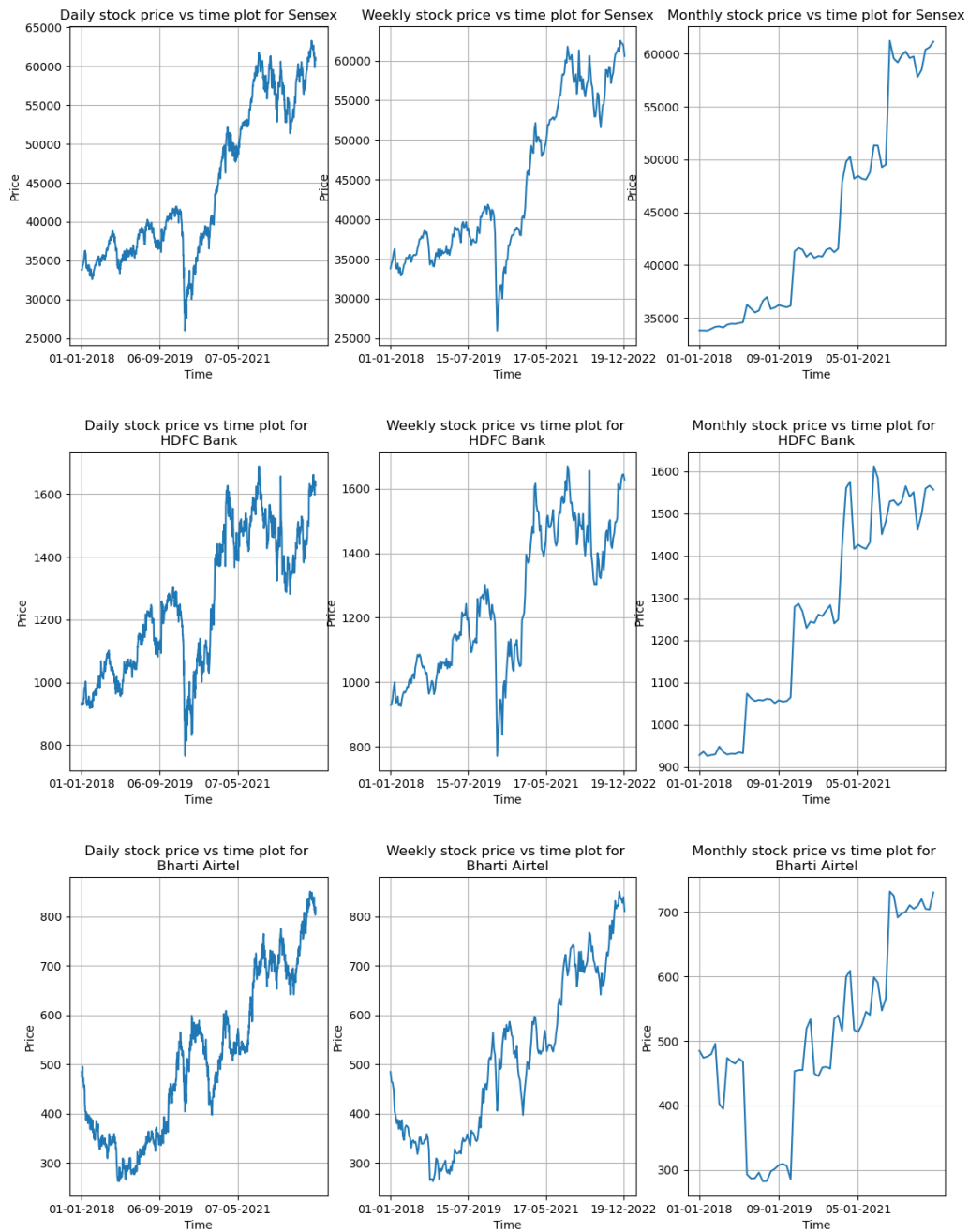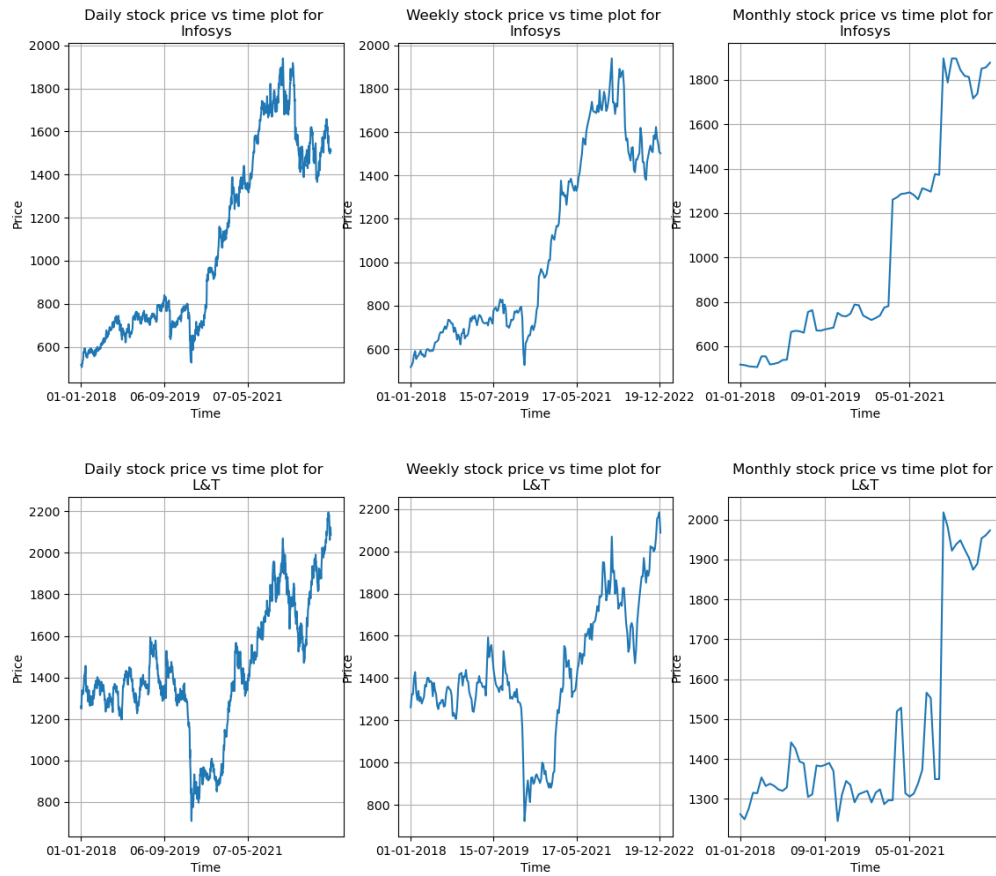# MA74 Lab 6

