

MA 374: FE-Assignment #6

Due on Monday, February 22, 2016

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PROBLEM

Consider the data in databases bsedata1 and nsedata1 that you have already obtained. Now for each of the stocks and for each of the market indices do the following :

1. Plot the prices against time (daily, weekly and monthly).
2. Compute the returns R_i (daily, weekly and monthly) and plot histograms of normalized returns

$$R_{ii} = \frac{(R_i - \mu)}{\sigma}$$

where μ and σ are sample mean and sample standard deviation respectively. Superimpose on each of these histograms a graph of the density function $N(0,1)$. Now, zoom into the tails of all these plots. What are your observations ?

3. Will the observations be different if you instead use the log returns ?
4. Now, consider the daily data only for the period January 1, 2007 to December 31, 2014 and estimate the μ and σ using log returns. Using the μ and σ , generate a path of stock prices that resembles (as closely as possible) the actual path of the stock for the period of January 1, 2015 to December 31, 2015.
5. Repeat the above with weekly and monthly data.

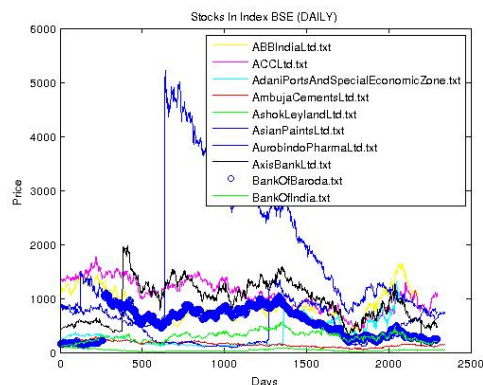
Summarize your observations in your report. Remember that you have to pick the same day of the week for weekly data and same day of the month for the monthly data.

SOLUTION

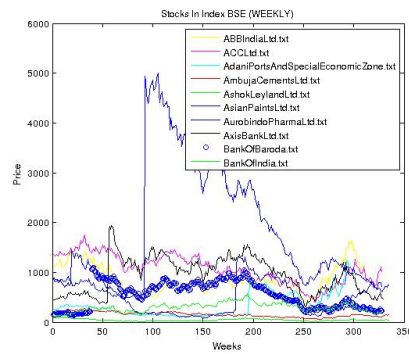
Stocks in BSE Index	Stocks not in BSE and NSE Indices	Stocks in NSE Index
ABBIndiaLtd ACCLtd AdaniPortsSpecialEconomicZone AmbujaCementsLtd AshokLeylandLtd AsianPaintsLtd AurobindoPharmaLtd AxisBankLtd BankOfBaroda BankOfIndia	AdityaBirlaNuvoLtd Alphabet Amazon Danone DollarGeneralCorporation Facebook HessCorporation LibertyLilacGroup MTNL TajHotels	ACCLtd AdaniPortsSpecialEconomicZone AmbujaCementsLtd ApolloHospitals AsianPaintsLtd AurobindoPharmaLtd AxisBankLtd BankOfBaroda BankOfIndia Bosch

Part 1

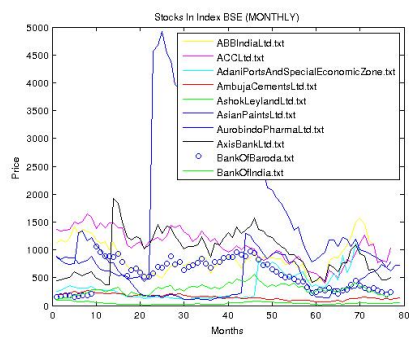
(1) Stocks included in the BSE Index (DAILY):



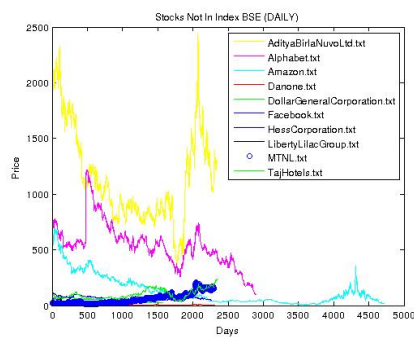
(2) Stocks included in the BSE Index(WEEKLY):



