STOCK MARKET ANALYSIS: A CASE STUDY

Dipali Meher[1], Vidya Jadhav[2], Jay Kunjir[3], Dhiraj Mahajan[4] and Shivansh Supekar[5]

[1]*Computer Science Department, Modern College of Arts, Science and Commerce, India*
[2,3,4,5]*Statistics Department, Modern College of Arts, Science and Commerce, India*

Abstract

Pharmaceutical industry is highly capital-intensive Industry. After economic liberalization most of the Indian company raise fund for their new projects through capital market by issuing shares. However, capital markets are highly volatile and investors need to have close eye on the market for getting maximum return. In the present study, the stock prices of three pharmaceutical companies namely CIPALA, SUNFARAMA, DIVISLAB were studied for their performances in the capital market of Bombay Stock Exchange (BSE). The stock price data of these companies are obtained at monthly time step from BSE website for the duration January 2011 to March 2022. The data was analyzed using various statistical methods such as descriptive statistics, simple moving average (SMA), money flow index (MFI), relative strength index (RSI) and beta Index. The results showed that stock of DIVISLAB is best performer followed by CIPLA and SUNPHARMA. This analysis also provides several clues to investors for making perfect decision on holding or buying or selling the stock during a particular signal revealed from statistical indices used in the study.

Keywords:

Stock Market, Money Flow Analysis, Beta Index, Regression analysis, Time Series Analysis

1. INTRODUCTION

Pharmaceutical Industry is highly capital-intensive Industry. The successful and timely completion of any infrastructure project is thus largely depending on available capital along with the companies.

- The pharmaceutical companies generally collect the required capital for the project through different methods. One of those methods is through stock marketing by releasing their shares. Through the selling of shares, the companies not only collect money but also establish a brand in the market and build confidence among the prospective buyers for their new projects.

- In general, the stock price of a company reflects its financial performance in terms of capital value [10]. It is also established fact that both economic and noneconomic factors affect stock return behaviour. A better understanding of the stock market trend will facilitate allocation of financial sources to the most profitable investment opportunity. The behaviour of stock returns will enable the investors to make appropriate investment decisions [11].

- The fluctuations of stock returns are due to several economic and non- economic factors. An investor can only succeed in his investment when they are able to select the right share in right sector. The investors must watch the situations keenly in the market like political, economy, company progress, industrial profile, returns and the risk involved in a share before investing in the share.

Thus, it is necessary to study on fluctuations in stock market [12] in understanding its behavior [1]. Various statistical techniques can serve as valuable tools to explore the performance of stocks. In this study, stock prices of three pharmaceutical companies namely CIPLA, SUNPHARMA and DIVISLAB were studied. The objective of the present study is to make analysis of selected stocks of the construction industry sector using historical data collected from secondary sources. The study is based on established statistical methods such as Beta index [2], Relative Strength Index [3] and Simple Moving average [4]. The analysis will help understand if the stock is technically strong. The results will also help understanding current trend and risks involved in studied stocks which in turn help the investors in taking proper decision on selling and buying of the stocks.

2. OBJECTIVES

- To examine the risk and volatility associated with stock prices.
- To study the current trend and strength of the three selected stock.
- To study the characteristics of stock prices of selected companies.
- To analyze monthly fluctuations in the stock prices.
- To study the price movements in the selected stocks.

3. DATA COLLECTION

This study is aimed at analyzing the equity share price movement in three Bombay Stock Exchange (BSE) listed pharmaceutical companies namely CIPLA Limited, SUNPHARMA and DIVISLAB using simple statistical analysis. The three companies were selected based upon the Market capitalization of the companies, minimum age of thirty years of the company and its reputation in handling in large infrastructure projects.

The pertained data on closing, opening, high and low prices at monthly time step were collected from the secondary sources viz. NSE official website. The monthly share prices of above-mentioned companies were taken for a period between Jan 2011 to Mar 2022.