Aman Bucha
200123006
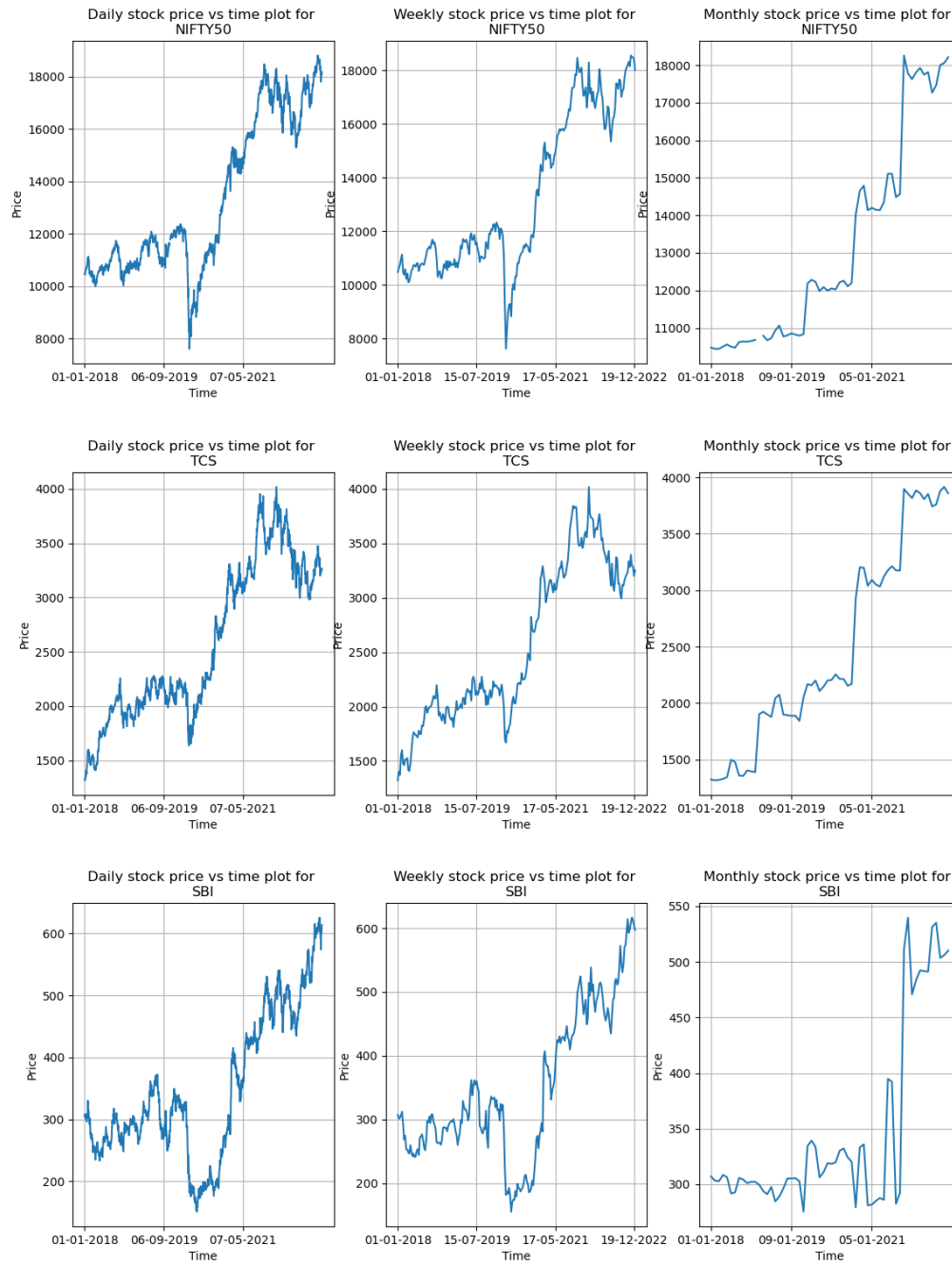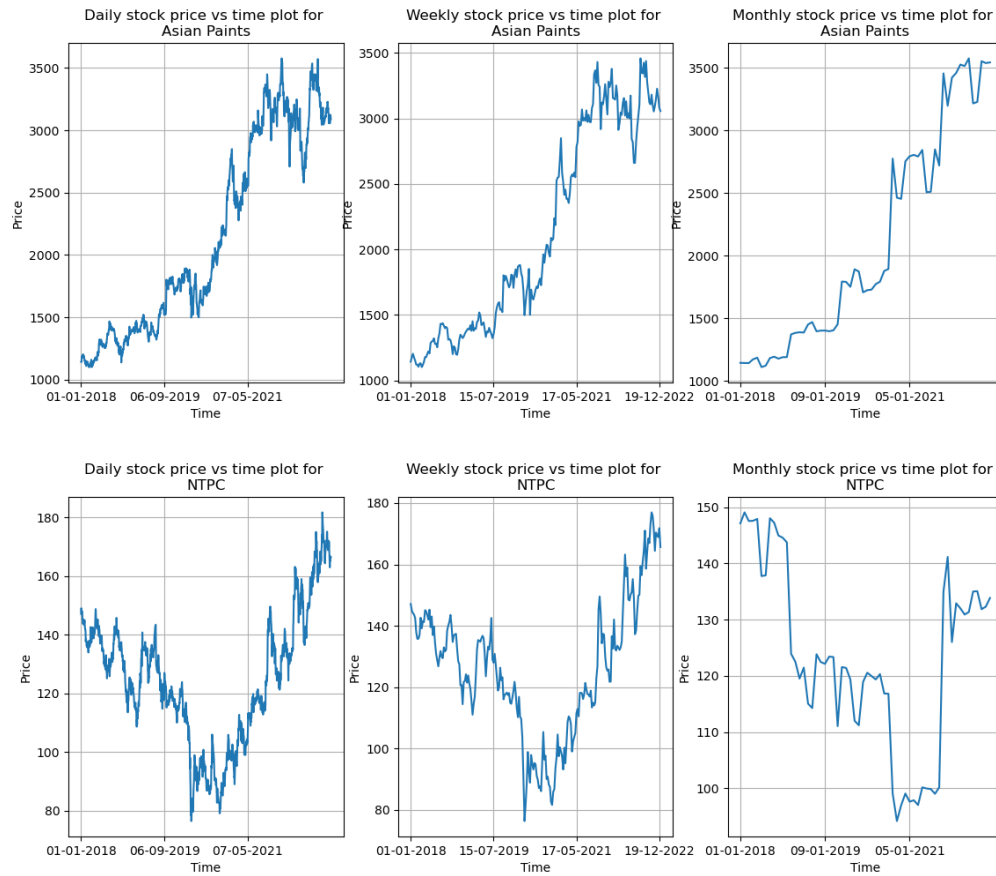
Question 1:

Some of the plots for the data in bsedata1 is as follows :

Some of the plots for nsedata1 are:

Daily stock price vs time plot for NIFTY50 · Weekly stock price vs time plot for NIFTY50 · Monthly stock price vs time plot for NIFTY50 · Daily stock price vs time plot for TCS · Weekly stock price vs time plot for TCS · Monthly stock price vs time plot for TCS · Daily stock price vs time plot for SBI · Weekly stock price vs time plot for SBI · Monthly stock price vs time plot for SBI

Daily stock price vs time plot for Asian Paints • Weekly stock price vs time plot for Asian Paints • Monthly stock price vs time plot for Asian Paints • Daily stock price vs time plot for NTPC • Weekly stock price vs time plot for NTPC • Monthly stock price vs time plot for NTPC

Question 2:

Some of the histogram plots of the normalized returns superimposing in a graph of the density function N (0, 1) for the data in nsedata1 are:

Normalized returns with N(0, 1) for SBI on daily basis
Normalized returns with N(0, 1) for SBI on weekly basis
Normalized returns with N(0, 1) for SBI on monthly basis
Normalized returns with N(0, 1) for NTPC on daily basis
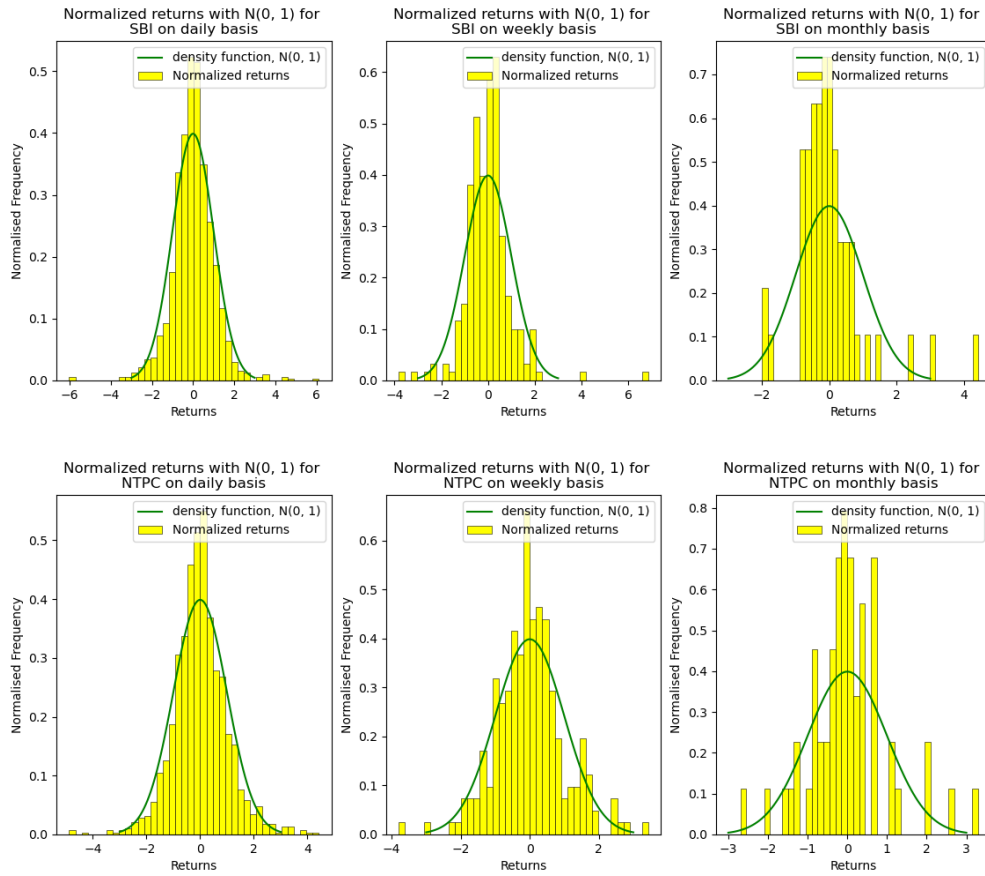Normalized returns with N(0, 1) for NTPC on weekly basis
Normalized returns with N(0, 1) for NTPC on monthly basis

and the same for bsedata1 are:

Normalized returns with N(0, 1) for Sensex on daily basis

Normalized returns with N(0, 1) for Sensex on weekly basis

Normalized returns with N(0, 1) for Sensex on monthly basis

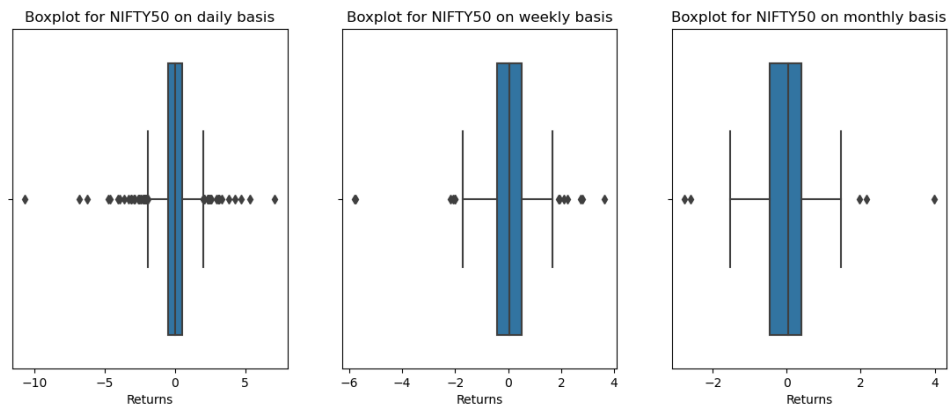Normalized returns with N(0, 1) for HDFC Bank on daily basis

Normalized returns with N(0, 1) for HDFC Bank on weekly basis

Normalized returns with N(0, 1) for HDFC Bank on monthly basis

Normalized returns with N(0, 1) for Bharti Airtel on daily basis

Normalized returns with N(0, 1) for Bharti Airtel on weekly basis

Normalized returns with N(0, 1) for Bharti Airtel on monthly basis

Now the corresponding boxplot of the normalized return of some of the stocks of nsedata1 are as follows:

Boxplot for TCS on daily basis

Boxplot for TCS on weekly basis

Boxplot for TCS on monthly basis

Boxplot for SBI on daily basis

Boxplot for SBI on weekly basis

Boxplot for SBI on monthly basis

Boxplot for Asian Paints on daily basis

Boxplot for Asian Paints on weekly basis

Boxplot for Asian Paints on monthly basis

Boxplot for NTPC on daily basis

Boxplot for NTPC on weekly basis

Boxplot for NTPC on monthly basis

And the same for bsedata1 are:

Boxplot for Infosys on daily basis — Boxplot for Infosys on weekly basis — Boxplot for Infosys on monthly basis

Boxplot for L&T on daily basis — Boxplot for L&T on weekly basis — Boxplot for L&T on monthly basis

Observations –

1. 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.
2. The deviations are due to the random fluctuations in the real world market, so, naïve Gaussian distribution can't completely model it.
3. 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.
4. Such a behaviour is called as leptokurtic, i.e., high peaks and heavy tails. Jump diffusion model (by Merton) take these so called jumps at the tails into account.

Question 3:

The similar plots for the log returns for the data in bsedata1 are:

Normalized log returns with N(0, 1) for Sensex on daily basis

Normalized log returns with N(0, 1) for Sensex on weekly basis

Normalized log returns with N(0, 1) for Sensex on monthly basis

Normalized log returns with N(0, 1) for HDFC Bank on daily basis

Normalized log returns with N(0, 1) for HDFC Bank on weekly basis

Normalized log returns with N(0, 1) for HDFC Bank on monthly basis

Normalized log returns with N(0, 1) for Bharti Airtel on daily basis

Normalized log returns with N(0, 1) for Bharti Airtel on weekly basis

Normalized log returns with N(0, 1) for Bharti Airtel on monthly basis

And for the data of nsedata1 are:

Normalized log returns with N(0, 1) for NIFTY50 on daily basis

Normalized log returns with N(0, 1) for NIFTY50 on weekly basis

Normalized log returns with N(0, 1) for NIFTY50 on monthly basis

Normalized log returns with N(0, 1) for TCS on daily basis

Normalized log returns with N(0, 1) for TCS on weekly basis

Normalized log returns with N(0, 1) for TCS on monthly basis

Normalized log returns with N(0, 1) for SBI on daily basis

Normalized log returns with N(0, 1) for SBI on weekly basis

Normalized log returns with N(0, 1) for SBI on monthly basis

Normalized log returns with N(0, 1) for Asian Paints on daily basis / weekly basis / monthly basis; and for NTPC on daily basis / weekly basis / monthly basis.

