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FORECASTING STOCK MARKET OF BANK USING BROWNIAN MOTION

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ABSTRACT. The principal factors namely smoothened value, changes in the smoothened value and the trend estimate are analyzed for the forecast of stock market. Forecasting error is calculated from the difference of peak value and the forecast value. Share values of a bank for three consecutive years are analyzed. Values are saved for each and every month and the variations are monitored carefully. The factors related to stock market are tabulated and graphs are plotted. It is concluded that the stock market follows Brownian motion and hence it is considered as fractals sets.

1. INTRODUCTION

Brownian motion refers to the mathematical models which explains those random actions, which will be explored Brownian motion was invented by the biologist Robert Brownian in 1827, [7]. The stock market is the most symbolic and is critically concerned at all time. The study of the exponential smoothing of stock markets [11]. Arrives at the findings that shares holding for a longer period with low beta and low debt-equity ratio offer additional profit, though investing the stocks for a short term with high beta and high debt-equity ratio offers high profit in the short time period [6, 12]. The financial service division proves that service division offers very good profit in the short time period and low profit in the long run as compared to profits from the average stocks. Stock

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markets, the foreign exchange markets, commodity Markets and bond markets are all supposed to follow Brownian motion, [3]. The location, namely the change of state on the assets, is being modified by random quantities. More significantly, the mathematical models utilized to explain Brownian motion are the basic primary tools on which all financial asset and product pricing models are based, [1].

It is observed that the logarithms or regular-stock market can be considered as a collection of results in a statistical stable state and that this collection of logarithms of prices each changing with the time has a close equivalence with the collection of coordinates of a large number of molecules, [2]. The value and momentum patterns in average profits are stored by empirical asset pricing models and whether such models put forward that asset pricing is included across areas for proof on market incorporation, [4]. Regular stock denotes the rights in a company. When you purchase regular stock, you are buying the company's factories, buildings, and products. Regular stock is sold in shares [9] each share of regular stock denotes the basic unit of ownership of the company. Equity capital is the amount used by the investor to buy stocks. As the investment of money can increase or lose the money, you must decide the quantity of money that you can allow to leave behind without disturbing your living style. The quantity of money an investor can have enough money to lose is called risk capital in [8], and that is the money that should be invested. Remember, invest only what you can have enough money to lose. The study attempts to fill the distance within the documentation and connects functions of documentation in the situation of rising Indian Economy. Additional research in this domain will enhance the documentation and theoretical opinions of connection among functioning performance and marketplace functioning of banking institutions.

Experts can stay up for these results to benchmark banking stocks in terms of capital introduction for the shareholders. Both can cross deep evaluation for cost creating banking stocks thru operational efficiencies as an alternative of simple accounting based totally information, [5, 10].

2. Method to prepare stock market forecast

Forecast from Exponential smoothing and subjective estimates, successful to a great extent. Exponential smoothing provides a convenient systematic method for revising the forecast for the next period.

The smoothened value is referred as S_t, changes in the smoothened value is referred as ΔS_t, Trend estimate is referred as T_t and the forecasted value is denoted as $\hat{S}_t$. These values are tabulated in table 2. e_t is calculated from these four factors as below. To describe smooth value, trend estimate, forecast and error of the stock market is obtained.

The smoothed value are calculated by the following result

$$S_t = \alpha x_t + (1 - \alpha)S_{t-1}.$$

The Brownian motion of a stock market index $S(t)$ is a smoothened value. Where t is time period and α is smoothing coefficients and S_t and S_{t-1} denote smooth value at time t and $t - 1$ correspondingly.

Step 1: Find the ΔS_t, the change in smoothed value, where

$$\Delta S_t = S_t - S_{t-1}.$$

Step 2: Find the Trend estimate T_t by the formula

$$T_t = \alpha(\Delta S_t) + (1 - \alpha)T_{t-1},$$

where T_t, T_{t-1} respectively denote trend at time t and $t - 1$. This time analysis indicates that the stock market is trend estimate (T_t). Thus prove that the Brownian motion is perfect.

