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Advanced Predictive Modeling for Life and Health Insurance Stock Prices: Combining AI

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Predicting the future share price of the stock market has proven to be quite difficult in recent days. The volatility of stock price data is extremely high because it is non-stationary data. This study describes how to use machine learning algorithms in conjunction with a time series model to predict life and health insurance firms' stock prices in the future. One time series model that uses statistical techniques to forecast the future based on historical data is the autoregressive integrated moving average. Artificial intelligence includes machine learning as a subset. The most effective technique for forecasting future values based on a sizable collection of historical data values is a machine learning algorithm. After receiving the input data, this algorithm examines the historical data to forecast future values. In this study, support vector machines and random forests were employed as algorithms. Life and health insurance are essential to the economy during pandemics. Most of them came to understand the value of health and life insurance coverage after COVID-19. One of the main players in a pandemic is the insurance company. The future prices of Star Health and Allied Insurance Co. Ltd., LIC of India, and ICICI are predicted using machine learning techniques like Random Forest and Support Vector Machines and time series models like ARIMA and Exponential Smoothing.
Keywords: ARIMA, Exponential Smoothing, Artificial intelligence, Insurance companies, Random Forest.

1. Introduction

In recent times, it has been increasingly challenging to forecast the future share price of the stock market. There are two approaches for predicting stock market price analysis. These analyses are both technical and fundamental. Analyzing a company's financial metrics, a stock's intrinsic worth, and the company's possible investments are all considered aspects of fundamental analysis. Analysing the company's quantitative and qualitative aspects is necessary to determine a stock's intrinsic value. A technique for evaluating and projecting price changes using historical data on a company's share price is known as technical analysis. This research makes it simple to see historical patterns and fluctuations in the share price of the company. Trend analysis makes it simple to determine the volatility of stock prices by utilizing the charts. Technical analysis is more trustworthy and makes it simpler to identify fluctuations on a regular basis, possibly on a minute, hourly, daily, weekly, monthly, annual, etc. basis. However, these differences in financial reporting cannot be discovered through fundamental analysis. Determine the variations in the company's performance only during the quarterly, half-yearly, and annual periods while doing a fundamental study. To evaluate the performance of the company, both analyses are crucial. However, it provides a much clearer picture of the company's status than do fundamental and technical analyses. Because of this, the performance of the life and health insurance firm is only examined technically in this study. Companies that provide health and life insurance were essential both during and after COVID-19. Prior to COVID-19, the majority of them were hesitant to purchase life and health insurance for a variety of reasons. They include issues such as lack of understanding, cost worries, overconfidence, perceived health status, and so on. While most people believe that paying insurance premiums is an unnecessary expense, there are many who may not fully see the significance of having life and health insurance plans. A few individuals believed they didn't require an insurance policy because they were in good health. The pandemic emphasized the significance of life and health insurance coverage, financial protection, medical bills, and so on. In India, there are 28 health insurance companies and 24 life insurance companies in operation. Star Health and Allied Insurance Co. Ltd., LIC of India, ICICI Prudential Life Insurance, HDFC Life Insurance, and SBI Life Insurance Company are the only five of the businesses that we will be discussing in this paper. Examine the performance of these companies using machine learning techniques and time series models. To forecast those companies' future share prices using these models.

2. Literature Review

The price of a share on the stock market is volatile. It takes on a non-linear form. Stock price prediction is a very difficult endeavour. These days, a number of factors impact share market prices, including the state of the economy, politics, company performance, and the market. This paper provides a thorough explanation of the concept of hedging, which is defined as reducing losses while maximizing profits [1][2]. Predicting the stock market accurately is an extremely difficult endeavour. It is nearly hard to forecast the share price due to market volatility. Additionally, because the data is non-linear, there is no appropriate trend. Therefore, it is difficult to forecast share price values [3]. AI is becoming increasingly important in today's environment. An area of artificial intelligence that includes machine

learning. Future share values can be predicted with the use of numerous machine learning techniques [4]. Supervised and unsupervised algorithms are the two categories of algorithms used in machine learning. Both input and output data in the study are processed using supervised algorithms. Assess the degree of accuracy of the data set based on the information provided. Unsupervised learning algorithms are another type of algorithm that takes an input value and predicts the values of the output depending on the input. [5]. Regression involves categorizing the data into two groups: linear and non-linear. Regression and classification are the two categories into which machine learning falls. Regression techniques examine the liner variable to determine R square, the regression line, the mean value, and other values. However, categorical variables are used in classification methods to calculate MSE, accuracy score, confusion matrix, and other metrics [6]. The future share price of any company is forecast using time series analysis. It makes predictions about share values in the future using past data. In order to estimate future trends, time series forecasting looks for patterns in data across predetermined intervals of time [7]. Dividends and returns on investment growth are accepted by the shareholder. When the company's share price crosses a resistance or support line, investors buy or sell their shares. It is the goal of investors to reduce risk and increase profit. Using the idea of hedging, they have put together a portfolio [8] [9]. Machine learning algorithms are used to detect trends in the stock market and discover firm performance. Identifying stock market behaviour can be facilitated by a variety of machine learning algorithms. Several techniques are employed to forecast and evaluate business performance, including Random Forest, Support Vector Machine, Naïve Bayes, K-Nearest Neighbour, and Softmax [10].

3. Methodology

3.1 Description of Data

The historical information for each of the five firms is sourced from Yahoo Finance. Beginning on the year the firm was listed on the NSE or BSE and ending on March 19, 2024, is when the financial data is available. Open, close, high, low, and volume are among the data points. Only the daily closing price for each company was taken into consideration. There are several steps in the processing process before selecting the model. Get the five companies' historical daily closing prices from Yahoo Finance first. Next, eliminate any anomalies from the dataset and address any missing numbers to ensure the data is clean. Utilize machine learning algorithms and the time series forecasting model to project the daily value's future value. ARIMA, Exponential Smoothing, Random Forest, and Support Vector Machines are a few of the models selected here to forecast future share prices. After selecting a model, divide the data into two groups. The purpose of the first dataset is to optimize performance by adjusting the model's parameters; the second dataset is for testing, which measures the performance of the trained model using the testing dataset. Predictions for future values are based on the values of the historical data once the model has been trained and assessed. In the end, display both the actual and predicted share price values visually.

