ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 11| Issue: 5| May 2025|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2025: 8.691 || ISI Value: 1.188

A STUDY ON STOCK PRICE PREDICTION USING TIME SERIES ANALYSIS OF TATA STEEL LTD

Mr. Ahamedjallaludeen[1], Mr. M. Selva Kumar[2], Dr. C. Rajalakshmi[3]
[1]*Student, Sakthi Institute of Information and Management Studies, Pollachi.*
[2]*Assistant Professor, Sakthi Institute of Information and Management Studies, Pollachi.*
[3]*Associate Professor, Sakthi Institute of Information and Management Studies, Pollachi*

ABSTRACT
The prices of shares prices are a critical task in financial analysis and investment decision - making. With the rise of strategies based on data based on statistical and machine learning, they have become the necessary tools for financial prognosis. This article represents a comparative study between ARIMA (Auto Regressive Integrated Moving Average), a traditional model of time series and LSTM (Long Short Term Model), a deep learning model, in predicting Tata Steel. Using historical data, we evaluate the performance of both models based on metrics such as Mae, RMSE and MAP. The results suggest that LSTM offers better performance when capturing non -linear patterns and dynamic market behavior.
KEY WORDS: *Stock price prediction, Financial forecasting, ARIMA, LSTM, Time series, Tata Steel, Machine learning, Deep learning, Forecast accuracy, Non-linear patterns, Market behavior.*

INTRODUCTION

Prediction of shares prices is a popular and very complex area of study in financial engineering and data science. Companies and investors are constantly looking for reliable methods for predicting pricing movements to make informed decisions. With the development of computational availability of energy and data, traditional statistical methods and advanced deep learning models are now commonly used in predictive modeling.

Tata Steel, the main player in the global steel industry, shows the dynamic behavior of shares influenced by market trends, macroeconomic factors and the performance of companies.

The aim of this article is to apply and compare the ARIMA and LSTM models to predict shares prices and eventually provide insight into the usability and performance of both models.

LITERATURE REVIEW

Shruti Chaksey (2019) "Prediction of stock prices using time series models" have been obtained historical data on the price of shares were obtained from the National Exchange (NSE) and used to create these models for comparative purposes. The results obtained show that all 3 models have strong potential for prediction and predicting on samples of historical data sources. All models worked better on larger LSTM data samples capable of predicting seasonality.

Anup Majumder, AL AMIN BISWAS, MD. Sabab Zulfiker, MD. Mahbubur Rahman (2022) "Prediction of stock market: time series analysis" For the transfer of the movement on the stock market, several machine learning techniques are available. Here we used several approaches to machine learning to historical data prices to understand future trends and formulas. For this purpose, we used five regression models, namely linear regression, random forest, support vector regression (SVR), vector authorization (VAR) and long short - term memory (LSTM).

Asha Sunki, C Satyakumar, G. Surya Narayan, Vinith Kopper and Manish Hake (2024) "The time series of the stock market forecast by Arima, LSTM and FB Prophet" The aim of this study is to analyze the performance of three widely used prediction methods: Arima, LSTM and FBPPHET. Arima is a statistical model of time series data that captures linear relations and stationarity. Recurrent neural networks such as LSTM are able to recognize non linear patterns and long -term dependence. FB Prophet is a library of time series developed on Facebook, which uses an additive regression model to take into account trends, seasonality and holidays.

S, Suresh Kumar and V, Joseph James (2016) "The accuracy in predicting shares prices Empirical access to the accuracy" This document represents the predictive model of the stock price using the ARIMA model to analyze the sensitivity of such models to various time horizons used to estimate trends and verify such predictions in their forecast. Published Historical Data on Shares, on an active traded share of the public sector and historical movements in the banking sector index, which is selected by the Bank, obtained from the National Stock Exchange (NSE), India and Finance Finance website. Experiments with used methods of dynamic and static predictions revealed that the ARIMA model has strong potential for short -term prediction and can offer better accuracy than long -term trends estimates.

OBJECTIVE

- Analyze historical data on the price of Tata Steel shares.
- To evaluate the predictive performance of the models.
- To understand the impact of external factors on stock prices.

ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 11| Issue: 5| May 2025|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2025: 8.691 || ISI Value: 1.188

- Provide information for investors and financial analysis.

DATA COLLECTION AND PREPROCESSING

The dataset for this study was collected from Yahoo Finance, which contained the daily prices of Tata Steel shares from 3 March 2014 to 14 March 2024. The primary variable used was the final price.

Initial steps of pre -processing include:

- Manipulation of missing values through a forward fill.
- Visual inspection and transformation of the protocol to reduce heteroscedasticity.
- Data normalization (for LSTM input) by means of a min-max scale.
- Data distribution into training (80%) and testing (20%) sets.

The data was different for the ARIMA to ensure a stationer and the ADF (Augmented Dickey Fuller) test was used to confirm. For LSTM, data was structured to sequences with a time window (e.g., 60 days) as input elements and the price of the next day as a goal.

ARIMA MODEL DEVELOPMENT

The Arima model consists of three components:

- AR (Auto Regressive): regression of variables on their own delayed values.
- I (Integrated): Observation difference to make the series.
- MA (Moving Average): Regression in mistakes of past predictions.

The model identification included analyzing ACF and PACF plots to select optimal parameters (p, d, q). The AIC (Akaike Information Criterion) was used to compare various configurations.

The selected Arima model (e.g., Arima (5,1,2)) was trained on the data set of training. Residual diagnostics was performed to ensure the behavior of white noise. The forecasts were then created for the period of the trial period. ARIMA provided adequate accuracy for short -term predictions, but fought sudden changes in the market or non -linear trends.