Step 3: Prepare the forecast $\hat{x}_t$ for period $(t + 1)$ as follows

$$\hat{x}_t = S_t + \frac{1 - \alpha}{\alpha}T_t.$$

In fact forecast $\hat{x}_t$ is the period $(t + 1)$.

Step 4: Calculate the Forecasting error e_t,

$$e_t = \hat{S}_t - x_{t+1},$$

where, actual value is x_t.

2.1. **Bank share forecast in the year 2017.** Real time datas of bank of the year 2017 are processed and plotted as shown in the Figure 1. The five factors namely smoothened value, changes in the smoothened value and the trend estimate, forecast, forecasting error decides the prediction of stock market. The forecasting is observed to be a Brownian motion and hence its referred as a fractal set.
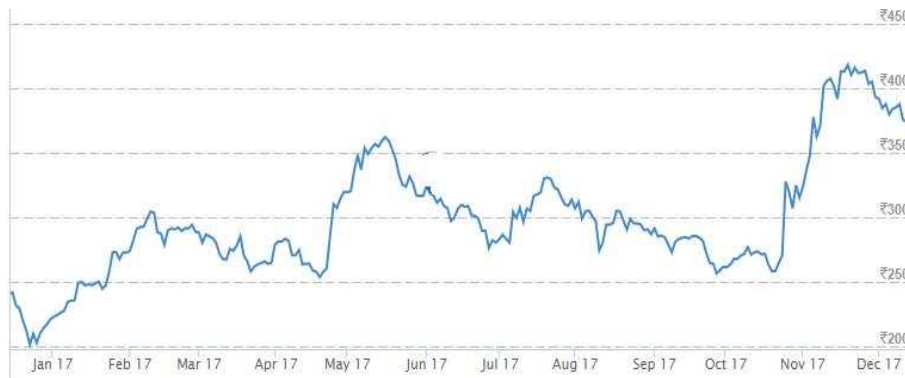

FIGURE 1. Analysis of a Bank Share Forecast in the year 2017

The peak value of the data's of each month of the year 2017 is tabulated and shown in table 1. The table values are derived from figure 1. The year started with the minimum share value and ends with the maximum share value.

TABLE 1. Peak value of the Bank Shares in the year 2017

Jan -17	Feb -17	Mar -17	Apr -17	May -17	June -17	July -17	Aug -17	Sep -17	Oct -17	Nov -17	Dec -17
225	275	280	275	320	370	280	320	280	265	375	380

The five factors namely smoothened value, changes in the smoothened value and the trend estimate, forecast, forecasting error decides the prediction of stock market. The forecast value is found to be varying for every month. These factors are tabulated in table 2. The factors are plotted as shown in figure 1.

The factors such as smoothened value, changes in the Smoothened value and the Trend estimate are observed as fluctuating during the year 2017 and the started to decrease slowly at the final segment of the year. Table 2 values are simulated using MATLAB and shown in Figure 2.

