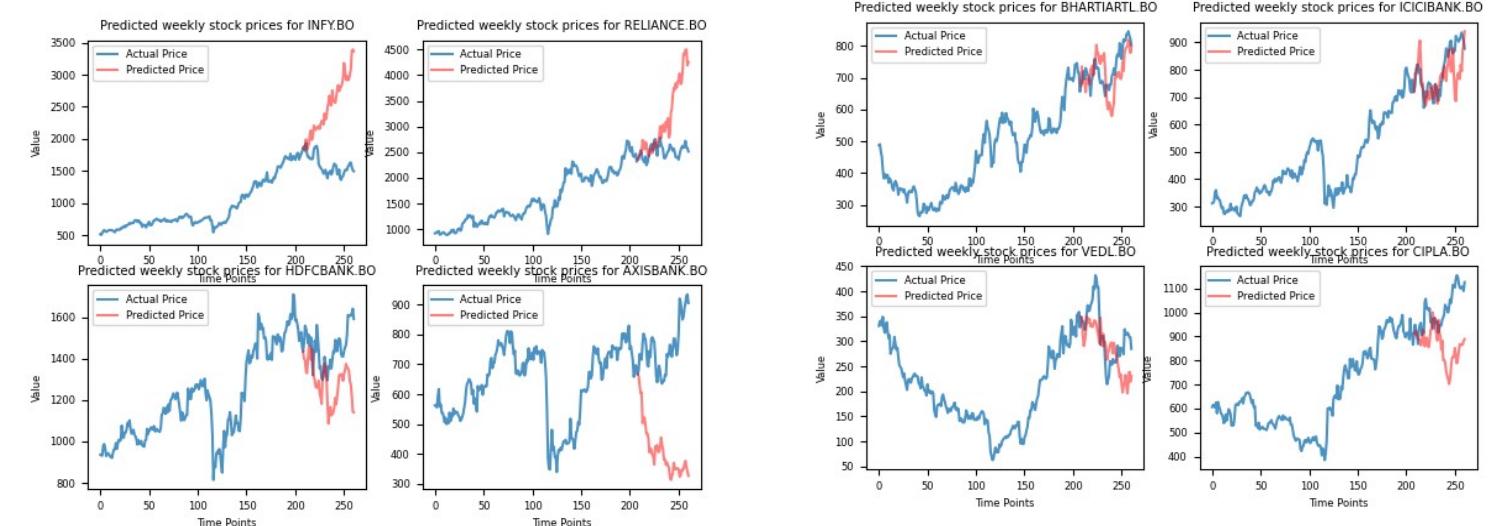
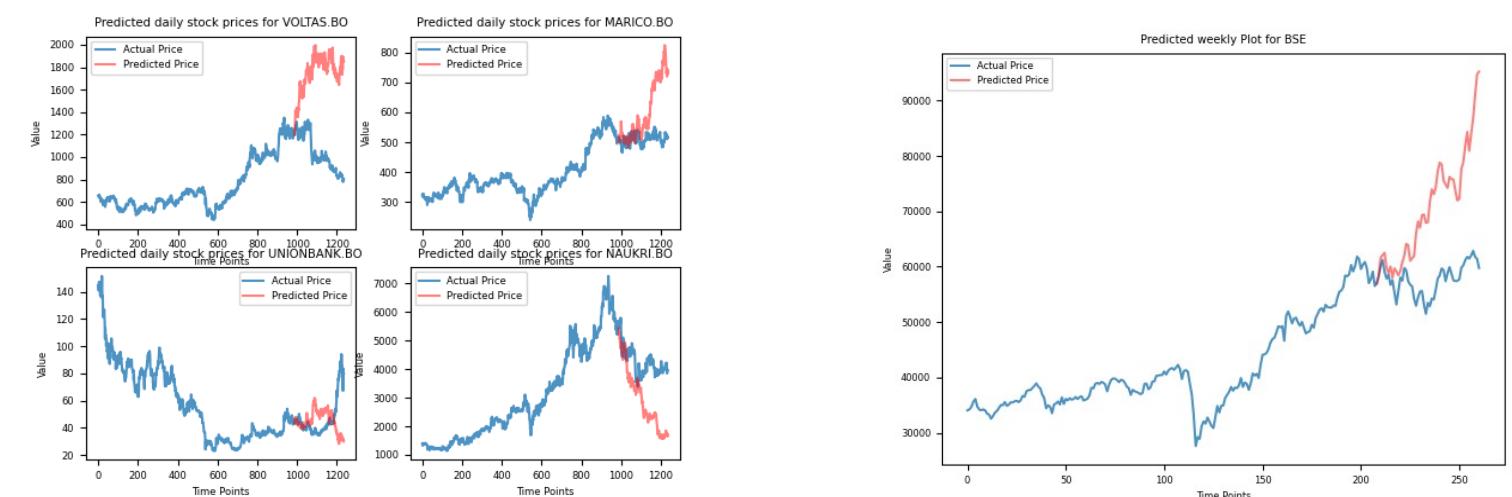
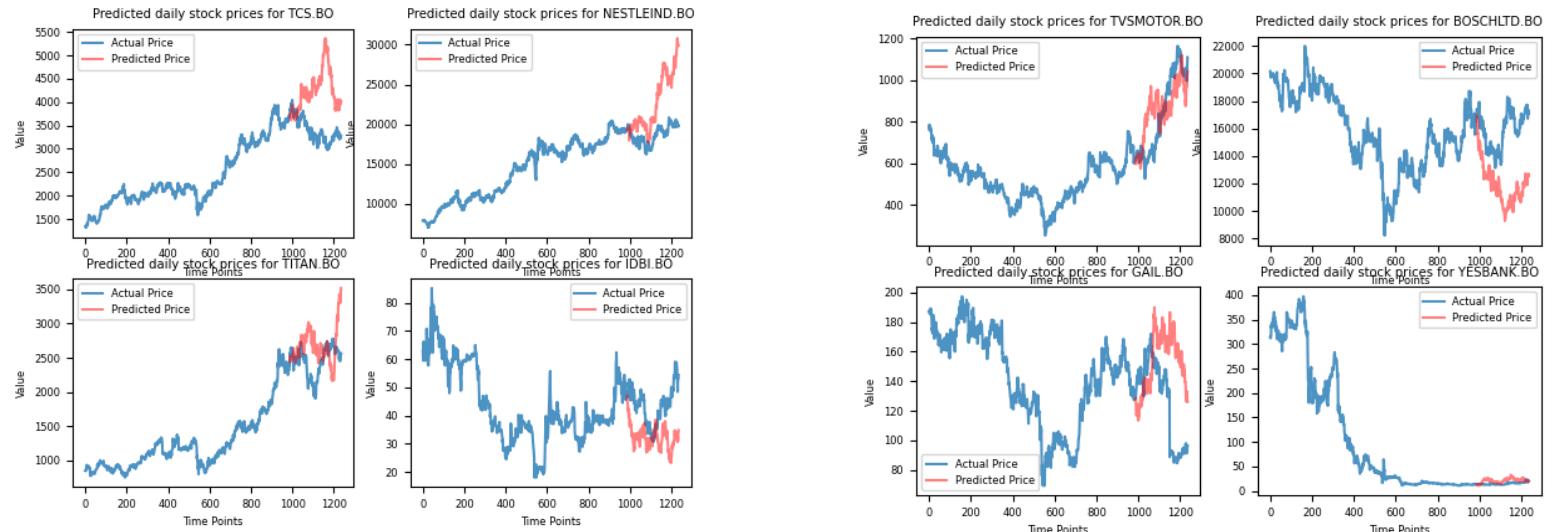
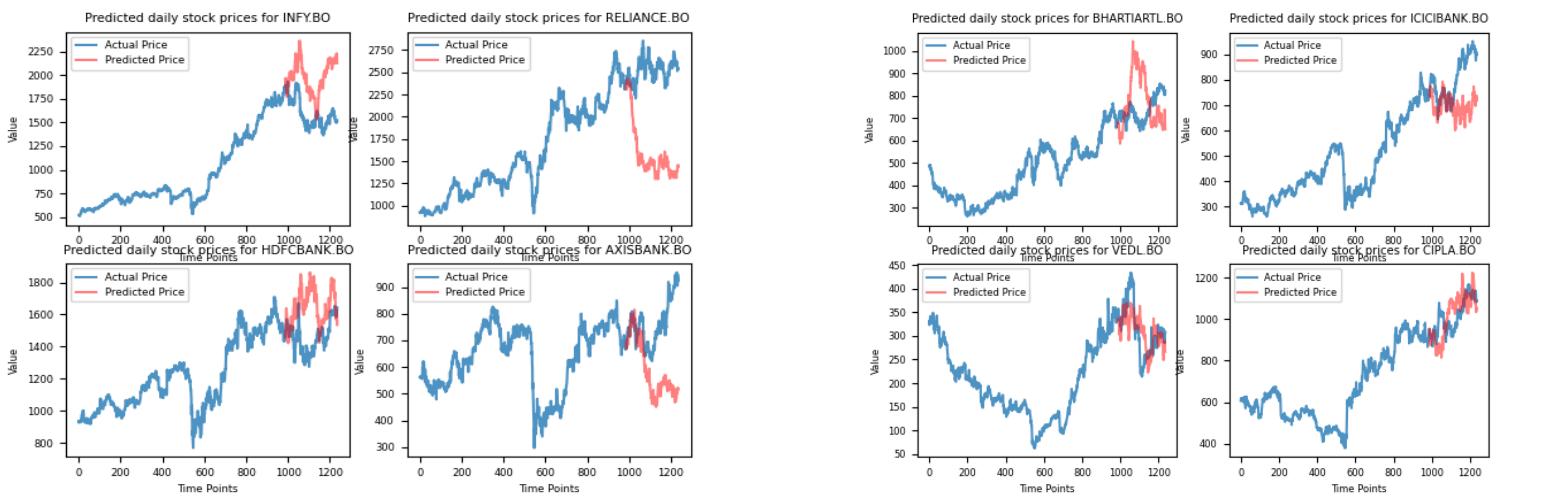
$$S(T) = S(t) e^{\sigma(W(T) - W(t)) + (\mu - \sigma^2/2)t}$$

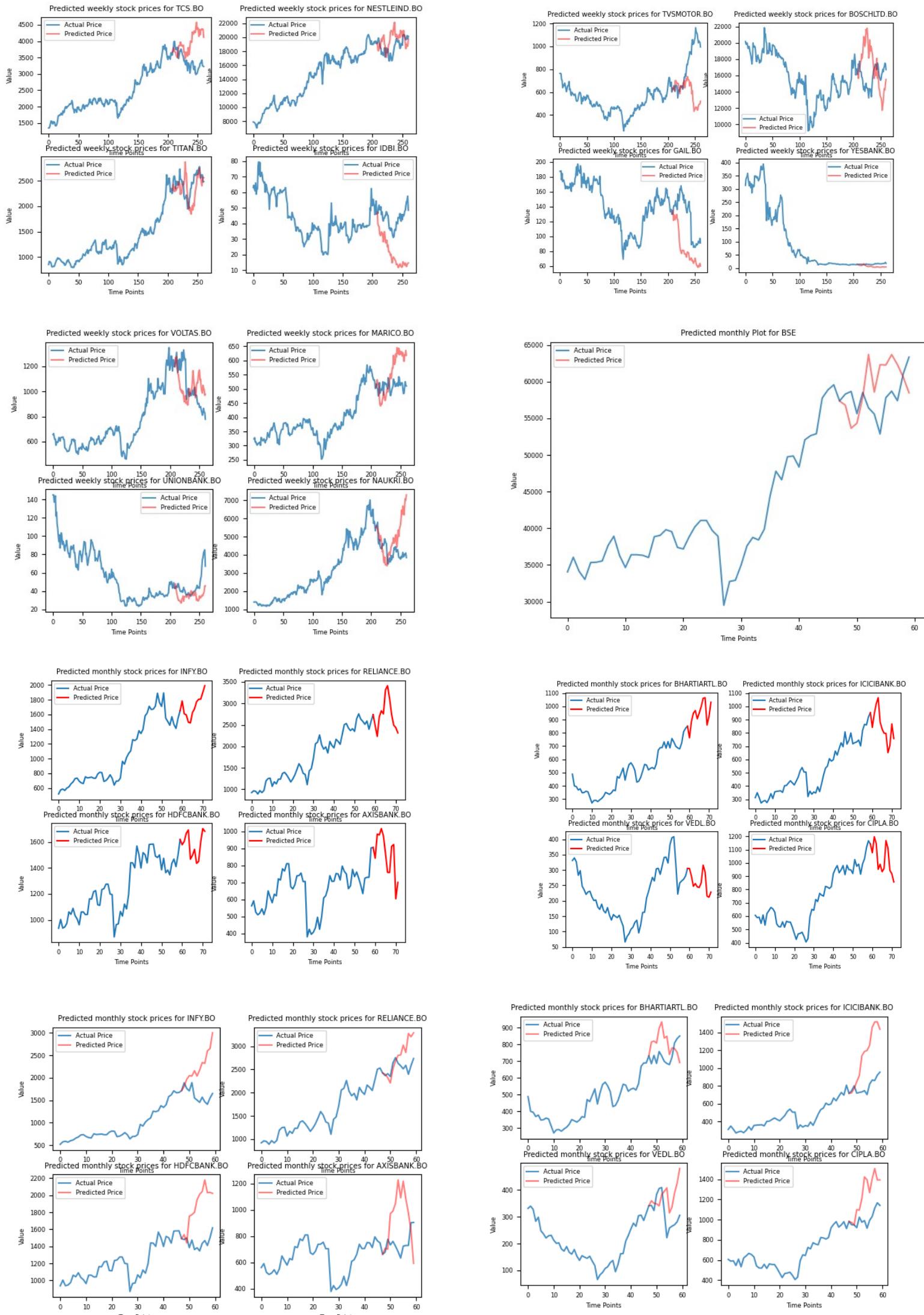