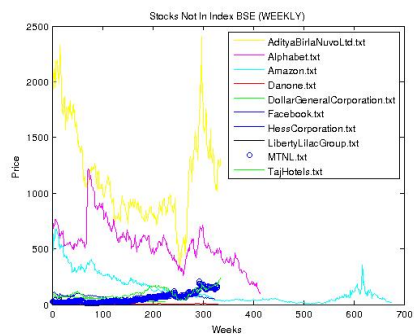
(3) Stocks not included in the BSE Index (MONTHLY):



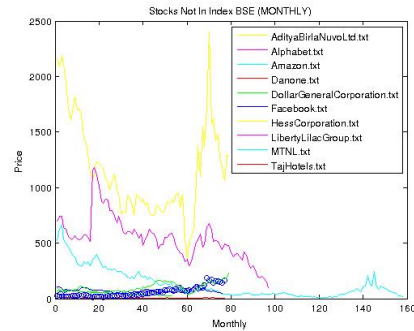
(4) Stocks not included in BSE and NSE Indices (DAILY):



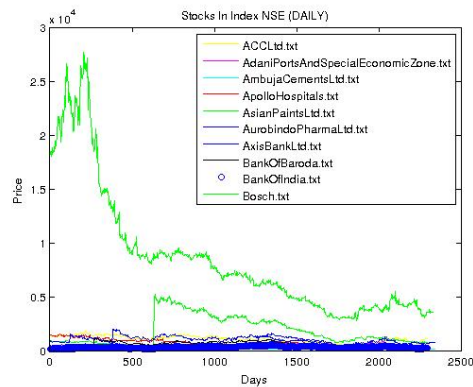
(5) Stocks not included in BSE and NSE Indices (WEEKLY):



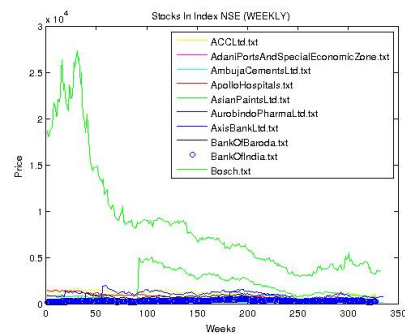
(6) Stocks not included in BSE and NSE Indices(MONTHLY):



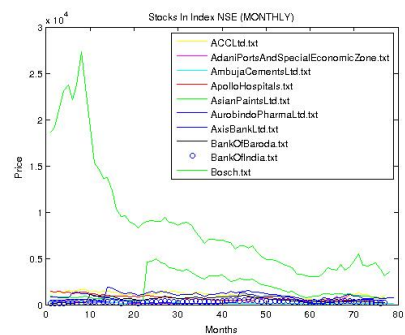
(7) Stocks included in the NSE Index (DAILY):



(8) Stocks included in the NSE Index(WEEKLY):



(9) Stocks not included in the NSE Index (MONTHLY):



(1) As mentioned in the table above, the stocks which are not included in both the indices are common so only one plot has been shown here as the other one is same .

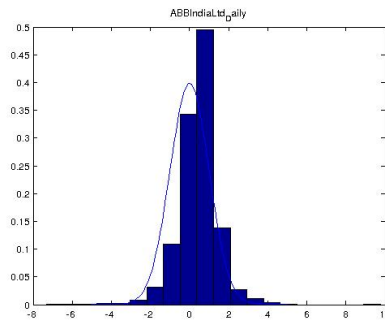
- (2) The prices are more or random (brownian motion) as approximated by us for simulations.
- (3) The variation in the prices is more abrupt in daily plots as the granularity is more there , in the weekly plot,the prices change less abruptly, however this might not be true in general. It depends on the dates chosen for the respective plots.