3.2 Autoregressive Integrated Moving Average (ARIMA):

A statistical modelling technique called autoregressive integrated moving average (ARIMA) uses time series data to improve understanding of the dataset or predict future trends. Based on historical share price data, the ARIMA model forecasts future share prices. The future share price values of all life and health insurance companies are modelled and forecast using a combination of moving average, differencing, and auto regression techniques. Auto regression (AR), differencing (I), and moving average (MA) are the three components that make up ARIMA.

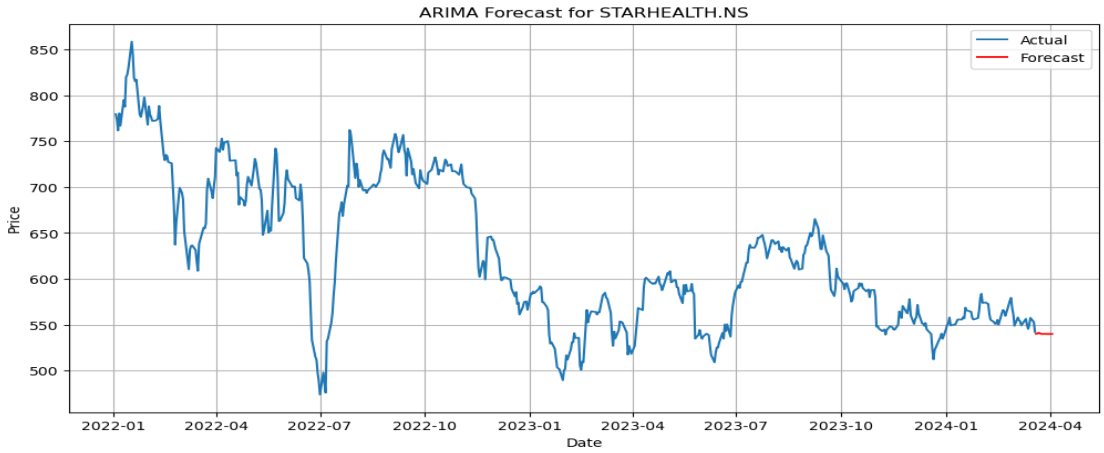

Fig 1: Star Health and Allied Insurance Co. Ltd.