Since $W(T) - W(t)$ is $N(0, \sqrt{T-t})$ hence for two continuous time points t_{i+1}, t_i $\log\left(\frac{S(t_{i+1})}{S(t_i)}\right)$ is normally distributed with mean $\mu - \sigma^2/2$ and variance σ^2 . Hence, I used Monte carlo simulation in order to generate the predicted stock prices. I took points from the sample and computed the log ratio at intermediate time points. Let the sample be denoted by E . Then I used the below two equations in order to estimate μ, σ from the below equations:-

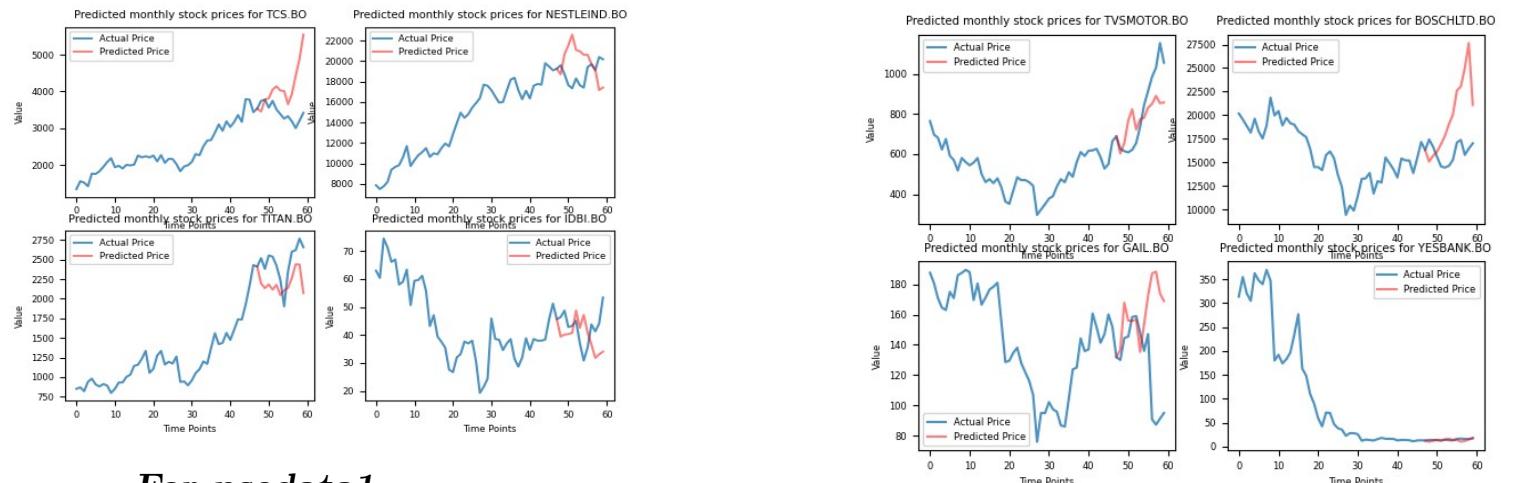
- $\text{mean}(E) = \mu - \sigma^2/2$
- $\frac{n}{n-1} \text{Var}(E) = \sigma^2$
- I followed the above steps and predicted the daily, weekly and monthly stock prices and the plots are given below (**Predicted prices in red**):-

For bsedata1









For nsedata1