Question 4 and 5:

Formulae used –

- Geometric Brownian motion is used to model the scenario since stock prices behave like a stochastic process:

$$S(t_{i+1}) = S(t_i) \exp\left((\mu - 0.5\,\sigma^2)(t_{i+1} - t_i) + \sigma\sqrt{t_{i+1} - t_i}\, Z_{i+1}\right)$$

- μ and σ^2 can be found by solving following equations:

$$\mu - \frac{\sigma^2}{2} = \frac{1}{n}\sum_1^n u_i = E(u)$$

$$\sigma^2 = \frac{1}{n-1}\sum_1^n (u_i - E(u))^2$$

$$u_i = \ln(\frac{S_i}{S_{i-1}})$$

where,

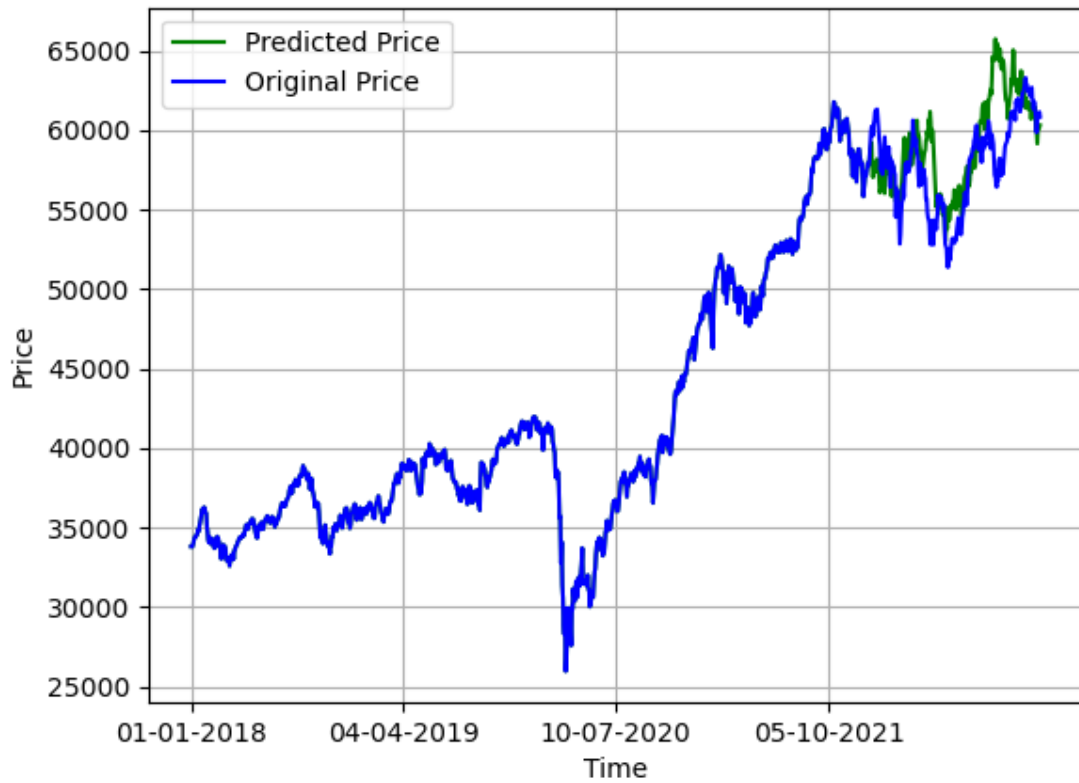Z1, Z2, …, Zn are independent N(0, 1) variables, ui is the log return of day i, and si and si-1 are adjacent closing stock prices of day i - 1 and day i respectively
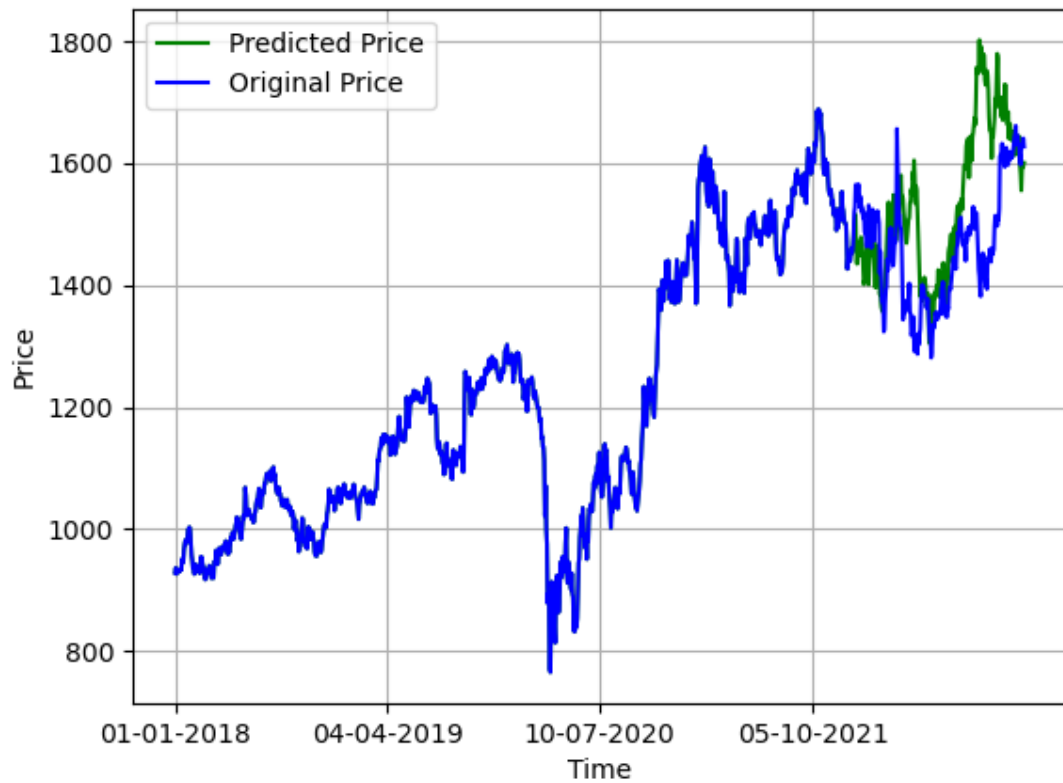
For daily stock data:

- The generated stock prices path along with the actual path for stocks in bsedata1 are:
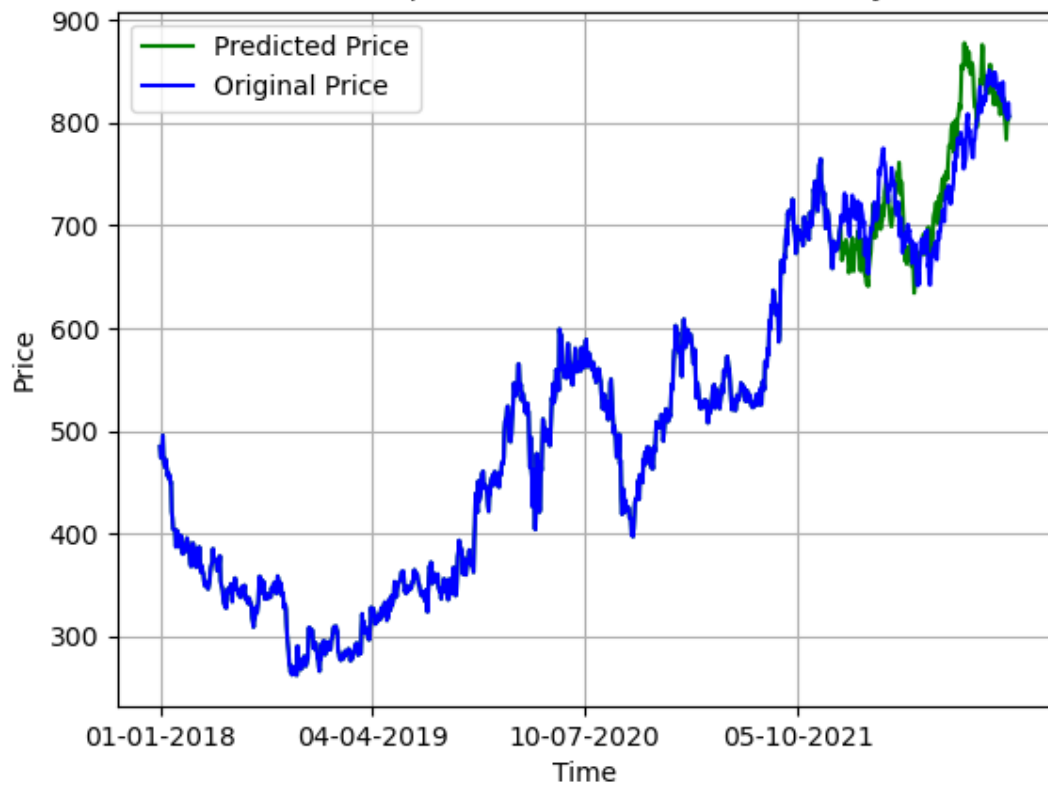
Plot for Stock prices for Sensex on daily basis
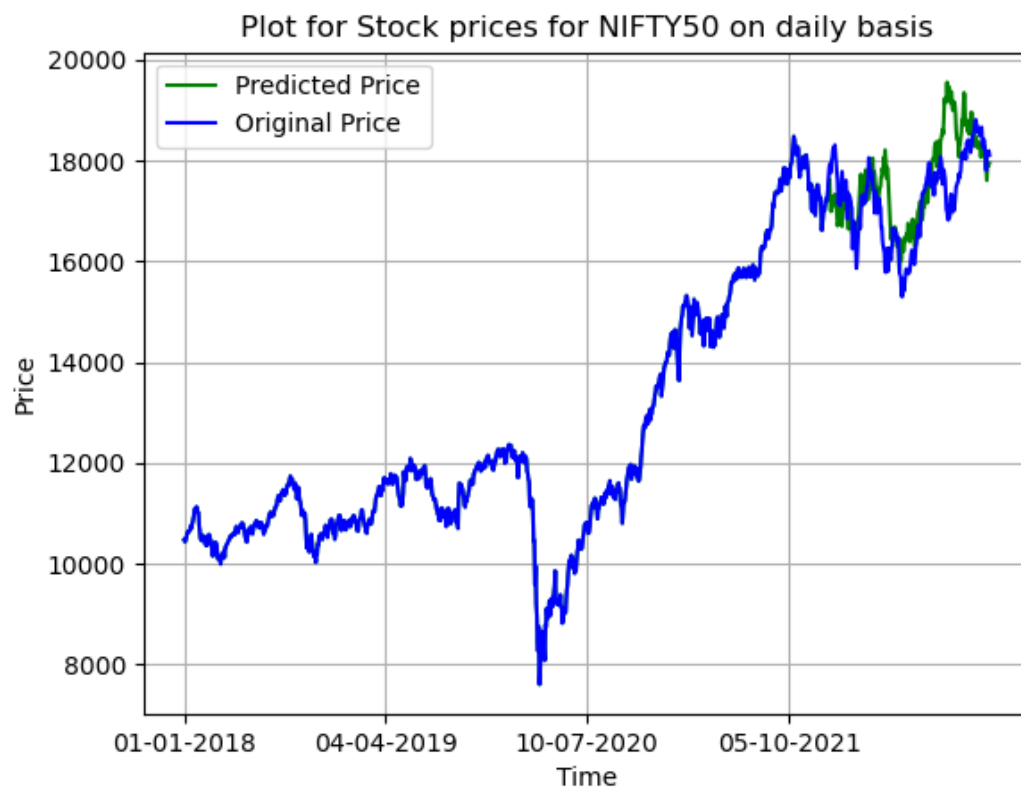