TABLE 2. Factors deciding forecast of Stock market in the year 2017

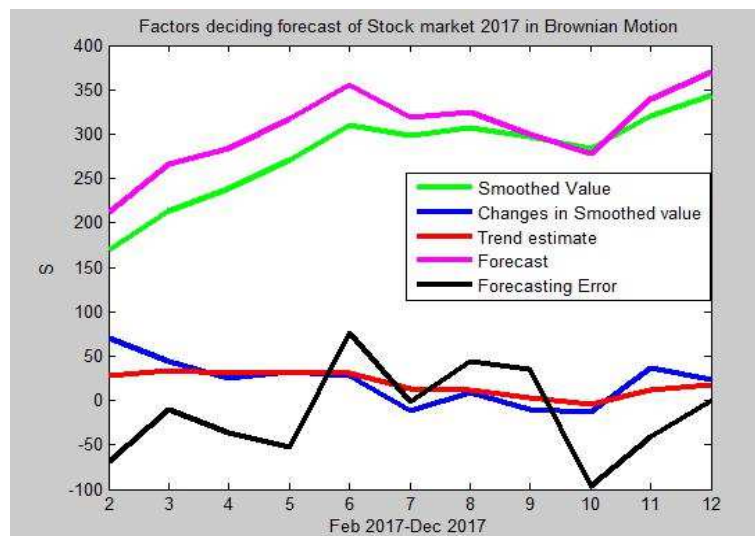| month	S_t	ΔS_t	T_t	$\hat{S}_t$	e_t
Feb-17	170	70	28	212	-68
Mar-17	214	44	34.4	265.6	-9.4
Apr-17	238.4	24.4	30.4	283.61	-36.39
May-17	271.04	32.64	31.30	317.99	-52.01
June-17	310.62	28.36	30.12	355.8	75.8
July-17	298.37	-12.25	13.17	318.13	-1.87
Aug-17	307.02	8.65	11.36	324.06	44.06
Sep-17	296.21	-10.81	2.49	299.95	34.95
Oct-17	283.73	-12.58	-3.54	278.42	-96.58
Nov-17	320.24	36.51	12.48	338.96	-41.04
Dec-17	344.14	23.9	17.05	369.72	-

FIGURE 2. Factors deciding forecast of Stock market in the year 2017

2.2. **Bank share forecast in the year 2018.** Real time datas of bank of the year 2018 are processed and plotted as shown in the fig 3. The five factors namely smoothened value, changes in the smoothened value and the trend estimate, forecast, forecasting error assists to predict the stock market for the corresponding year. The forecasting is observed to be a Brownian motion and hence its referred as a fractals set.
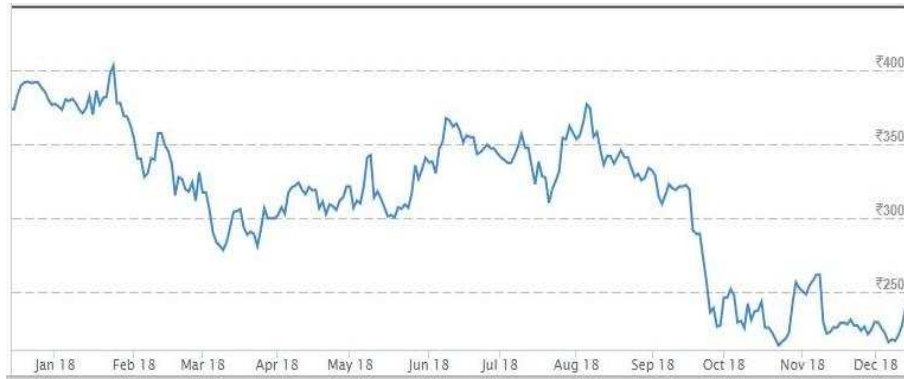
FIGURE 3. Analysis of a Bank share forecast in the year 2018

The peak value of the data's of each month of the year 2018 is tabulated and shown in table 3. The year started with the maximum share value and ends with the minimum share value.

TABLE 3. Peak value of the Bank Shares in the year 2018

Jan -18	Feb -18	Mar -18	Apr -18	May -18	June -18	July -18	Aug -18	Sep -18	Oct -18	Nov -18	Dec -18
390	375	325	310	320	340	350	375	325	245	260	225

The five factors namely smoothened value, changes in the smoothened value and the trend estimate, forecast, forecasting error are tabulated. Forecasting values are calculated from the smoothened values and the trend estimate. Initially, the forecasting error is observed as negative. The error value is found as maximum during the month of September. Table 4 is derived from Table 3.