Part 2

Only one stock out of 10 from each of the set of stocks (Included in BSE,Not included in both BSE and NSE,Included in NSE) has been shown here due to space constraint,the rest of the stocks are included in the folder.

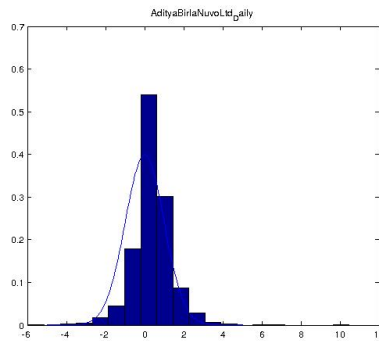
- (1) Daily returns of stocks included in BSE Index :

ABBIndiaLtd



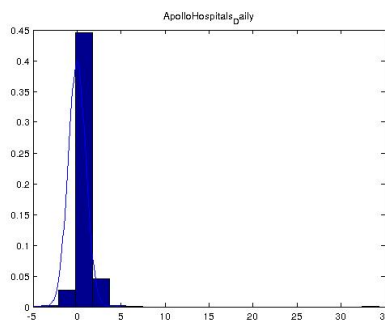
- (2) Daily returns of stocks not included in BSE and NSE Indices :

AdityaBirlaNuvoLtd



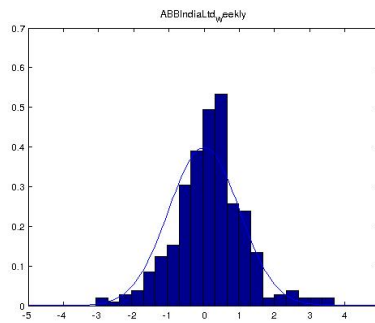
- (3) Daily returns of extra stocks included in NSE Index :

ApolloHospitals



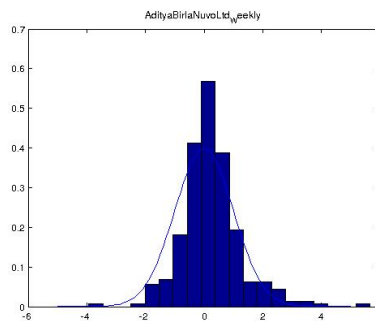
(4) Weekly returns of stocks included in BSE Index :

ABBIndiaLtd



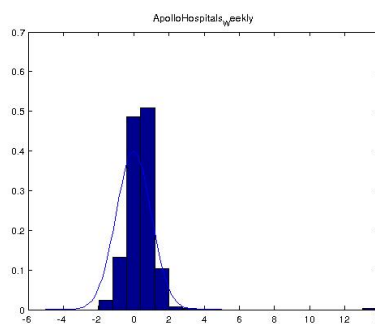
(5) Weekly returns of stocks not included in BSE and NSE Indices :

AdityaBirlaNuvoLtd



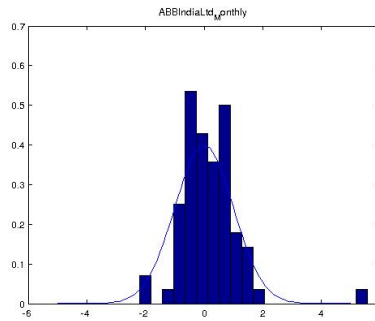
(6) Weekly returns of extra stocks included in NSE Index :

ApolloHospitals



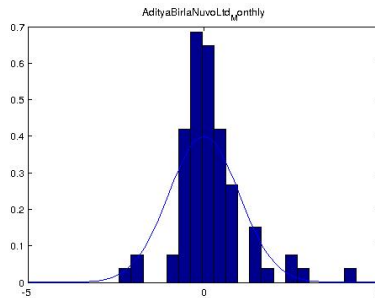
(7) Monthly returns of stocks included in BSE Index :