4. RESEARCH METHODOLOGY

Tools Used to display data analysis are Histogram, Frequency polygon, Bar chart. Statistical techniques used are:

4.1 MONEY FLOW ANALYSIS

Money flow is a technical indicator used to measure the amount of money flowing in and out of a security or market.

$$\text{Flow} = (\text{Typical price}) \times (\text{volume}) \qquad (1)$$

$$\text{Typical Price} = [(\text{Month High} + \text{Month Low} + \text{Month close})/3] \qquad (2)$$

$$\text{Money Flow Index} = 100 - (100 / (1 + MFR)) \qquad (3)$$

4.2 BETA INDEX

Beta index of a firm refers to the sensitivity of its share price with respect to a bench mark index (e.g., BSE or NSE Sensex) [5]. Although beta can be seen as a measure of risk, but its value highly depends on duration of the period considered in its computation. Moreover, there are various methods of beta computation, which may portray a different picture. In this study, it is calculated using following formula:

$$\beta = \text{covariance}(Pi, Pbm)/\text{variance}(Pbm) \qquad (4)$$

where Pi = price of security 'i' and Pbm = price of benchmark index (i.e., BSE Sensex). The values of beta index for all the companies for stock opening, closing, high and low in all situations are relatively less than (0.1) and negative. It indicates that all stocks are relatively less volatile in comparison to overall market index i.e., BSE Sensex. The negative values, however, reveal an inverse relationship between the stock prices of studied companies and overall market index.

4.3 RELATIVE STRENGTH INDEX

The Relative Strength Index (RSI) is a technical analysis indicator that measures the magnitude of recent price changes to evaluate the overbought or oversold conditions of a security or market. The RSI is calculated based on the average gains and losses over a specified period of time, typically 14 days. The formula for calculating the RSI is as follows:

$$RSI = 100 - (100 / (1 + RS)) \qquad (5)$$

where RS is the average of the closing prices on up days divided by the average of the closing prices on down days over the specified time period.

4.4 RELATIVE STRENGTH (RS)

The RS is calculated by dividing the average gain over the chosen period by the average loss over the same period. This is typically done using a simple moving average (SMA).

RS = (Average Gain over chosen period) / (Average Loss over chosen period)

The RSI oscillates between 0 and 100, with readings above 70 considered overbought and readings below 30 considered oversold. Traders and investors often use the RSI to identify potential buy and sell signals. However, it is important to note that the RSI should not be used in isolation and should be considered along with other technical indicators and fundamental analysis when making trading or investment decisions.

5. RESULT ANDDISCUSSION

5.1 MONEY FLOW ANALYSIS

The money flow into and out of the capital market is another robust indictor of the health of the stock. It is analyzed for all three stocks with the help money flow index (MFI) and is presented in table below. The MFI values for all the three stocks invariably show positive values of different magnitudes indicating the money is flowing in the market. This is displayed in following Table.1.

Table.1. Money Flow Analysis

Company Name	MFA
CIPLA	54.88005%
SUNPHARMA	59.22924%
DIVISLAB	64.2639%

The money flow index of all three stocks is greater than 50 it means that all three stocks are going towards bullish, investors are holding stock for long terms.

5.2 BETA INDEX ANALYSIS

Among all types of stock, monthly high is most volatile and monthly low is least volatile. However, stock closing price is logically more important from an investor point of view. Herein, DIVISLAB is observed to be the most volatile followed by CIPLA and SUNPHARMA. The beta index of SUNPHARMA has a negative value, it shows the inverse relation with market index. The sensitivity or volatility of the stocks are studied and compared using beta index which are presented in below Table.2.

Table.2. Money Flow Analysis

Company Name	Open	High	Low	Close
CIPLA	0.013661684	0.013832	0.013178	0.013787
SUN PHARMA	-0.000548133	-0.00053	-4.9E-05	-0.00016
DIVISLAB	0.083739992	0.086942	0.080584	0.084785

Stock markets are characterized by a volatile nature due to wide price fluctuations and imbalance trade owing to heavy trading in one direction. High volatility is often seen as a sign of worry for investors.
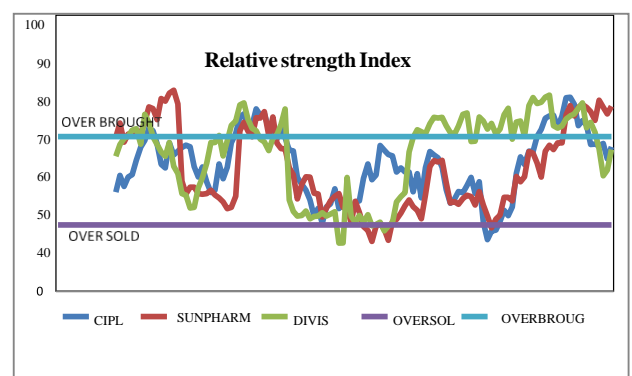