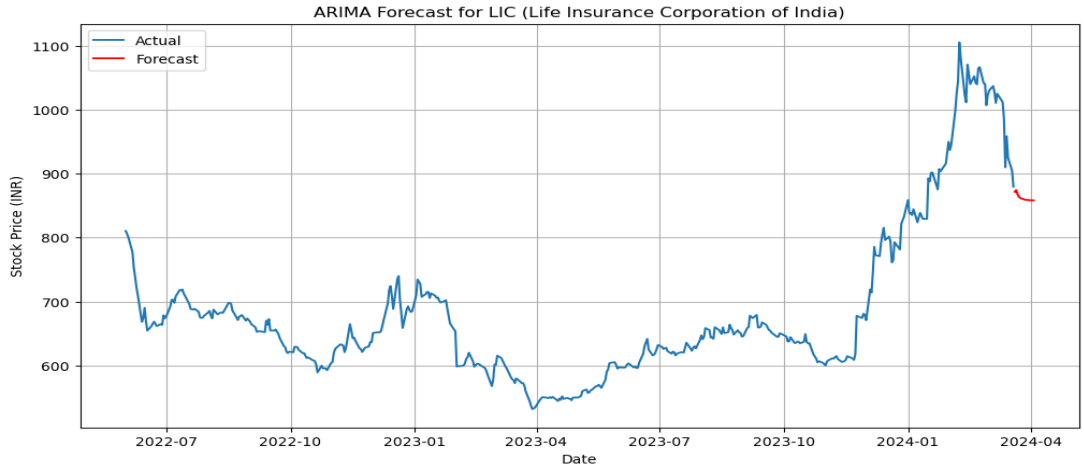

Fig 2: LIC of India

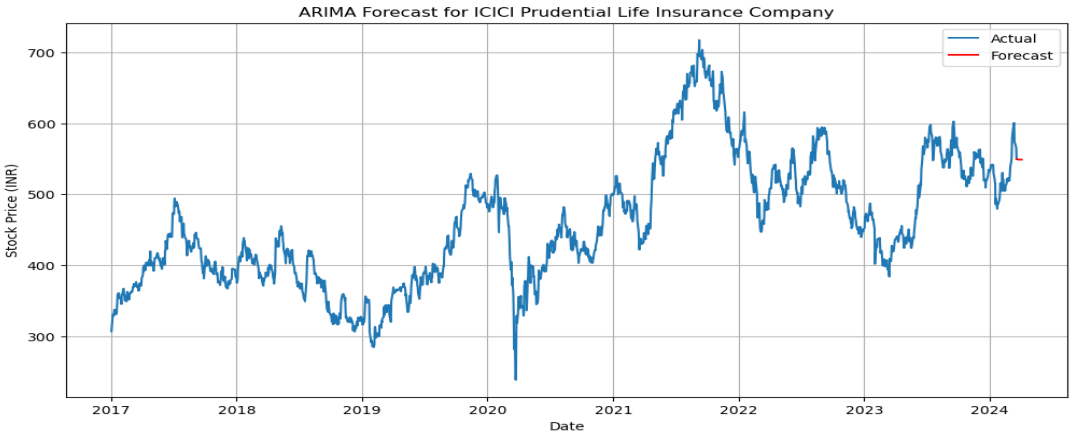

Fig 3: ICICI Prudential Life Insurance

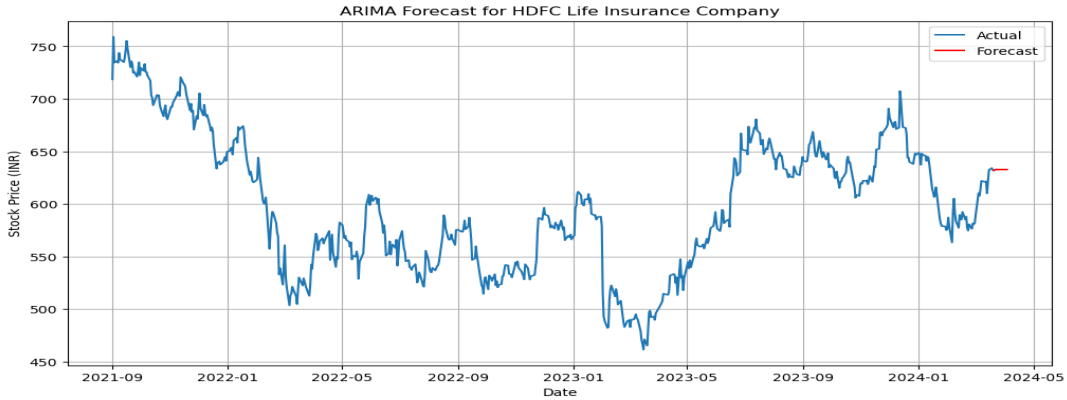

Fig 4: HDFC Life Insurance

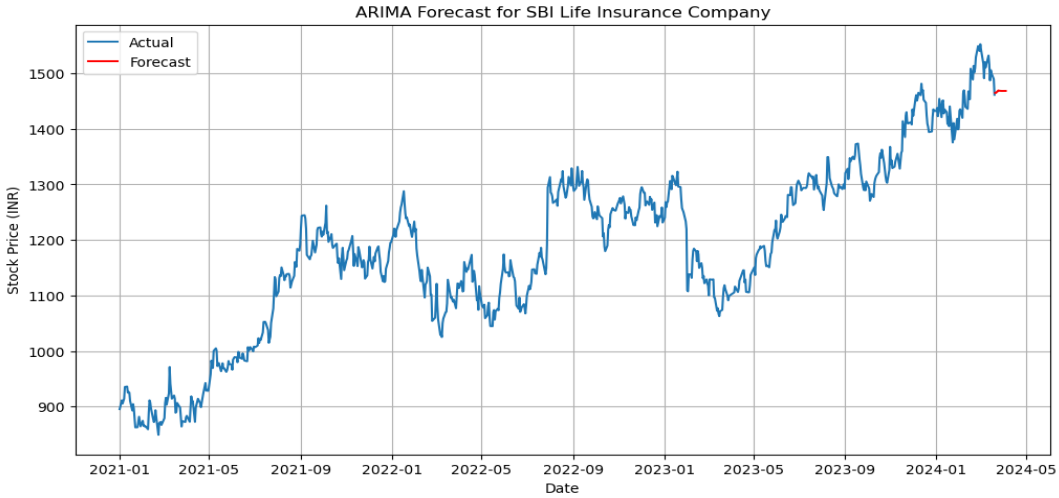

Fig 5: SBI Life Insurance Company

3.3 Exponential Smoothing:

One of the most used methods for time series forecasting is exponential smoothing. It is also highly helpful in forecasting share prices. It makes use of an exponential function to smooth the data. The dataset's noise is eliminated using this procedure. Through a smoothing procedure, it integrates error, trend, and seasonal components. Each term is combined additively, multiplicatively, or by letting go of the model. Finding the trend, season, and error is best accomplished in this manner.