ABBIndiaLtd



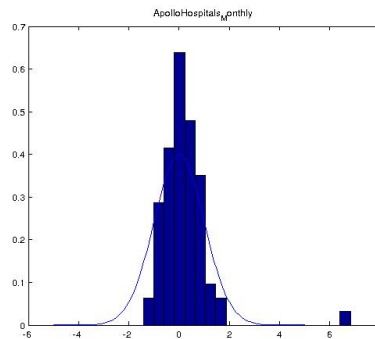
(8) Monthly returns of stocks not included in BSE and NSE Indices :

AdityaBirlaNuvoLtd



(9) Monthly returns of extra stocks included in NSE Index :

ApolloHospitals



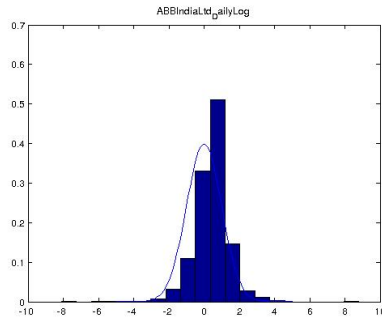
(1) The rest of the stocks also show similar trends that is they are not exactly normal.

(2) Stock prices are generally brownian processes and the difference in stock prices at tow time instants are normal in the idea case, the deviation from normal as seen in the plots could be due to change in market conditions.

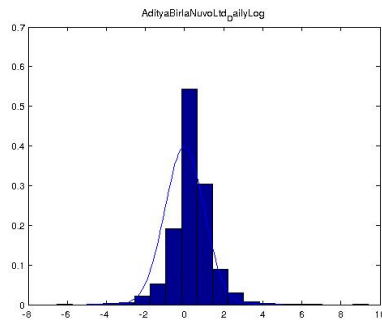
Part 3

Only one stock out of 10 from each of the set of stocks (Included in BSE,Not included in both BSE and NSE,Included in NSE) has been shown here due to space constraint,the rest of the stocks are included in the folder.

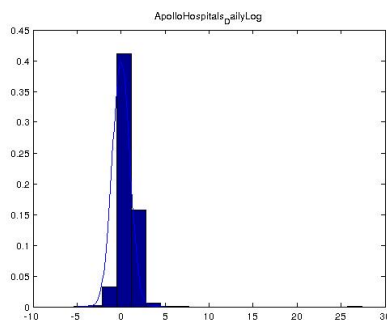
(1) Daily log-returns of stocks included in BSE Index :

ABBIndiaLtd

(2) Daily log-returns of stocks not included in BSE and NSE Indices :

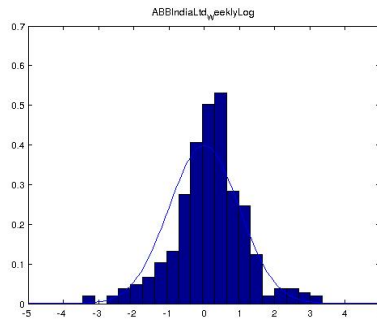
AdityaBirlaNuvoLtd

(3) Daily log-returns of extra stocks included in NSE Index :

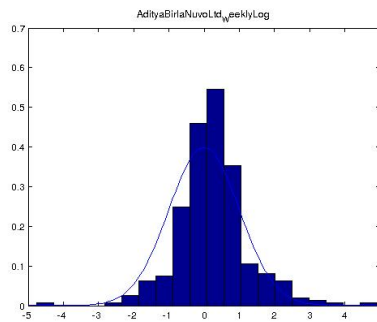
ApolloHospitals

(4) Weekly log-returns of stocks included in BSE Index :

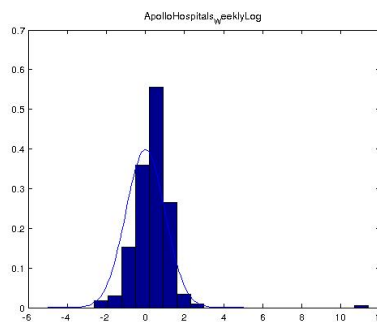
ABBIndiaLtd



(5) Weekly log-returns of stocks not included in BSE and NSE Indices :
AdityaBirlaNuvoLtd