Fig.1. Relative Strength Analysis

5.3 RELATIVE STRENGTH ANALYSIS

The following graph shows the relative strength index of the three companies. It is quite obvious from the figure that although the trend is almost similar for three companies, all the three stocks consistently within the limit of overbought. (70) and oversold (30). RSI for DIVIS LAB was kept above over brought line for

maximum duration of study period which made it richest stock among the three. The same trend is also expected in the near future for DIVISLAB. RSI for SUNPHARMA is also kept above the over brought line for maximum duration of study period it means that there was most of investor hold stock for long term. RSI for CIPLA was in between the over brought and oversold region. The average values of RSI for CIPLA, SUNPHARMA and DIVIS LAB are 57.3689940, 54.96626512 and 62.19070552 respectively. It also reconfirms that for three stocks RSI is very close to over brought region (70) during the study period.

5.4 DESCRIPTIVE STATISTICS

Following Table.3 - Table.6 shows descriptive statistics for 3 companies for high price and low price, open price and close price.

Table.3. High Price

HIGH PRICE	CIPLA	DIVISLAB	SUNPHARMA
MEAN	584.068	1772.67	680.6196
MEADIAN	580.8	1319	644.05
MINIMUM	299.1	644.45	414.85
MAXIMUM	1083.15	5425	1200.7
RANGE	784.05	4780.55	785.85
STANDARD DEVIATION	188.658	1189.14	177.4411
COEFF.VAR	32.3006	67.0819	26.07053
VARIANCE	35591.7	1414062	31485.36
STANDARD ERROR	31.889	201.002	29.99303
Q1	426.5	1060.5	536.25
Q2	580.8	1319	644.05
Q3	675.05	1875.5	834.575

Table.4. Low Price

LOW PRICE	CIPLA	DIVISLAB	SUNPHARMA
MEAN	517.5052	1545.423	594.5059
MEADIAN	512.15	1110.05	561.65
MINIMUM	273.6	533.1	315.2
MAXIMUM	931.7	4766.5	928
RANGE	658.1	4233.4	612.8
STANDARD DEVIATION	166.8839	1043.915	154.1334
COEFF.VAR	32.24778	67.54879	25.92631
VARIANCE	27850.24	1089758	23757.12
STANDARD ERROR	28.20853	176.4538	26.05331
Q1	378.775	926	468.675
Q2	512.15	1110.05	561.65
Q3	605.4	1679.05	732.975

Table.5. Open Price

OPEN PRICE	CIPLA	DIVISLAB	SUNPHARMA
MEAN	550.8404	1651.11	637.6148
MEADIAN	554.9	1206	600
MINIMUM	280.75	583.05	355
MAXIMUM	982.9	5190	1048
RANGE	702.15	4606.95	693
STANDARD DEVIATION	178.1329	1111.47	163.4061
COEFF.VAR	32.33839	67.3166	25.62772
VARIANCE	31731.33	1235362	26701.56
STANDARD ERROR	30.10996	187.872	27.62068
Q1	404	987.675	501.025
Q2	554.9	1206	600
Q3	643.8	1782	778

Table.6. Close Price

CLOSE PRICE	CIPLA	DIVISLAB	SUNPHARMA
MEAN	553.881	1674.88	639.1163
MEADIAN	554.35	1221.8	597.6
MINIMUM	280	583.4	352.2
MAXIMUM	1014.9	5171.8	1045.5
RANGE	734.9	4588.4	693.3
STANDARD DEVIATION	181.279	1133.13	165.1749
COEFF.VAR	32.7288	67.6542	25.84427
VARIANCE	32861.9	1283981	27282.76
STANDARD ERROR	30.6417	191.534	27.91966
Q1	403.7	984.375	500.95
Q2	554.35	1221.8	597.6
Q3	642.025	1794.73	782.775

Here we are done the descriptive statistics for three pharmaceutical company that are 'CIPLA' 'DIVISLAB' 'SUNPHARMA'. We use here scaling (normalization scaling) we find this value by formula

$$X_i\text{-min}(X) \, /\text{min}(X)*\text{max}(X) \tag{5}$$

X_i=value of stock on particular day and X=value of stock for data period

Following are the comparison or conclusion for the value that we find in given table

- *Mean*: Here we compare the mean of this company to get an idea of the average performance. In this case, the mean for Cipla for Divislab for Sunpharma. Comparing these values, we can see that Cipla has the highest mean, followed by Sunpharma and Divislab.