Plot for Stock prices for HDFC Bank on daily basis

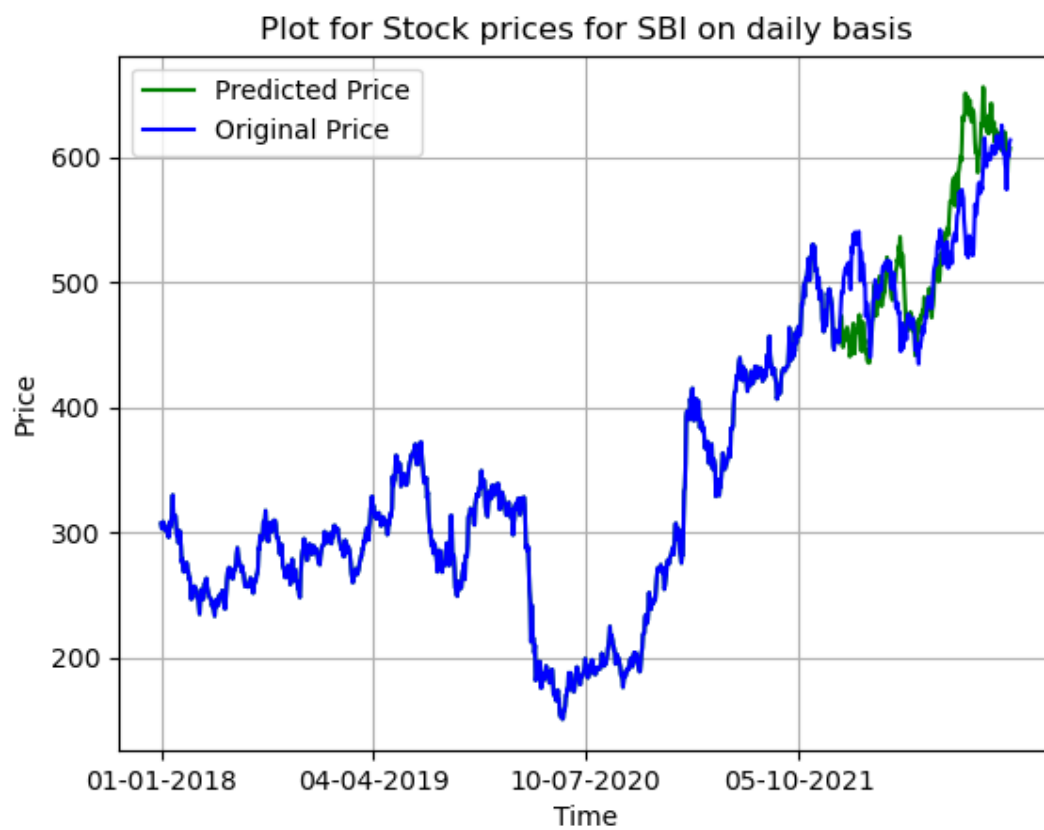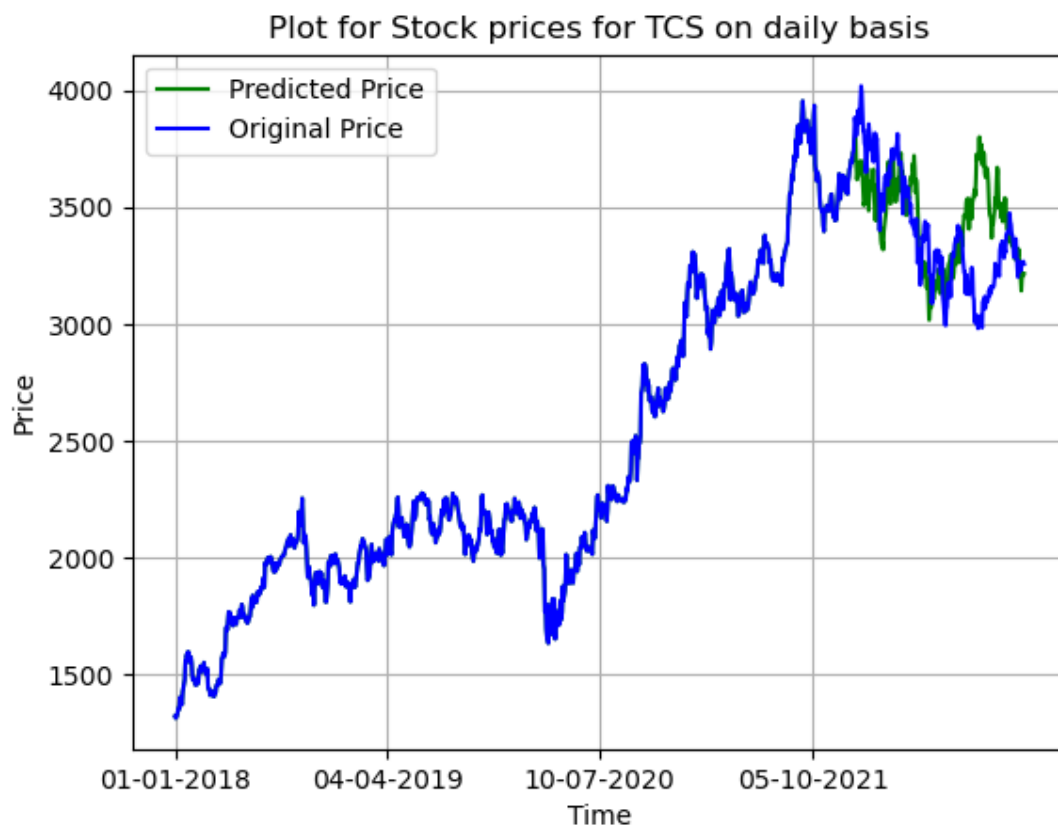Plot for Stock prices for Bharti Airtel on daily basis