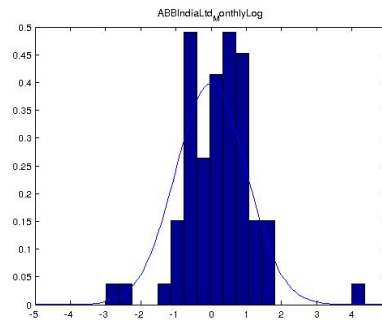


(6) Weekly log-returns of extra stocks included in NSE Index :
ApolloHospitals



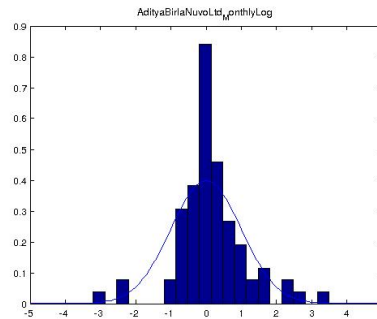
(7) Monthly log-returns of stocks included in BSE Index :

ABBIndiaLtd



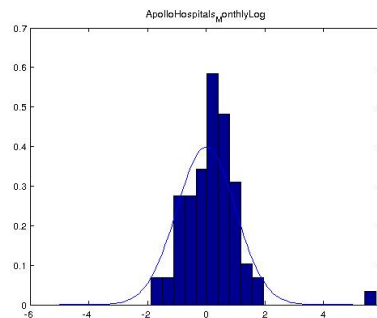
(8) Monthly log-returns of stocks not included in BSE and NSE Indices :

AdityaBirlaNuvoLtd



(9) Monthly log-returns of extra stocks included in NSE Index :

ApolloHospitals



(1) The rest of the stocks also show similar trends for the distribution of log-returns that is they are more normally distributed than the naive return calculated above.

(2) The reason for the log-returns to be more normal could be attributed to the expression of log-normal return itself .

Part 4

Calculation of μ and σ from log-returns of the stocks:

Stock prices generally follow geometric brownian motion given by

$$S(t) = S(0)e^{(\mu - \frac{\sigma^2}{2})\Delta t + \sigma W_t}$$

$$\log\left(\frac{S(t)}{S(0)}\right) = \left(\mu - \frac{\sigma^2}{2}\right)\Delta t + \sigma\sqrt{\Delta t}Z$$

Let log return be r

$$E(r) = \left(\mu - \frac{\sigma^2}{2}\right)\Delta t$$

$$Var(r) = \sigma^2\Delta t$$

$$\mu = \frac{E(r) + \frac{Var(r)}{2}}{\Delta t}$$

$$\sigma = \frac{\sqrt{Var(r)}}{\sqrt{\Delta t}}$$

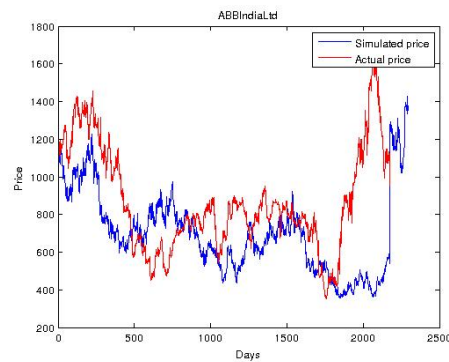
The paths along with the actual prices of all the stocks were plotted by simulating the paths using the μ and σ as calculated above.

The algorithm used to simulate the path as close to the real prices as possible was :

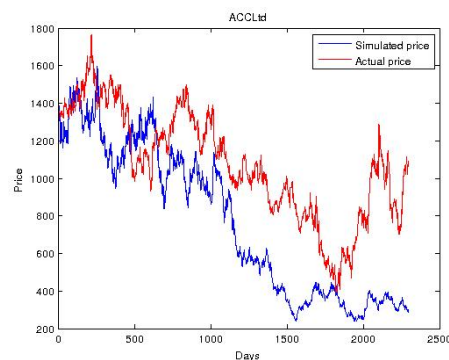
- Simulate some 300 paths using Monte Carlo Simulation
- For each of the path check if the difference between the simulated price and the real price is less than a threshold (0.5 in this case) or not
- Count the data points where the difference is less than or equal to the threshold value. If the number of data points where the difference is more than the threshold is negligible then that path is chosen to simulate the price as closely as possible.

