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Indian Stock Price Forecast Using Tpm Method

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Abstract:- Stock market trading plays an important role for economic growth in every developing country. India is one of the largest and electronic stock market traders in the world. Reliance Group is one of the largest commercial investors in India. In this work we find the Reliance Communication Ltd (RCOM) weekly stock trade price forecast using Transistion Probability Matrix (TPM) method. From the results, it is more likely that the Small Decrease (SD) trend will be come the future weeks because it has a higher order probability chance.

Keywords:- *Stock Price, Markov Chain, Higher Order TPM Matrix.*

I. INTRODUCTION

The stock market sector plays an important role in a fast moving economy. The stock market in our country is the oldest and busiest. I have taken this topic to see how the future price of stock price data is set using TPM method. In a book by Taylor and Karlin (1998), A stochastic process is a family of random variables X_t, where t is a parameter running over a suitable index set T (where convenient, write X(t) instead of X_t). The Markov chain is the main method underlying the stochastic process. Generally, the time series model takes into account all of the past events (data) and makes predictions. The Markov chain helps to obtain the results of future data using only present and previous present data. The uniqueness of this method is that it detects future data trends without using past data. This method was introduced in 1907 by A. A. Markov. This method is known by the following mathematical formula.

$$\Pr\left\{X_{n+1}=j \,\middle|\, X_n=i, X_{n-1}=i_{n-1}\ldots, X_1=i, X_0=i_0\right\} \quad \ldots (1)$$

The important thing about Markov chain is that it converts data into matrices and then evaluates it. Due to the use of stock market data in this paper, this passage is presented in the research article of analysts who used the Markov chain method for similar stock market data. Onwukwe and Samson (2014) applied a Markov model for long-term behaviour of the closing prices of the Nigerian Bank. Huang *et al* (2017) integrated two types of Markov Chain (regular and absorbing) are used in HTC (Taiwan) stock. Singh *et al* (2017) evaluated a Markov approach in opening stock price change prediction of Nifty50. Ashik *et al* (2019) applied many statistical tools of indian stock market daily price and forecast that data. Reliance Communication Limited's week closing stock prices data are used in this paper. The duration of these data is two years (ie from June 2016 to May 2018). A total of 157 observations and these data were downloaded from the Bombay Stock Exchange website.

II. ANALYSIS AND DISCUSSION

Reliance Communications has used the MC method to calculate the stock's forecast for the week close price. First, we need to find the markovian difference for the data. The results are obtained using the formula $d_t = Y_t - Y_{t-1}$ to find the Markovian difference. MC difference is to subtract the previous week's price from the current week's price. Where Y_t is the stock price of the current week and Y_{t-1} is the stock price of the previous week. The total number of available data is currently less than the original data. So now the total number of data is 156.

Construct of the TPM Matrix:

Markov difference data is divided into 5 states and given the range. They are LD ($d_t < -5$), SD ($-5 \le d_t < 0$), NC ($d_t = 0$), SI ($0 < d_t \le 5$) and SI ($d_t > 5$). *[LD – Large Decrease, SD – Small Decrease, SI – Small Increase, LI – Large Increase and NC – No Change.]* The values of the 5 states in this data are 11, 64, 09, 48 and 24 respectively. Then, the data is converted to matrix format and the corresponding TPM matrix is found. All the results for this are shown in the matrix format below.

$$\begin{array}{c} \\ LD \\ SD \\ NC \\ SI \\ LI \end{array}\begin{bmatrix} 0.2 & 0.5 & 0.2 & 0.1 & 0 \\ 0.063 & 0.429 & 0.190 & 0.302 & 0.016 \\ 0 & 0.346 & 0.154 & 0.423 & 0.077 \\ 0.085 & 0.362 & 0.149 & 0.298 & 0.106 \\ 0 & 0.6 & 0 & 0.2 & 0.2 \end{bmatrix} \quad P_{RCOM} = \begin{bmatrix} 0.200 & 0.500 & 0.200 & 0.100 & 0 \\ 0.063 & 0.459 & 0.160 & 0.302 & 0.016 \\ 0 & 0.356 & 0.154 & 0.443 & 0.077 \\ 0.085 & 0.352 & 0.149 & 0.278 & 0.106 \\ 0 & 0.600 & 0 & 0.200 & 0.200 \end{bmatrix}$$