Plot for Stock prices for Infosys on daily basis

For **nsedata1:**

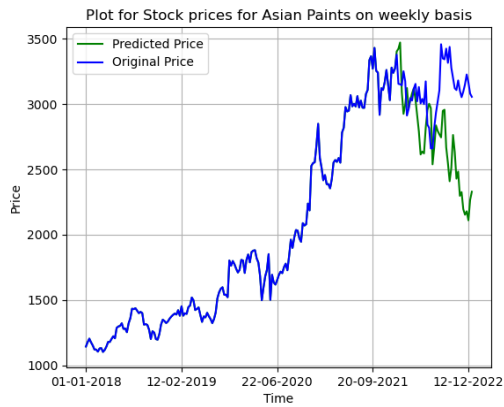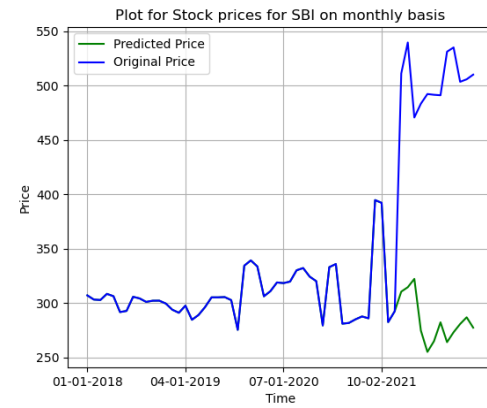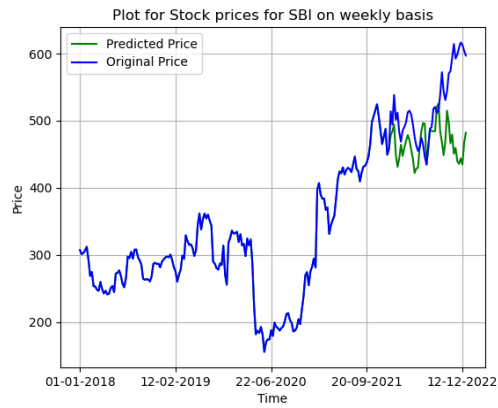Plot for Stock prices for NIFTY50 on daily basis

Plot for Stock prices for TCS on daily basis

Plot for Stock prices for SBI on daily basis

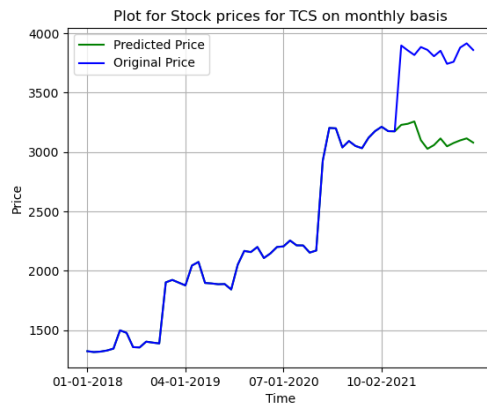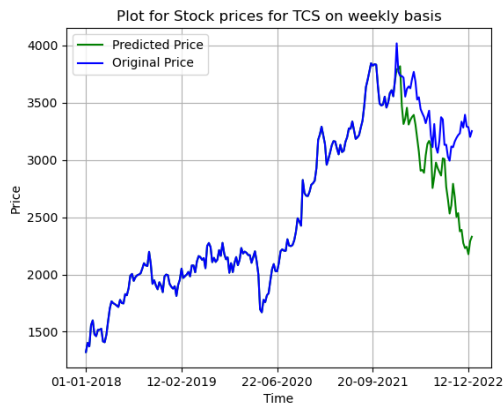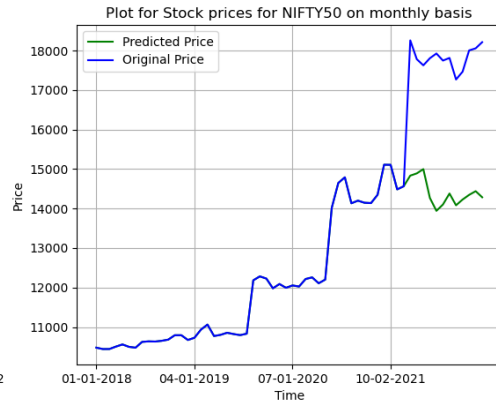Plot for Stock prices for Asian Paints on daily basis

Now for **Weekly** and **Monthly** Returns the similar plots are :

For **nsedata1**:

Plot for Stock prices for NIFTY50 on weekly basis

Plot for Stock prices for NIFTY50 on monthly basis

Plot for Stock prices for TCS on weekly basis

Plot for Stock prices for TCS on monthly basis

Plot for Stock prices for SBI on weekly basis

Plot for Stock prices for SBI on monthly basis

Plot for Stock prices for Asian Paints on weekly basis

Plot for Stock prices for Asian Paints on monthly basis

For **bsedata1**:

Plot for Stock prices for Bharti Airtel on weekly basis

Plot for Stock prices for Bharti Airtel on monthly basis

Plot for Stock prices for Infosys on weekly basis

Plot for Stock prices for Infosys on monthly basis