Stocks included in BSE

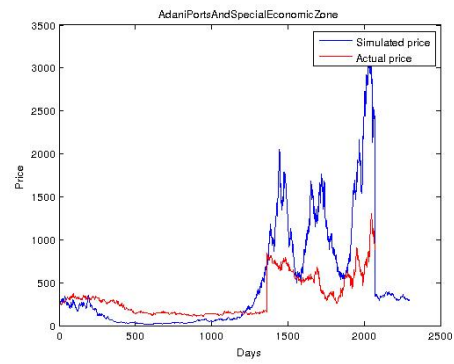
(1) ABB India Ltd :



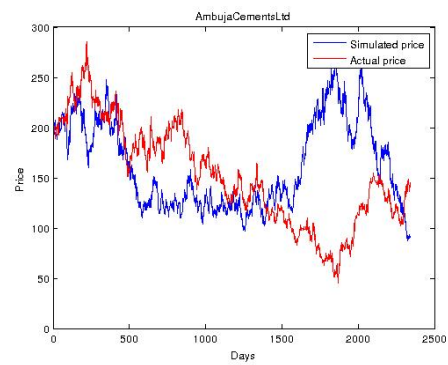
(2) ACC Ltd :



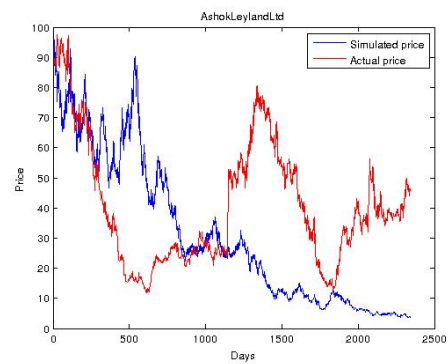
(3) Adani Ports And Special Economic Zone:



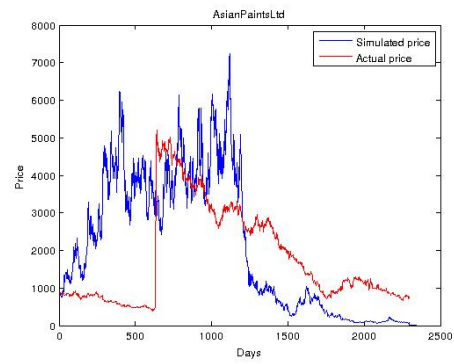
(4) Ambuja Cements:



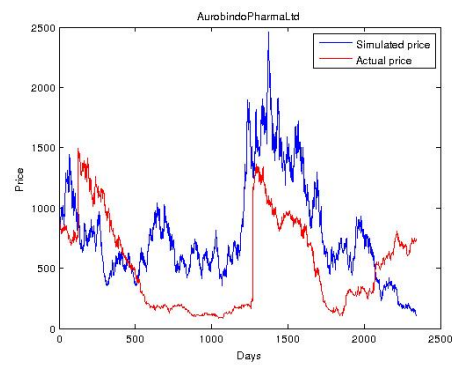
(5) Ashok Leyland Ltd:



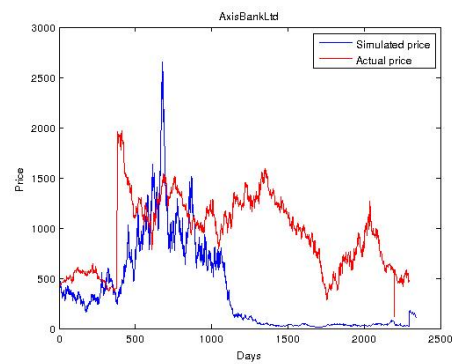
(6) Asian Paints Ltd:



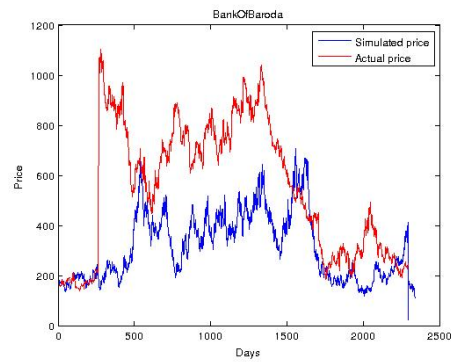
(7) Aurobindo Pharma Ltd:



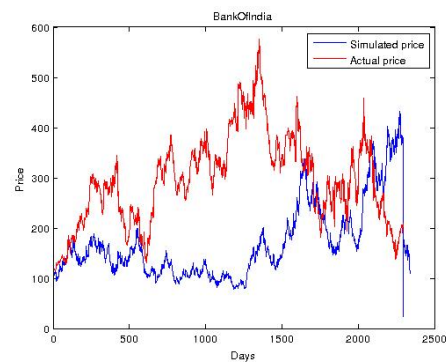
(8) Axis Bank Ltd :



(9) Bank Of Baroda :

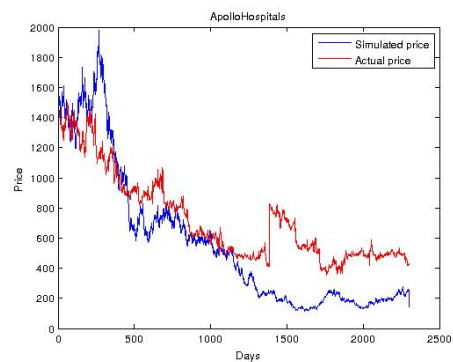


(10) Bank Of India :

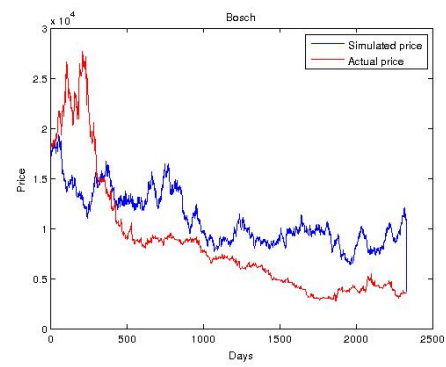


Extra Stocks included in BSE (Rest are in BSE as well)

(1) Apollo Hospitals :

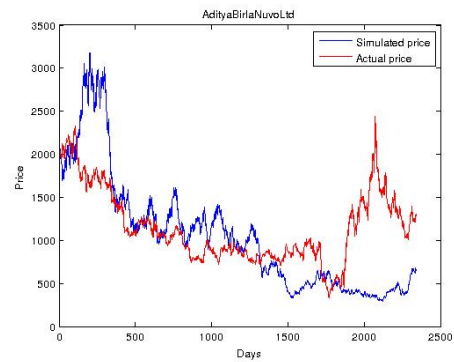


(2) Bosch:

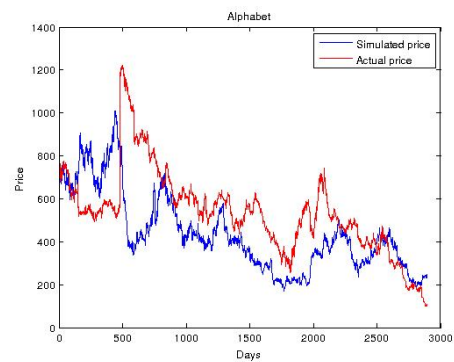


Stocks not included in BSE and NSE as well)