Higher-Order Transition Matrices for RCOM:

The higher-order TPM matrix can be used to find the equilibrium for data. An equilibrium (or Stable or stationary or invariant) distribution is a specific entity which is unchanged by the effect of some matrix or operator, it need not be unique. Thus stationary distributions are related to eigenvectors for which the eigenvalue is unity. Higher order TPM occurred by equilibrium state of that data.

$$P^{(2)}_{RCOM} = \begin{bmatrix} 0.800 & 0.419 & 0.180 & 0.285 & 0.034 \\ 0.065 & 0.400 & 0.168 & 0.309 & 0.056 \\ 0.057 & 0.401 & 0.152 & 0.311 & 0.077 \\ 0.065 & 0.420 & 0.153 & 0.290 & 0.070 \\ 0.054 & 0.449 & 0.143 & 0.280 & 0.070 \end{bmatrix} \quad P^{(5)}_{ROCM} = \begin{bmatrix} 0.064 & 0.410 & 0.160 & 0.300 & 0.063 \\ 0.064 & 0.410 & 0.160 & 0.300 & 0.063 \\ 0.064 & 0.411 & 0.160 & 0.300 & 0.063 \\ 0.064 & 0.410 & 0.160 & 0.300 & 0.063 \\ 0.064 & 0.410 & 0.160 & 0.300 & 0.063 \end{bmatrix} \quad P^{(4)}_{ROCM} = \begin{bmatrix} 0.064 & 0.409 & 0.161 & 0.301 & 0.062 \\ 0.064 & 0.410 & 0.160 & 0.300 & 0.063 \\ 0.064 & 0.411 & 0.160 & 0.300 & 0.063 \\ 0.064 & 0.411 & 0.160 & 0.300 & 0.063 \\ 0.064 & 0.410 & 0.160 & 0.301 & 0.063 \end{bmatrix}$$

$$P^{(6)}_{ROCM} = \begin{bmatrix} 0.065 & 0.430 & 0.140 & 0.300 & 0.065 \\ 0.065 & 0.430 & 0.140 & 0.300 & 0.065 \\ 0.065 & 0.430 & 0.140 & 0.300 & 0.065 \\ 0.065 & 0.430 & 0.140 & 0.300 & 0.065 \\ 0.065 & 0.430 & 0.140 & 0.300 & 0.065 \end{bmatrix} \quad P^{(7)}_{ROCM} \ldots = \begin{bmatrix} 0.065 & 0.430 & 0.140 & 0.300 & 0.065 \\ 0.065 & 0.430 & 0.140 & 0.300 & 0.065 \\ 0.065 & 0.430 & 0.140 & 0.300 & 0.065 \\ 0.065 & 0.430 & 0.140 & 0.300 & 0.065 \\ 0.065 & 0.430 & 0.140 & 0.300 & 0.065 \end{bmatrix}$$

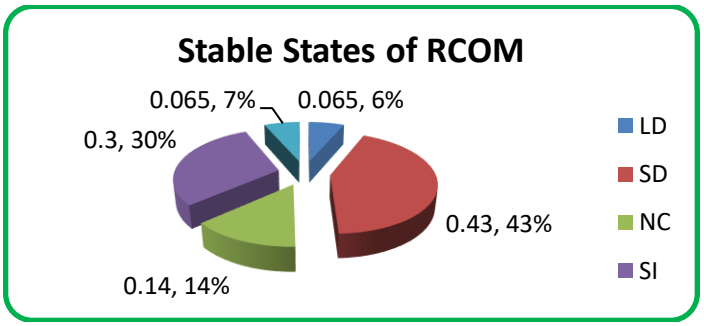

Figure 1: Pie-Chart of Equilibrium States of RCOM

The probability values for the invariant in Figure 1 are illustrated by the pie chart. The value of SD probability is that it can be seen in large part. The probability values for states can be found by higher-order TPM. Its values are 0.065, 0.430, 0.140, 0.300 and 0.065, respectively. The transition graph for the RCOM weekly stock price data is depicted in Figure 2.