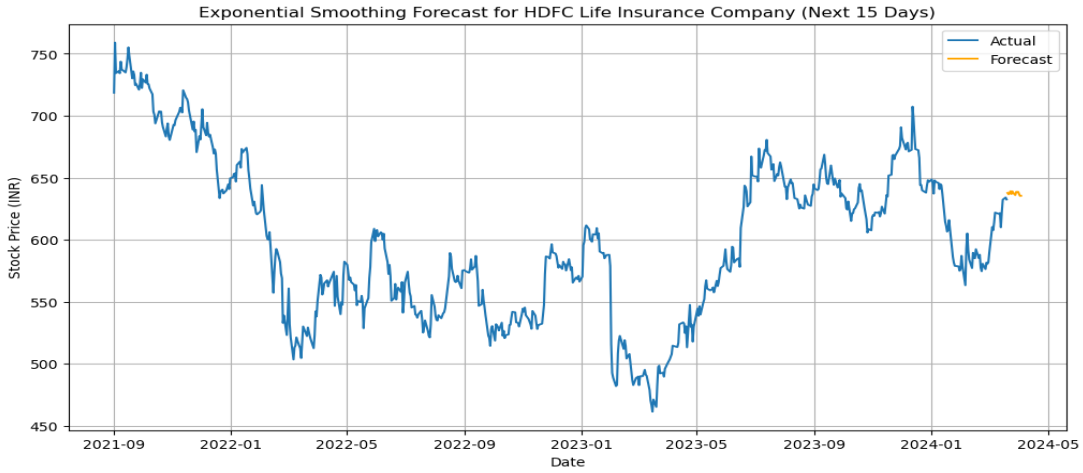

Fig 6: HDFC Life Insurance

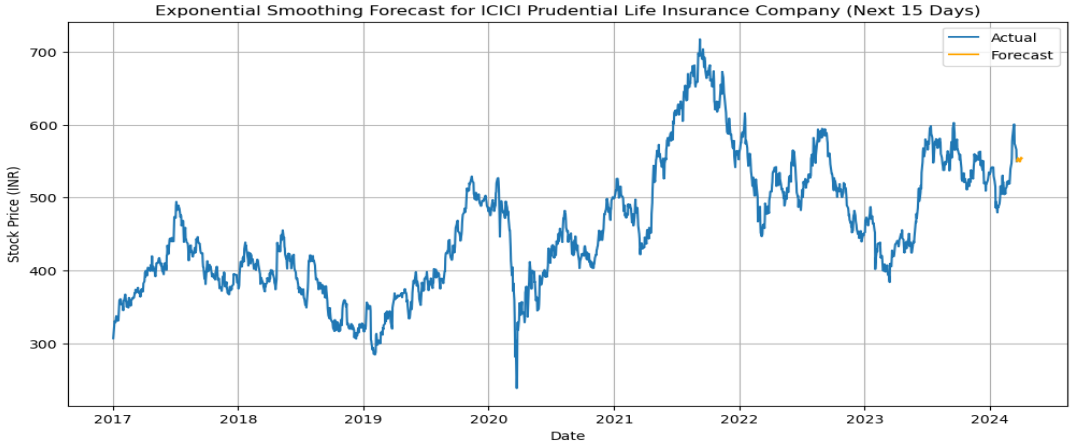

Fig 7: ICICI Prudential Life Insurance

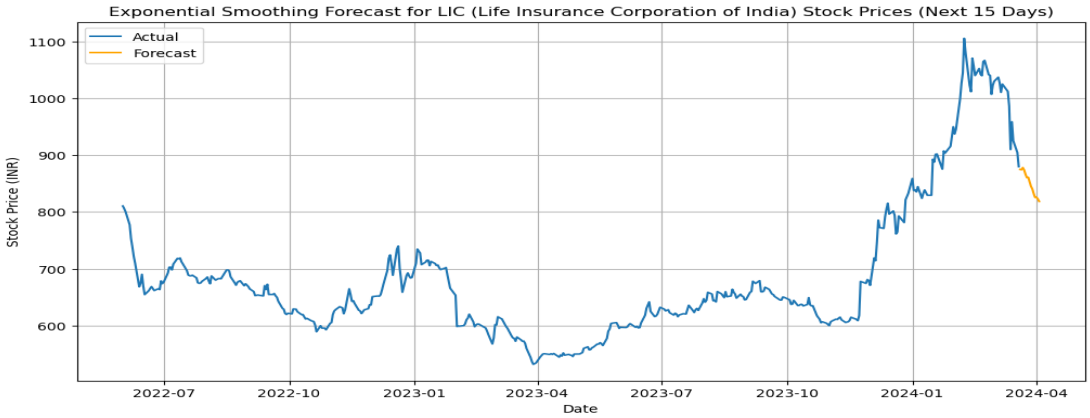

Fig 8: LIC of India

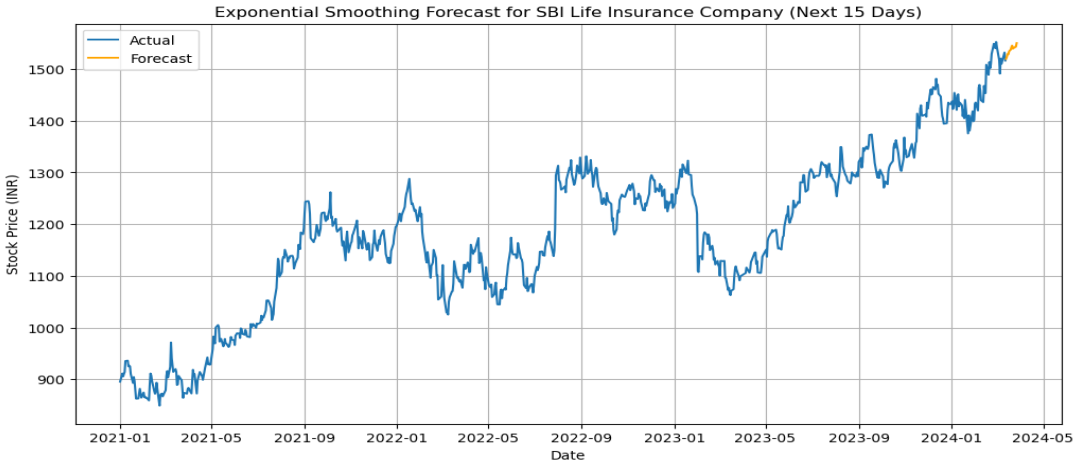

Fig 9: SBI Life Insurance Company

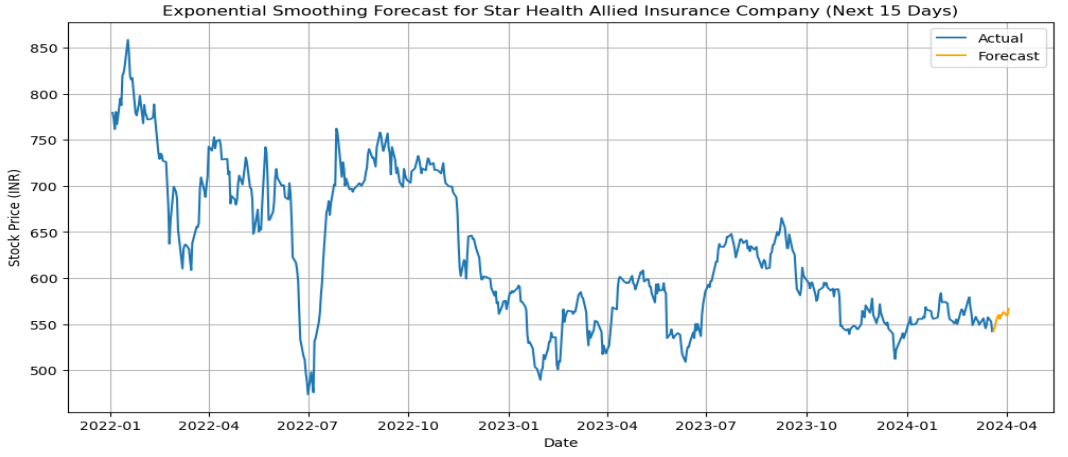

Fig 10: Star Health and Allied Insurance Co. Ltd.

3.4 Random Forest

Among machine learning algorithms, Random Forest is the most potent. It is applied to situations involving both regression and classification. We can create a multiple decision tree model by utilizing machine learning algorithms. The consensus of several trees results in increased accuracy and lowers the possibility of the model being over fitting. This algorithm is easy to use and can handle both classification and regression problems. Managing the intricate datasets is simple. It handles categorical variables for classification and the continuous variable data set for regression.