The forecasted value is found to be maximum during February, August month and minimum during December month. The values are frequently changing for every month and hence it follows Brownian motion. Hence it is fractals set. The values are tabulated in table 4 and the corresponding graphs are generated using MATLAB and displayed in figure 4.

2.3. **Bank share forecast in the year 2018.** Real time datas of Bank for the year 2019 are processed and plotted as shown in the figure 5. The five factors namely smoothened value, changes in the smoothened value and the trend estimate, forecast, forecasting error decides the prediction of stock market. The

TABLE 4. Factors deciding Forecast of Stock Market in the year 2018

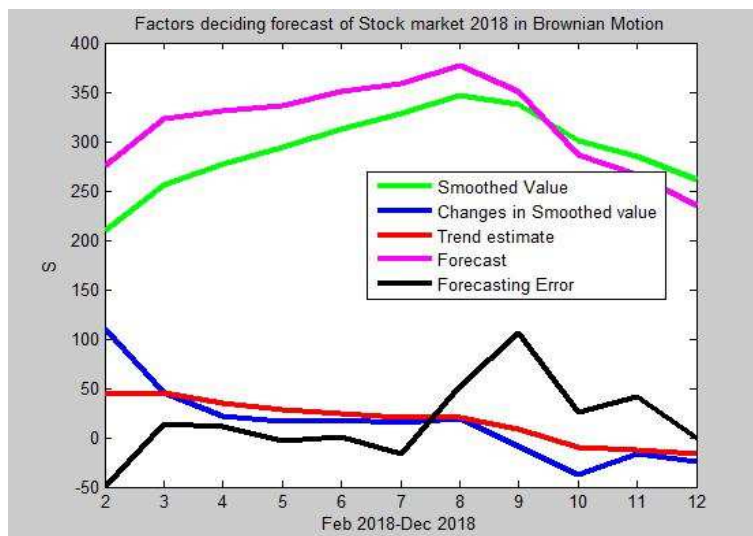| month	S_t	ΔS_t	T_t	$\hat{S}_t$	e_t
Feb-18	210	110	44	276	-49
Mar-18	256	46	44.8	323.2	13.2
Apr-18	277.6	21.6	35.52	330.88	10.88
May-18	294.56	16.96	28.10	336.71	-3.29
June-18	312.74	18.18	24.13	350.44	0.44
July-18	327.67	14.9	20.44	358.3	-16.7
Aug-18	346.58	18.94	19.84	376.34	51.34
Sep-18	337.95	-8.63	8.45	350.63	105.63
Oct-18	300.77	-37.18	-9.80	286.07	26.07
Nov-18	284.46	-16.31	-12.40	265.86	40.86
Dec-18	260.68	-23.78	-16.95	235.26	-

FIGURE 4. Factors deciding Forecast of Stock Market in the year 2018

forecasting is observed to be a Brownian motion and hence its referred as a fractal set.

The peak value of the data's of each month of the year 2019 from figure 5 is tabulated and shown in table 5. It is observed that the year ends with the minimum share value.
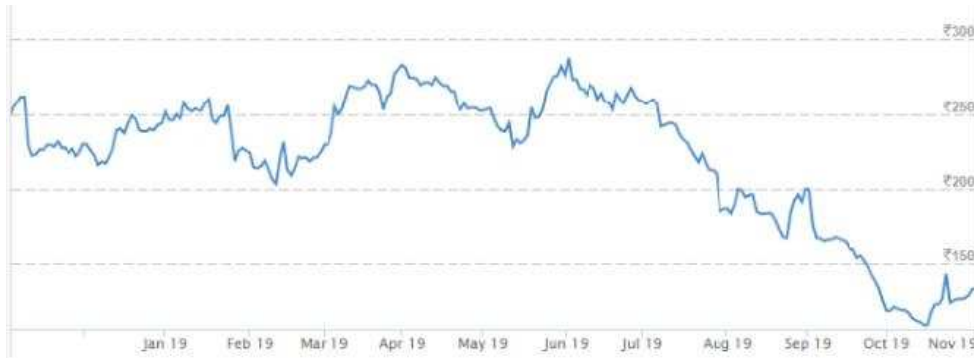
FIGURE 5. Analysis of a Bank Share Forecast in the year 2019