LSTM MODEL DEVELOPMENT

The Long Short Term Model (LSTM) was developed using Tensor flow and Keras, Architecture included:

- Input layer for time sequences.
- One or more LSTM layers with premature completion of study for regularization.
- Dense output layer for price prediction.

The model was trained using the Adam optimizer and an average square error (MSE) as a loss function. The size of the batch and the number of epochs was tuned using trends on validation.

LSTM effectively captured the time dependence in the data and adapted to changing formulas over time. His ability to remember long sequences was particularly effective for volatile stock behavior.

The model was evaluated on the test kit and the predictions were inverse transformed for comparison with real prices.

MODEL EVALUATION AND COMPARISON

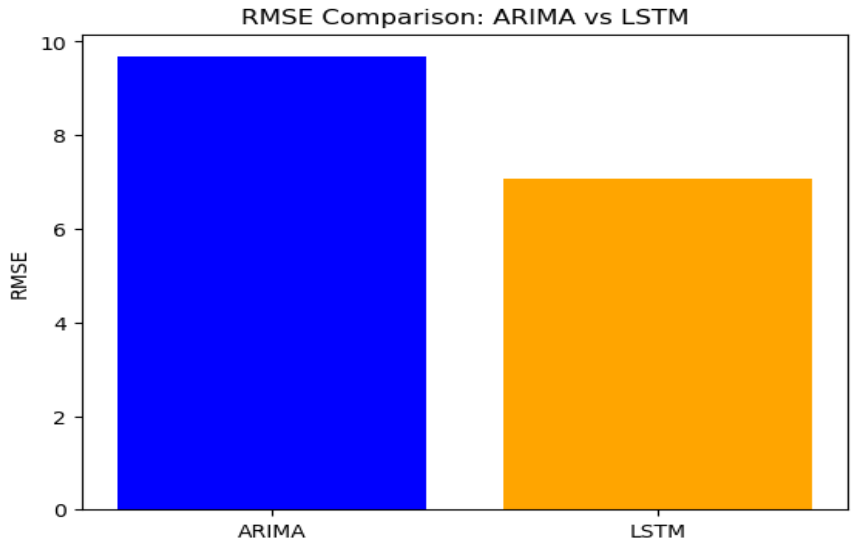
The performance of the ARIMA and LSTM models was evaluated using the Root Mean Squared Error (RMSE) metrics.

Comparison of model performance (lower RMSE is better):

- ARIMA RMSE: 9.675808160497345
- LSTM RMSE: 7.063710630502535

LSTM overcame Arima across all metrics, showing better accuracy and robustness to capture the dynamic nature of Tata Steel's shares.

The comparison chart of ARIMA and LSTM Models of Root Square Mean Error (RSME)



ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 11| Issue: 5| May 2025|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2025: 8.691 || ISI Value: 1.188

RESULTS AND DISCUSSION

Visual inspection of the expected actual stock prices revealed that Arima can monitor general trends, but missed during a sharp increase or drops. LSTM, showed smoother and closer adaptation to real values

The deep learning of LSTM allowed him to detect latent features and non -linearity in data that traditional Arima could not adapt. However, the LSTM models require significant computing power, the tuning of the hyperparameter and more data for optimal performance.

The comparison result of ARIMA and LSTM forecast stock prices with Actual prices.

Day	Actual Price (INR)	ARIMA Forecast (INR)	LSTM Forecast (INR)
1	120.5	119.59	119.92
2	120.38	123.16	120.16
3	121.68	121.66	120.35
4	123.07	121.49	121.64
5	121.83	123.07	122.81
6	122.35	120.52	123.98
7	124.68	125	124.6
8	124.39	121.45	125.59
9	123.67	121.68	124.1
10	125.2	125.49	124.42
11	124.71	125.82	125.14
12	125.22	125.48	127.07
13	126.45	126.28	126.41
14	124.81	124.36	126.69
15	125.52	123.3	122.37
16	127.2	126.12	128.18
17	127.26	126.57	127.37
18	129.11	130.69	128.75
19	128.4	128.92	128.51
20	128.42	125.77	126.03
21	131.81	132.3	131.55
22	130.64	130.06	131.06
23	131.45	130.43	133.22
24	130.47	131.39	129.85
25	131.87	133.42	130.9
26	133.04	134.44	132.44
27	132.3	131.04	133.4
28	134.34	133.88	134.74
29	133.88	134.38	133.25
30	134.71	136.17	135.32

CONCLUSION

This study compared the Arima and LSTM models to predict Tata steel prices and found that LSTM provides excellent performance. While Arima is simpler and interpreted, it does not achieve manipulation with complex patterns and non - stationary data.

Future research could explore hybrid models combining Arima and LSTM, include macroeconomic variables or use alternative models of deep learning such as GRU or Transformers. Integration of sentiment of messages or social media analysis could further increase the accuracy of the forecast.

REFERENCES

1. *Box, G. E. P., & Jenkins, G. M. (1970). Time series analysis: Forecasting and control. Holden-Day.*
2. *Brownlee, J. (2017). Deep learning for time series forecasting: Predict the future with MLPs, CNNs and LSTMs in Python. Machine Learning Mastery.*
3. *Fischer, T., & Krauss, C. (2018). Deep learning with long short-term memory networks for financial market predictions. European Journal of Operational Research, 270(2), 654–669. https://doi.org/10.1016/j.ejor.2017.11.054*
4. *Hochreiter, S., & Schmidhuber, J. (1997). Long short-term memory. Neural Computation, 9(8), 1735–1780 https://doi.org/10.1162/neco.1997.9.8.1735*
5. *Yahoo Finance. (n.d.). Tata Steel Ltd. (TATASTEEL.NS) stock historical prices & data. Retrieved, from https://finance.yahoo.com/*