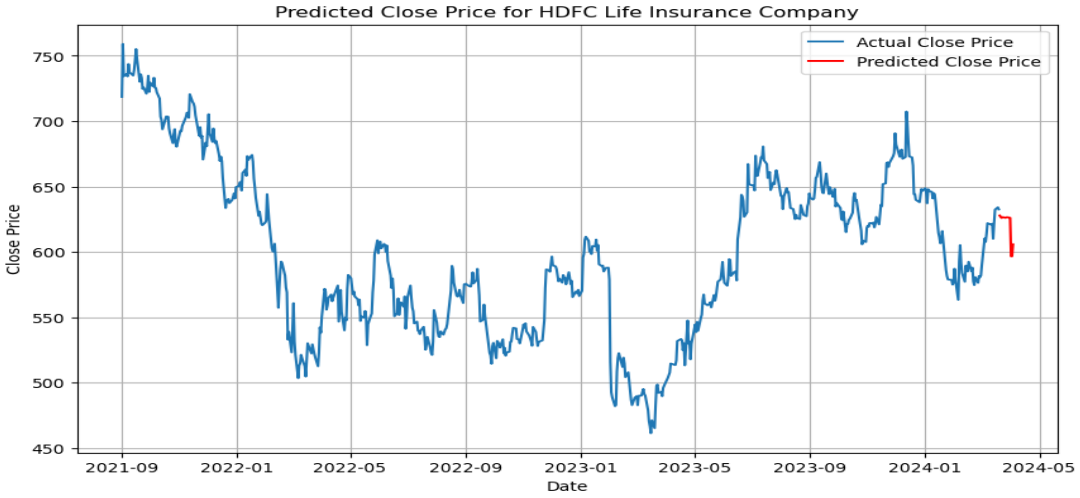

Fig 11: HDFC Life Insurance

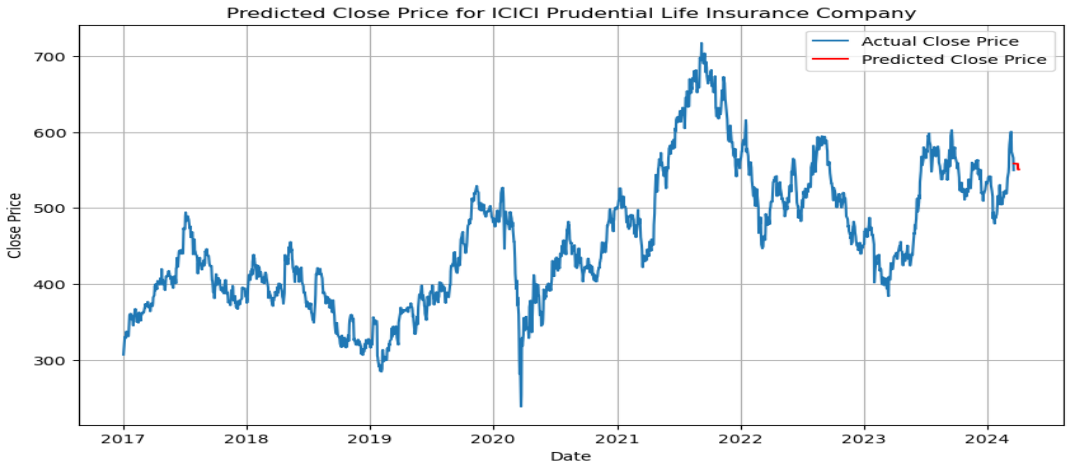

Fig 12: ICICI Prudential Life Insurance

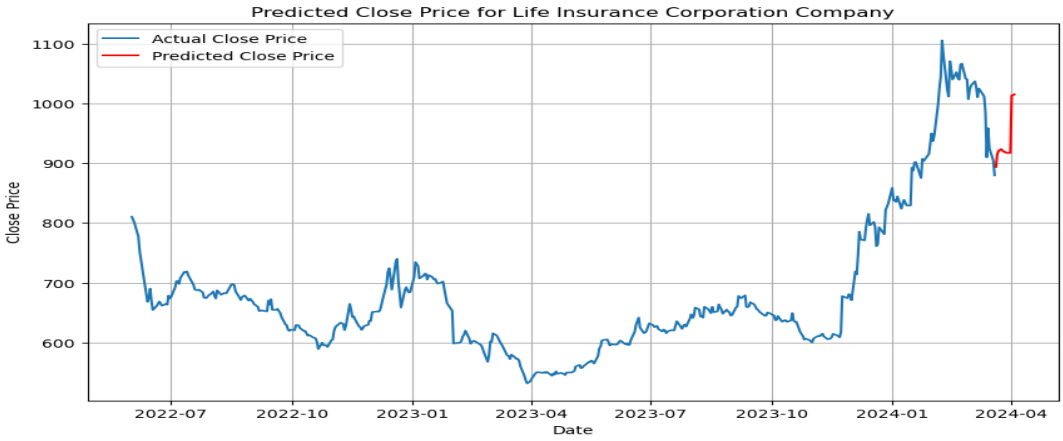

Fig 13: LIC of India

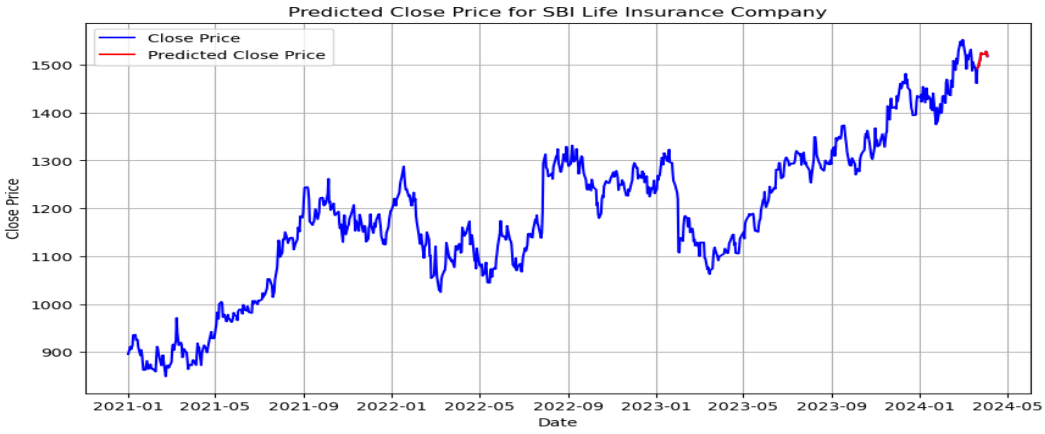

Fig 14: SBI Life Insurance Company

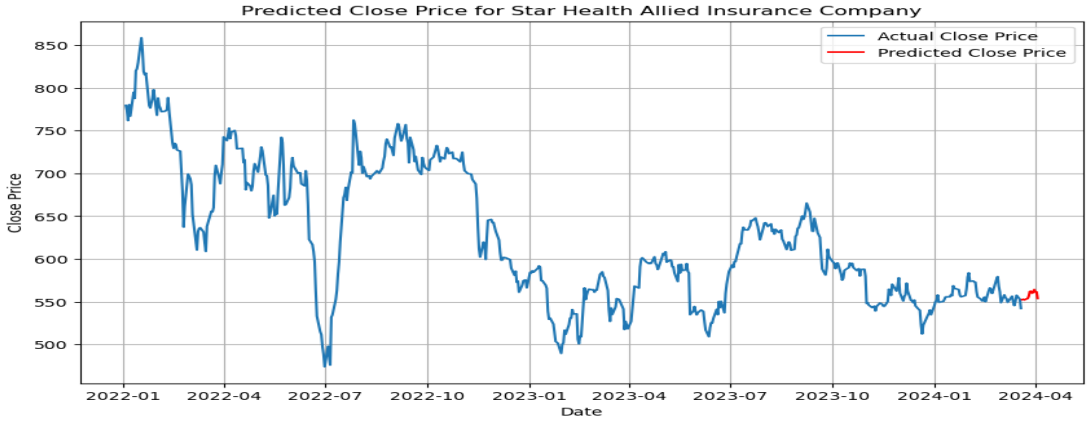

Fig 15: Star Health and Allied Insurance Co. Ltd.