- *Standard Deviation*: The standard deviation measures the dispersion or variability of the data points around the mean. A lower standard deviation indicates that the data points are closer to the mean. In this case, Cipla has the highest standard deviation of 0.000620001, followed by Sunpharma with 0.000434699, and Divislab with the lowest standard deviation of 0.000361523. This implies that the stock prices of Cipla are more volatile compared to Divislab and Sunpharma.

- *Coefficient of Variation*: The coefficient of variation (CV) is a relative measure of variability that compares the standard deviation to the mean. It allows us to compare the relative variability between datasets with different means. In this case, Divislab has the highest CV of 0.993805307, indicating a higher relative variability compared to Cipla (CV: 0.631710261) and Sunpharma (CV: 0.530705791). Divislab's stock prices have a higher relative variation compared to the other two companies.

- *Variance*: Variance measures the average squared deviation from the mean. It gives an idea of how spread out the data points are. In this case, Cipla has the highest variance with a value of 3.84E-07, followed by Sunpharma with 1.89E-07 and Divislab with the lowest variance of 1.31E-07.

- *Standard Error*: The standard error estimates the precision of the sample mean. A lower standard error indicates a more precise estimate of the population mean. In this case, Divislab has the lowest standard error of 0.000361524, followed by Sunpharma with 0.000434902, and Cipla with the highest standard error of 0.000620172.

- *Quartile*: Cipla has the highest quartile values among the three companies, indicating a potentially higher distribution of values in the upper range. (It suggests that the values are more scattered or varied.) Divislab has the lowest quartile values, suggesting a narrower distribution with most values concentrated in the lower range. (It indicates a smaller spread of data points, with values being more concentrated around the mean or median.) Sunpharma falls between Cipla and Divislab in terms of quartile values, suggesting a moderate distribution of values. (It suggests that the values are neither extremely scattered nor tightly clustered.)

6. TIME SERIES ANALYSIS

6.1 CIPLA COMPANY

Fitting of straight line by least square method: Y_t = Closing price of stock. X=Year. Let the trend line be

$$\hat{Y}_t = a + b*x' \tag{9}$$

Since, $x = 2017$, $x'=x-2017$. Statistics shown in Table.6.

Table.7. Statistics of Cipla Company

Year(x)	Y_t	x'	$X'*Y_t$	x^2	$\hat{Y}_t$
2011	319.55	-5	-1597.75	25	362.2
2012	414.1	-4	-1656.4	16	405.1682
2013	400.55	-3	-1201.65	9	448.1364
2014	625.8	-2	-1251.6	4	491.1045

2015	649.5	-1	-649.5	1	534.07271
2016	568.2	0	0	0	577.0409
2017	607.15	1	607.15	1	620.0091
2018	520	2	1040	4	662.9773
2019	478.45	3	1435.35	9	705.9454
2020	819.85	4	3279.4	16	748.9136
2021	944.3	5	4721.5	25	791.8818
Total	6347.45	0	4726.5	110	-

Let the straight-line trend between the given time series value (Y_t) and time (t) be given by equation Y_t.

$$\hat{Y}_t=a+b*t \tag{7}$$

The normal equations for the estimating a and b:

$$\sum Y_t=n_a+b\sum t$$
$$\sum t*Y_t=a\sum t+ b\sum t'$$
$$b_{est}= \sum{}_{x'}Y_t/\sum x'^2$$
$$\hat{a} = \hat{Y}_t \tag{8}$$

For CIPLA b= 42.96818 a= 577.0409 Hence the least square fitting equation is Y_t = 42.96818 + 577.0409*x' Predicted value for next 5 year of CIPLA is shown in Table.7.