TABLE 5. Peak value of the Bank Shares in the year 2019

Jan -19	Feb -19	Mar -19	Apr -19	May -19	June -19	July -19	Aug -19	Sep -19	Oct -19	Nov -19
250	225	230	270	255	280	265	200	200	120	140

The five factors namely smoothened value, changes in the smoothened value and the trend estimate, forecast, forecasting error decides the prediction of stock market. The factors present in table 6 are derived from table 5.

TABLE 6. Factors deciding Forecast of Stock Market in the year 2019

month	S_t	ΔS_t	T_t	$\hat{S}_t$	e_t
Feb-19	150	50	20	180	-50
Mar-19	182	32	42.8	246.2	-23.8
Apr-19	217.2	35.2	39.76	276.84	21.84
May-19	232.32	15.12	29.90	277.17	-2.83
June-19	251.39	19.07	25.57	289.75	24.75
July-19	256.83	5.44	17.52	283.11	83.11
Aug-19	243.10	-22.73	1.42	236.23	36.23
Sep-19	220.46	-13.64	-4.60	213.56	93.56
Oct-19	180.28	-40.18	-18.83	152.04	12.04
Nov-19	164.14	-16.14	-17.75	137.52	-

The forecasting values are found from the smoothened values, trend estimate and change in the smoothened values. The values are found fluctuating and hence it follows Brownian motion. So it also fractals set.

The data from table 6 are plotted using MATLAB and the corresponding graph is shown in fig 6.
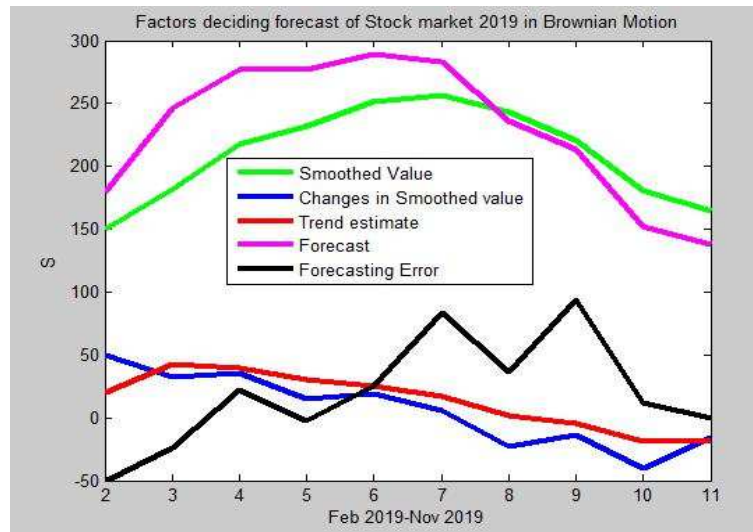

FIGURE 6. Factors deciding Forecast of Stock Market in the year 2019

3. CONCLUSION

This research paper, the share values of a bank for the three consecutive years are analyzed. The fluctuations of share prices on daily basis, makes the stock market more unpredictable and very difficult to predict because of economic factors of the country. Many analysts are carried on bank functioning both in grown and growing economies. Even though sufficient analysis at the organization of developing dimensions of stock functioning with Bank efficiency is presented for the grown nations, this kind of research in developing economies is constrained. Forecasting stock market has become a significant financial subject. The datas of a bank share for three consecutive years 2017, 2018 and 2019 are tabulated and graphs are plotted. The factors deciding the forecast of stock market are calculated and graphs are drawn. The graphs are found to observe Brownian motion. Hence it is concluded that it is a fractal set.

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