3.5 Support Vector Machines

Under supervised learning models, support vector machines are included. The classification and regression difficulties can be solved with great assistance from it. This is the most effective method for classifying the data points into two distinct groups and predicting the regression's target variables. Finding the hyper plane and calculating the separation between it and the closest data points are its goals. By employing the kernel method, it can also handle data that is not linearly separable. Sigmoid, polynomials, linear functions, and radial basis functions are a few of the kernel functions. It seeks to maximize the margin and reduce the categorization errors. It is applied to the prediction of a continuous variable, such as company share prices. It's crucial to note that support vector machines have the potential to be useful for forecasting future

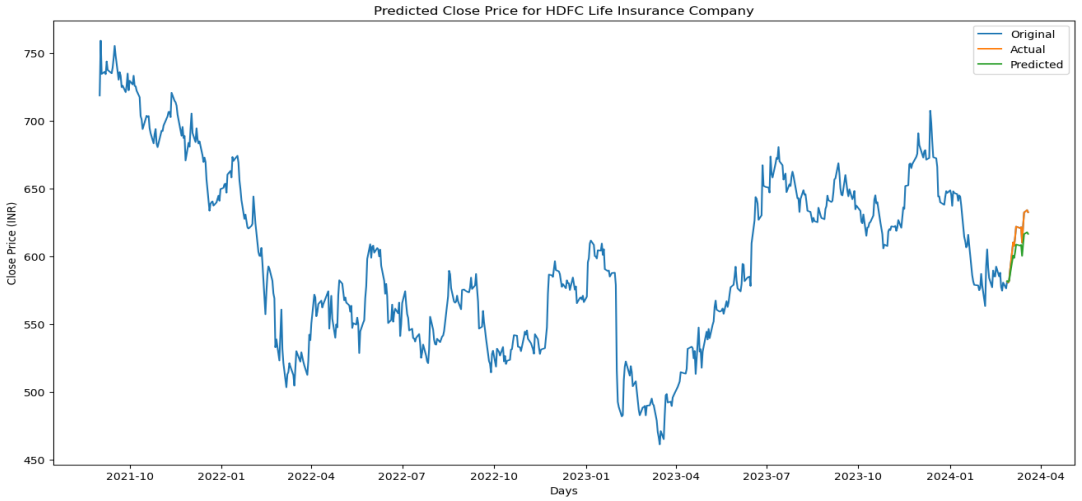

Fig 16: HDFC Life Insurance

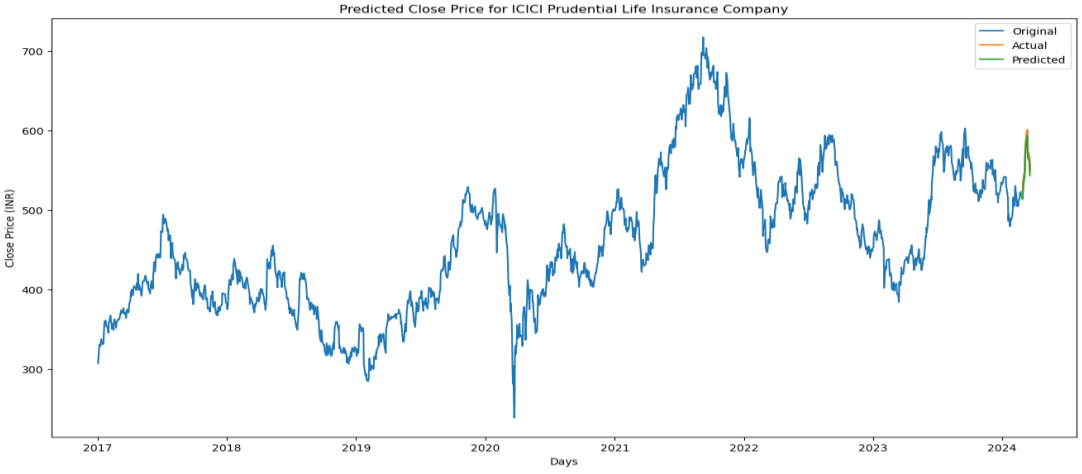

Fig 17: ICICI Prudential Life Insurance

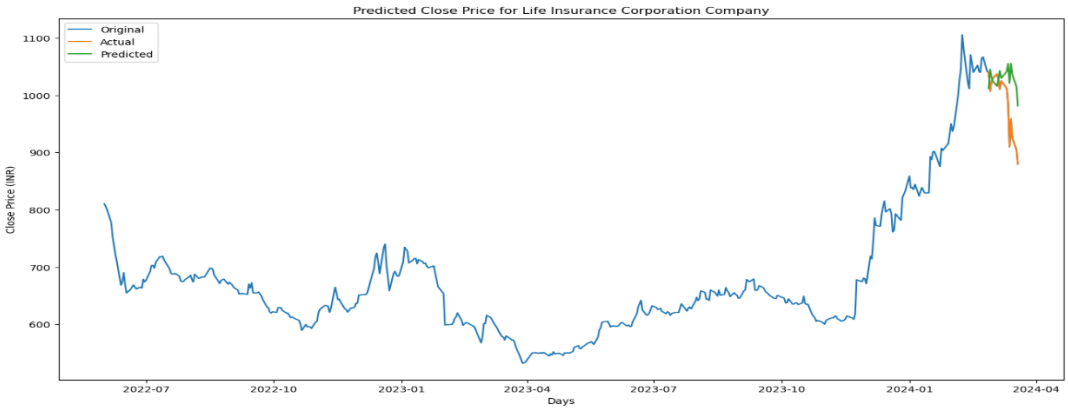

Fig 18: LIC of India

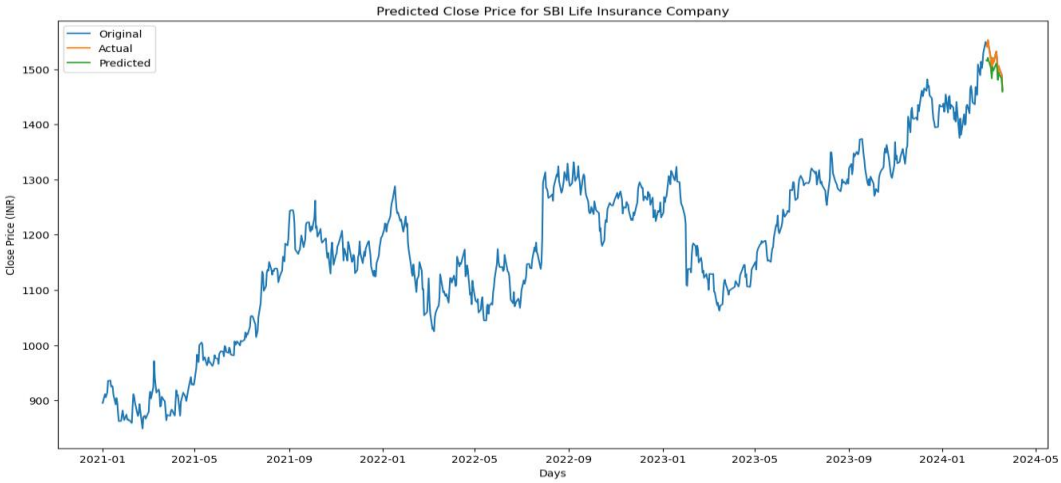

Fig 19: SBI Life Insurance Company

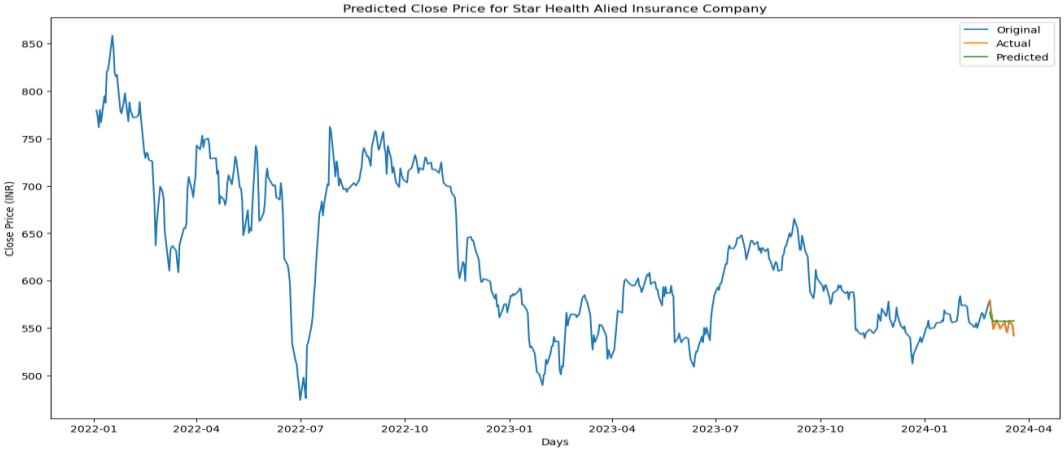

Fig 20: Star Health and Allied Insurance Co. Ltd.

4. Experimental Results

Star Health and Allied Insurance Co. Ltd., LIC of India, ICICI Prudential Life Insurance, HDFC Life Insurance, and SBI Life Insurance Company were the only five life and health insurance firms that were evaluated in this research paper analysis. Make two predictions here. First, forecast the future share price of all of those companies from 01/03/24 to 15/03/24, i.e., for the first 15 days of March 2024, and then compare that forecast to the current share prices of those companies. The next slot is for determining the predicted future share prices of those firms from March 20 to April 3rd, 24. Over more than fifteen days, the future stock price analysis proved to be inaccurate. The projected future wasn't accurate after more than 15 days of stock price analysis. Predict the value for the first 15 days and the next 15 days based on that information.

Current Stock Price on 04/03/24	Companies	ARIMA	EXPONENTIAL SMOOTHING	RANDOM FOREST	SUPPORT VECTOR MACHINE
558.05	STARHEALTH	561.56	552.77	568.68	559.99
546.95	LIC	532.55	532.02	515.36	502.21
1036.9	ICICI PRUDENTIAL	1020.29	1032.34	994.93	968.03