Table.8. Predicted value for next 5-years of Cipla

Year	$\hat{Y}_t$
2022	834.85
2023	877.8182
2024	920.7863
2025	963.7545
2026	1006.723

6.2 SUNPHARMA COMPANY

Y_t = Closing price of indices. X = Year; a = 631.6045, b = -2.50682 Hence the least square fitting equation is

$$Y_t = 631.6045 + (-2.50682)x' \tag{9}$$

Table.9. Statistics of SUNPHARMA

Year (x)	Y_t	x'	$x'*Y_t$	x'^2	yt_{est}
2011	496.85	-5	-2484.25	25	644.1386
2012	735.5	-4	-2942	16	641.6318
2013	567.75	-3	-1703.25	9	639.125
2014	826.15	-2	-1652.3	4	636.6181
2015	819.95	-1	-819.95	1	634.1113
2016	629.75	0	0	0	631.6045
2017	570.8	1	570.8	1	629.0977
2018	430.65	2	861.3	4	626.5909
2019	432.5	3	1297.5	9	624.084
2020	592.35	4	2369.4	16	621.5772
2021	845.4	5	4227	25	619.0704

Total	6947.65	0	-275.75	110	-

Predicted value for next 5 years SUNPHARAMA shown in Table.10.

Table.9. Predicted value for next 5-years of SUNPHARMA

Year	$\hat{Y}_t$
2022	616.5636
2023	614.0568
2024	611.5499
2025	609..431
2026	606.5363

Following graph shown predicted value for next 5 years for Sunpharma

6.3 DIVISLAB

Y_t = Closing price of stock. $X=Year$; a=1719.359; b=289.1927 Hence the least square fitting equation is given below and the statistics is given in shown in Table.10.

$$Y_t = 1719.359 + *x' \qquad (10)$$

Table.10. Statistics of DIVISLAB

Year(x)	Y_t	x'	$X'*Y_t$	x^2	yt_{est}
2011	775.35	-5	-3876.75	25	344.564
2012	1103.9	-4	-4415.6	16	633.923
2013	1221.8	-3	-3665.4	9	923.282
2014	1718.5	-2	-3437	4	1212.641
2015	1155.25	-1	-1155.25	1	1502
2016	783.1	0	0	0	1791.359
2017	1098.2	1	1098.2	1	2080.718
2018	1482.2	2	2964.4	4	2370.077
2019	1846.1	3	5538.3	9	2659.436
2020	3842.45	4	15369.8	16	2948.795
2021	4678.1	5	23390.5	25	3238.154
Total	19704.95	0	31811.2	110	-

Predicted value for DIVISLAB shown in Table.11.

Table.11. Predicted value for next 5-years of DIVISLAB

Year	$\hat{Y}_t$
2022	3527.513
2023	3816.872
2024	4106.231
2025	4395.59
2026	4684.949

From above Tables of trends of three stock share prices, we observe an increasing trend.

6.4 REGRESSION ANALYSIS

6.4.1 CIPLA:

For Year 2022, X: Independent variable (Nifty Pharma Indices Closing Price) Y: Dependent variable (Stock Closing Price-CIPLA) SLRM:

$$Y_t = a+bX \qquad (11)$$

where, Y_t (Predicted Values) Correlation between X and Y: 0.05177 a= 907.9261 b = 0.008223. For Dec 2022 shown in Table.12.

Table.12. Regression Analysis for Cipla

Date	Close Price of Stock	Close of Nifty PH	Prediction
30-Dec-22	1,075.95	12597.6	1011.51218
29-Dec-22	1,087.55	12634.3	1011.813953
28-Dec-22	1,085.80	12624.15	1011.730493
27-Dec-22	1,095.85	12694.75	1012.311014
26-Dec-22	1,096.50	12677.1	1012.165884
23-Dec-22	1,119.15	12784.45	1013.048589
22-Dec-22	1,122.45	12892.75	1013.939106
21-Dec-22	1,128.00	12920.4	1014.166463
20-Dec-22	1,091.15	12618.45	1011.683623
19-Dec-22	1,096.65	12646.45	1011.913859
16-Dec-22	1,089.40	12636.2	1011.829576
15-Dec-22	1,101.80	12816.1	1013.308837
14-Dec-22	1,112.70	12883.6	1013.863868

6.4.2 SUNPHARAMA:

For Year 2022, X: Independent variable (Nifty Pharma Indices Closing Price) Y: Dependent variable (Stock Closing Price-SUNPHARMA) SLRM: $Y_t = a+bX$ Y_t (Predicted Values) Correlation between X and Y: 0.20474 a= 554.8103 b= 0.02727. For Dec 2022 shown in Table.13.