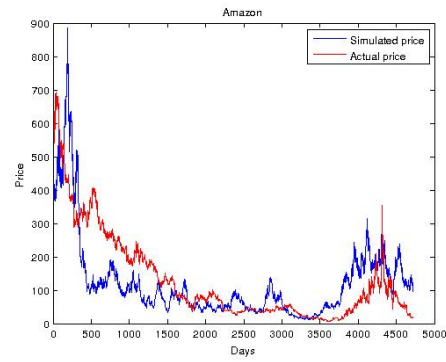
(1) Aditya Birla Nuvo Ltd:



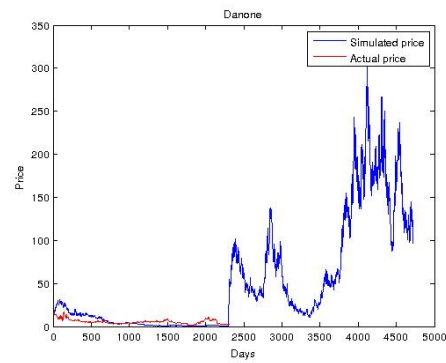
(2) Alphabet:



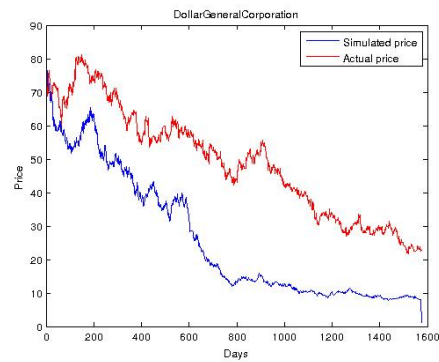
(3) Amazon :



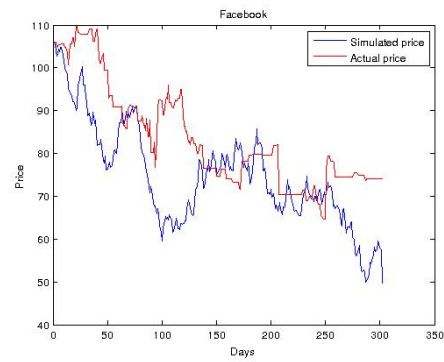
(4) Danone :



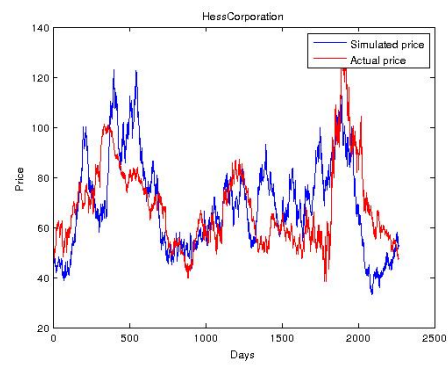
(5) DollarGeneralCorporation :



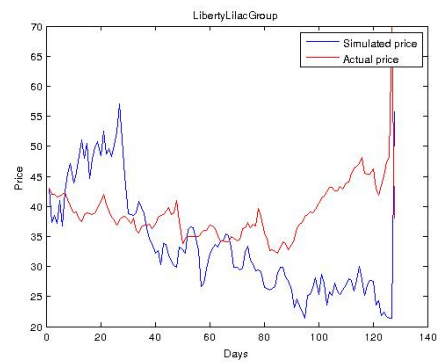
(6) Facebook :



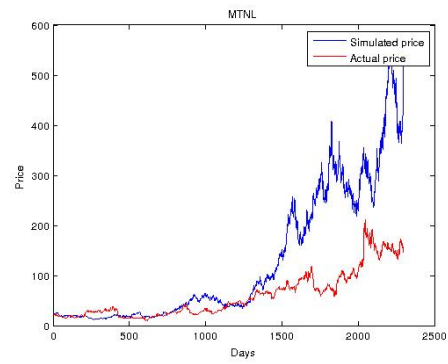
(7) Hess Corporation :



(8) Liberty Lilac Group :



(9) MTNL :



(10) Taj Hotels :