610.3	HDFC LIFE	581.87	577.63	581.07	579.68
1517.95	SBI LIFE	1549.43	1549.15	1428.22	1442.05

TABLE 1: Compare the predicted share price with current price as on 04/03/24

Utilizing Random Forest, Exponential Smoothing, ARIMA, and Support Vector machines, I estimated the future share for Star Health and Allied Insurance Co. Ltd., LIC of India, ICICI Prudential Life Insurance, HDFC Life Insurance, and SBI Life Insurance Service. Check out Table 1 to see how the present share price as of March 24 compares to the anticipated future share price. ARIMA provides three out of five companies with the closest value among the four approaches.

Current Stock Price on 14/03/24	Companies	ARIMA	EXPONENTIAL SMOOTHING	RANDOM FOREST	SUPPORT VECTOR MACHINE
549	STARHEALTH	548.53	552.65	551.75	560.28
961	LIC	985.80	997.09	1005.10	1023.01
573	ICICI PRUDENTIAL	601.56	602.87	572.74	513.69
621	HDFC LIFE	621.54	625.02	616.97	576.14
1507.85	SBI LIFE	1515.85	1523.21	1516.21	1505.19

TABLE 2: Compare the predicted share price with current price as on 14/03/24

Forecasted the future share for Star Health and Allied Insurance Co. Ltd., LIC of India, ICICI Prudential Life Insurance, HDFC Life Insurance, and SBI Life Insurance Company using ARIMA, Exponential Smoothing, Random Forest, and Support Vector machines. Now, as of March 14, 2023, compare the current share price (Table 2) with the anticipated future share price. ARIMA provides the value that is closest to three out of five companies among the four approaches.

Current Stock Price on 15/03/24	Companies	ARIMA	EXPONENTIAL SMOOTHING	RANDOM FOREST	SUPPORT VECTOR MACHINE
549	STARHEALTH	548.53	555.43	553.01	559.38

961	LIC	964.44	1001.23	1025.58	984.61
573	ICICI PRUDENTIAL	601.95	602.53	572.23	512.08
621	HDFC LIFE	621.74	628.13	616.96	574.37
1507.85	SBI LIFE	1508.25	1529.40	1516.21	1512.76

TABLE 3: Compare the predicted share price with current price as on 15/03/24

Utilizing Random Forest, Exponential Smoothing, ARIMA, and Support Vector machines, I estimated the future share for Star Health and Allied Insurance Co. Ltd., LIC of India, ICICI Prudential Life Insurance, HDFC Life Insurance, and SBI Life Insurance Service. Presently, contrast the share price as of March 15, 2024 (Table 3) with the anticipated future price. Four out of five organizations receive the closest value via ARIMA, which is derived from the four approaches.