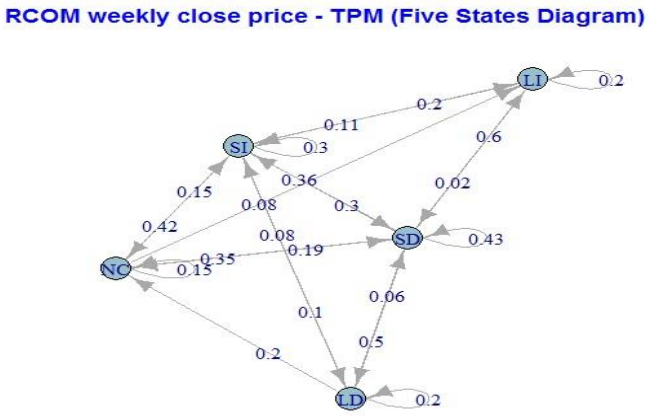

Figure 2: Transition graph of Markov Chain for RCOM

Forecasting: In this study, the five different states of closing price are considered which are large decrease, small decrease, no change, a small increase and large increase. An Initial State Vector (ISV) is needed to predict the future of data using the Markov Chain method. The initial state vector gives the probability of the five different states. If the state vector is denoted by $\pi^{(0)} = (\pi_1, \pi_2, \pi_3, \pi_4, \pi_5)$ then π_1, π_2, π_3, π_4 and π_5 gives the probability of large and small increase (up), large and small decrease (down) and remain no change: π_1 = 13/156 = 0.083; π_2 = 69/156 = 0.442; π_3 = 22/156 = 0.141; π_4 = 41/156 = 0.263 and π_5 = 11/156 = 0.071. Thus the initial state vector of RCOM stock price is

$$\pi^{(0)} = \begin{bmatrix} 0.083 & 0.442 & 0.141 & 0.263 & 0.071 \end{bmatrix}$$

Then, to predict the probability of future data, IVS should be multiplied in the TPM. The state probabilities of the closing stock price of RCOM (157th week):

$$\pi^{(1)} = \pi^{(0)} * P_{RCOM} = \begin{bmatrix} 0.083 & 0.442 & 0.141 & 0.263 & 0.071 \end{bmatrix} * \begin{bmatrix} 0.200 & 0.500 & 0.200 & 0.100 & 0 \\ 0.063 & 0.459 & 0.160 & 0.302 & 0.016 \\ 0 & 0.356 & 0.154 & 0.443 & 0.077 \\ 0.085 & 0.352 & 0.149 & 0.278 & 0.106 \\ 0 & 0.600 & 0 & 0.200 & 0.200 \end{bmatrix}$$

$$\pi^{(1)} = [0.076 \quad 0.440 \quad 0.142 \quad 0.268 \quad 0.074]$$

Similarly, the state probabilities of the closing stock price of RCOM (158th week) is given below:

$$\pi^{(2)} = \pi^{(1)} * P_{RCOM} = [0.076 \quad 0.440 \quad 0.142 \quad 0.268 \quad 0.074] * \begin{bmatrix} 0.200 & 0.500 & 0.200 & 0.100 & 0 \\ 0.063 & 0.459 & 0.160 & 0.302 & 0.016 \\ 0 & 0.356 & 0.154 & 0.443 & 0.077 \\ 0.085 & 0.352 & 0.149 & 0.278 & 0.106 \\ 0 & 0.600 & 0 & 0.200 & 0.200 \end{bmatrix}$$

$$\pi^{(2)} = [0.075 \quad 0.442 \quad 0.140 \quad 0.270 \quad 0.073]$$

The state probabilities of the closing stock price of RCOM (159th & 160th weeks):

$$\pi^{(3)} \pi^{(4)} = [0.075 \quad 0.443 \quad 0.140 \quad 0.270 \quad 0.072]$$

Table 1: Comparison of Actual and Forecast

Date	Actual			Prediction		Decision
	Price	Difference	State	Higher (%)	State	
30-12-2018	35.00					
06-01-2019	32.40	-2.60	SD	44.2	SD	Correct
13-01-2019	30.25	-2.15	SD	44.0	SD	Correct
20-01-2019	29.10	-1.15	SD	44.2	SD	Correct
27-01-2019	27.90	-1.20	SD	44.3	SD	Correct

III. CONCLUSION

The evaluated Markovian difference and construct the TPM of RCOM data. The higher-order TPM and ISV were calculated for the data. These data appropriate fit into the Markov Chain method because our prediction data and the original data are equal. In table, there is negligible difference between the two (original and prediction) data. Its results may be affected by certain policies taken by the government.

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