Table.13. Regression Analysis for Sunpharma

Date	Close Price of Stock	Close of Nifty PH	Prediction
30-Dec-22	1,001.40	12597.6	898.4198697
29-Dec-22	1,000.55	12634.3	899.4208915
28-Dec-22	995	12624.15	899.1440421
27-Dec-22	1,000.15	12694.75	901.0697135
26-Dec-22	1,000.05	12677.1	900.5882957
23-Dec-22	1,001.55	12784.45	903.5163527
22-Dec-22	1,010.65	12892.75	906.4703217
21-Dec-22	1,005.60	12920.4	907.2244975
20-Dec-22	988.35	12618.45	898.9885701
19-Dec-22	987.95	12646.45	899.7522924
16-Dec-22	993.65	12636.2	899.4727155

| 15-Dec-22 | 1,002.20 | 12816.1 | 904.3796317 |
| 14-Dec-22 | 1,000.25 | 12883.6 | 906.2207481 |

6.4.3 Divislab:

For Year 2022, X: Independent variable (Nifty Pharma Indices Closing Price) Y: Dependent variable (Stock Closing Price-DIVISLAB) SLRM: $Y_t = a + bX$. Y_t (Predicted Values). Correlation between X and Y: 0.699855 $a = 3900.58$ $b = 0.599798$. For December 2022 shown in Table.14.

Table.14. Regression Analysis for Cipla

Date	Close Price of DIVISLAB	Close Price of Nifty PH	Prediction
30-Dec-22	3,413.20	12597.6	3655.43808
29-Dec-22	3,412.20	12634.3	3677.450664
28-Dec-22	3,446.35	12624.15	3671.362715
27-Dec-22	3,477.10	12694.75	3713.708449
26-Dec-22	3,428.80	12677.1	3703.122016
23-Dec-22	3,498.45	12784.45	3767.510324
22-Dec-22	3,495.90	12892.75	3832.468441
21-Dec-22	3,518.75	12920.4	3849.052854
20-Dec-22	3,351.55	12618.45	3667.943867
19-Dec-22	3,345.85	12646.45	3684.738209
16-Dec-22	3,326.90	12636.2	3678.59028
15-Dec-22	3,365.45	12816.1	3786.493929
14-Dec-22	3,393.85	12883.6	3826.98029

There is positive correlation in all three stocks we studied above. Therefore: closing stock prices of sunpharma, divislab and cipla is dependent on nifty pharma's closing index.

7. CONCLUSION

Making money is everyone's dream but people often get scared by the risks. Stock Market is one such field where a person having its knowledge is prepared to take a calculated risk which is return gives him a profit multiplied by manifolds [6]. As we studied, "statistical analysis of stock prices of pharmaceutical company, its very helpful for those investors having knowledge about stock market to take a decision for buy a stock or cell a stock" [7]. By this analysis we interpret the future status of stock prices on given data. It is suggested that the investors can invest in shares showing a definitive signal of buy or sell recovering out of either over bought or oversold condition. The present study discussed the stock prices of the pharmaceutical companies using statistical method. The basic statistics along with histogram diagram helped deciphering the dynamics of the stock prices during the studied period. It is found that stock prices are not normally distributed and the stock price of DIVISLAB is the richest performer among all the three. Simple moving average is applied to spread of open-close prices and close price of the stocks which also showed an increasing trend in stock prices in general. However, it also gave certain clue for investor to take necessary decisions with stocks [8].

The positive money flow index (MFI) pointed out that money was draining in the capital market continuously. Similarly, relative strength index (RSI) reviled that the DIVISLAB and CIPLA is strongest performer followed by SUNPHARMA. RSI values too help investor in taking decision on if they should hold the stock, sell or buy the stock. It is suggested that the investors can invest in the shares showing a definitive signal of buy or sell by recovering out of either over brought or oversold condition.

Regression Analysis: There is a positive correlation between all the three stocks and Nifty Pharma Index. Therefore, whenever Nifty Pharma Index [9] shows increasing trend then all the stocks will show increasing trend (but not for all the time). This result may vary from time to time as we've considered only one-year data for regression analysis. However, the suggestion made here may have certain limitation due to fact that the study has been carried out with limited monthly data.

8. LIMITATIONS AND FUTURE SCOPE

In this study, we consider only three top pharmaceutical companies. We consider only the limited data period for this study i.e.; the whole conclusion is depending on the data studied by us. Conclusion was made here may have certain limitation due to fact that the study has been carried out with limited monthly data. Researcher can further extend study and use advanced statistical analysis techniques to study stock market analysis of different companies.

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