For all of the firms employing the ARIMA model, exponential smoothing, random forest, and support vector machine algorithms, the following table (i.e., tables 4, 6, 7, and 8) displays the future projected share values from March 20 to April 3, 2024.

Star Health and Allied Insurance Co. Ltd				
Closing Price	ARIMA	ES	RF	SVR
2024-03-20	540.16	542.50	552.43	566.50
2024-03-21	540.35	545.56	552.93	560.89
2024-03-22	541.18	549.92	552.06	558.60
2024-03-23	540.89	555.29	552.82	557.01
2024-03-24	540.24	558.02	553.30	557.81
2024-03-25	540.02	560.22	553.66	557.32
2024-03-26	540.02	555.81	556.42	557.19
2024-03-27	540.08	560.01	562.03	557.00
2024-03-28	540.07	559.89	562.37	557.54
2024-03-29	540.03	563.17	560.02	557.00
2024-03-30	540.01	562.63	560.86	557.20
2024-03-31	540.01	561.65	564.25	557.00
2024-04-01	540.02	559.41	561.21	557.73
2024-04-02	540.02	560.10	561.56	557.13
2024-04-03	540.02	566.70	553.85	557.68

TABLE 4: Future share price of the Star Health and Allied Insurance Co. Ltd

LIC of India				
	ARIMA	ES	RF	SVR
2024-03-20	871.52	874.76	893.61	1011.54
2024-03-21	874.18	874.07	914.82	1045.02
2024-03-22	868.35	877.98	920.44	1031.62
2024-03-23	864.13	873.51	922.25	1024.31

2024-03-24	861.82	866.01	923.52	1015.76
2024-03-25	860.80	860.20	921.24	1027.01
2024-03-26	860.52	860.94	918.90	1042.59
2024-03-27	859.61	852.77	918.90	1029.59
2024-03-28	858.99	844.90	917.19	1041.35
2024-03-29	858.73	840.19	917.19	1055.11
2024-03-30	858.56	832.00	917.19	1020.74
2024-03-31	858.45	825.42	917.19	1055.24
2024-04-01	858.32	825.75	1013.32	1036.01
2024-04-02	858.23	822.86	1013.41	1014.61
2024-04-03	858.19	818.43	1015.14	981.28

TABLE 5 : Future share price of the LIC of India

ICICI Prudential Life Insurance				
	ARIMA	ES	RF	SVR
2024-03-20	549.52	550.12	558.56	517.41
2024-03-21	549.08	552.39	558.54	513.32
2024-03-22	549.08	553.17	558.54	517.61
2024-03-23	548.82	554.23	558.57	526.66
2024-03-24	548.89	553.41	558.31	533.27
2024-03-25	548.87	551.36	558.31	540.59
2024-03-26	548.85	550.93	558.27	547.18
2024-03-27	548.85	549.64	558.22	569.81
2024-03-28	548.85	550.05	558.22	576.37
2024-03-29	548.85	549.54	558.36	592.43
2024-03-30	548.85	551.04	558.36	592.62
2024-03-31	548.85	553.65	558.36	566.59
2024-04-01	548.85	554.95	550.73	565.76
2024-04-02	548.85	554.29	550.73	559.07
2024-04-03	548.85	553.89	550.73	543.17

TABLE 6: Future share price of the ICICI Prudential Life Insurance Company

HDFC Life Insurance				
	ARIMA	ES	RF	SVR
2024-03-20	631.77	637.79	627.85	581.74
2024-03-21	632.31	636.69	626.74	581.11
2024-03-22	632.78	637.30	625.95	582.00
2024-03-23	632.83	639.17	626.57	587.08

2024-03-24	632.73	636.94	626.49	600.53
2024-03-25	632.69	639.09	626.29	598.76
2024-03-26	632.71	637.36	626.06	603.04
2024-03-27	632.74	637.09	626.48	608.71
2024-03-28	632.74	636.04	626.50	607.92
2024-03-29	632.73	638.68	626.44	608.42
2024-03-30	632.73	638.49	626.12	600.36
2024-03-31	632.73	638.70	626.13	608.93
2024-04-01	632.73	636.83	596.65	616.42
2024-04-02	632.73	635.39	596.65	617.76
2024-04-03	632.73	635.48	605.80	616.54

TABLE 7: Future share price of the HDFC Life Insurance Company

SBI Life Insurance				
	ARIMA	ES	RF	SVR
2024-03-20	1464.92	1462.80	1492.84	1515.92
2024-03-21	1464.88	1463.40	1495.47	1514.65
2024-03-22	1466.58	1467.19	1497.48	1520.59
2024-03-23	1467.34	1470.06	1506.73	1515.65
2024-03-24	1469.21	1463.34	1509.49	1501.85
2024-03-25	1468.78	1465.42	1523.66	1483.27
2024-03-26	1468.69	1464.16	1524.74	1503.38
2024-03-27	1468.50	1464.50	1522.29	1496.93
2024-03-28	1468.46	1463.67	1522.29	1510.29
2024-03-29	1468.34	1470.15	1522.29	1500.86
2024-03-30	1468.39	1474.03	1522.29	1480.30
2024-03-31	1468.40	1471.14	1522.29	1493.83
2024-04-01	1468.42	1469.44	1527.94	1489.71
2024-04-02	1468.42	1465.49	1526.41	1482.10
2024-04-03	1468.42	1467.13	1517.70	1459.02

TABLE 8: Future share price of the SBI Life Insurance Company

5. Conclusion:

Using ARIMA, Exponential Smoothing, Random Forest, and Support Vector Machines, we examine the future share prices of Star Health and Allied Insurance Co. Ltd., LIC of India, ICICI Prudential Life Insurance, HDFC Life Insurance, and SBI Life Insurance Company in this research paper. Determine which strategy is more accurate for predicting corporate share

values. In short-term duration future prices for the life and health insurance sectors can best be predicted using the ARIMA method of stock price forecasting, according to the investigation. Stakeholders and investors can boost decision-making capacity, expand investment prospects, and reduce risk by utilizing this strategy. The ARIMA model is an appropriate strategy for predicting future share prices over a short period, such as fewer than 15 days. If the share price prediction is made for more than 15 days, it will not provide the nearest numbers. The forecast value holds some accuracy for a short-term duration of fewer than 15 days. Thus, the ARIMA method is appropriate for investors for short-term projection. The ARIMA model for predicting short-term stock prices has important consequences for insurance industry stakeholders, investors, and financial analysts. Ultimately, the ARIMA model is the best forecasting technique for projecting short-term stock prices in the health and life insurance companies.

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