



FORECASTING TIME SERIES STOCK RETURNS USING ARIMA: EVIDENCE FROM S&P BSE SENSEX

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Abstract

The main objective of this paper is to forecast the return values of S&P Bombay Stock Exchange (BSE) Sensex index. The BSE Sensex constitutes 30 top most companies listed which are popularly known as blue-chip companies. The financial econometric approach Auto Regressive Integrated Moving Average (ARIMA) method is used to forecast the future returns. In this paper, ARIMA approach is deployed to fit 10 years of past data from April 2007 to March 2017 and forecast future return values from April 2017 to March 2019. Different types of models evaluated using Akaike Information Criteria (AIC) value. Validation accomplished by comparison of forecasted and actual data values for the hold back period of 2 years from April 2015 to March 2017. Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) both are used for accuracy measurement. From the analysis the different investors can choose companies according to their return perspective.

Key Words: Akaike Information Criteria (AIC), Bombay Stock Exchange (BSE), Auto Regressive Integrated Moving Average (ARIMA), Time series.

JEL Classification Codes: G12, G14, G17.

1 Introduction

Forecasting stock market returns is one of the major issues in the present scenario. Forecast the stock price or return will continue to be a fascinating era of research making researchers in the domain field always enthusiastic to improve present forecasting models, the main reason is that investors and institutions are empowered to make good decision making, return payoff and success about their daily and future endeavors. Efficient Market Hypothesis (EMH) (Fama, 1965) is one of the widely accepted financial theories, which states that a market is efficient when the prices fully reflect the information. Weak form, Semi-strong and strong form are the three forms of market efficiency that could be tested. If the future return prediction is not reflect or influence by historical stock price movements then it is called as weak form efficient market. Semi-strong efficiency means that stock market prices include all publicly available information. Strong form efficiency states that the price

movements reflect or influence all public and inside information. Capital assets would be distributed in the preeminent possible way, when the markets are efficient (Fama, 1970). Bombay stock exchange (BSE) is relevant in market efficiency. BSE considered as developing markets from the global perspective, which means trading volumes and capitalizations are low when compare to developed markets.

The S&P BSE SENSEX is bellwether index in BSE. It is deliberate to measure the performance of 30 companies listed at BSE Ltd.

2 Literature Review:

Forecasting of stock returns in the stock market is a prominent issue for the past several decades. The existing econometric models has been improved depending on applications (Zotteri.,et al.,2005). The efficient and robust econometric models are Auto Regressive Integrated Moving Average (ARIMA) models, which are used to forecast the financial time series data for short term than the other techniques such as Artificial Neural Networks, etc., (L.C. K yung joo et al.,2007, N. Merh et al.,2010, J. Sterba, 2010). Many researchers worked in ARIMA forecasting models to predict the future returns (M. Khasel et al., 2009, C. Lee, C. Ho, 2011 and M. Khashei et al. 2012).

Gerra (1959) studied a time series analysis based on least square method to forecast the storage movement and stock price for egg industry. Suits (1962) establish an econometric model for the purpose of forecasting policy analysis and instrument of U.S. economy.

Suchmitz and watts (1970) were analyzed the time series data for identifying the moving average and auto regressive process estimations. They used parametric model of exponential smoothing method in United States, Canada, Australia and Argentina to forecast wheat yields.

Reid (1971), New bold and Granger (1974) were concluded and finalized that the Jenkins approach of ARIMA model produces most appropriate and accurate results than regression and exponential smoothing (Naylor et al ,1972). N. Rangan and N. Titida, (2006) analyzed ARIMA forecasting on oil palm price time series data, he

found that estimated ARIMA term is most efficient for the future returns. In ARIMA model, stationarity, invertibility and parsimony are the three important parameters are used to identification, estimation and diagnostic checking respectively (Asteriou, D. and S.G. Hall 2015).

3 Research design and methodology

ARIMA Method The ARIMA method was established in 1990s for the prediction of time series (Box and Jenkins, 1976). The ARIMA model main notion is over the given period of time it form a predicted object as a random series, to take a data series. To describe the series, a particular statistical technique could be established according to autocorrelation analysis of the time series. Once the technique construct, the future values could be predict through the past and present values of time series.

An ARIMA(p,d,q) model is defined as an I(d) process whose dth integer difference follows a stationary ARMA(p,q) process. In polynomial form :

$$Y_t = \sum_{i=1}^p \phi_i Y_{t-1} + \epsilon_t + \sum_{i=1}^q \theta_i \epsilon_{t-1} \quad (1)$$

Where Y_t = differenced time series value ; ϕ and θ = unknown parameters ϵ = independent identically distributed error terms with zero mean. Y_t could be expressed as past and current values as well as past error terms. In this study the ARIMA forecast for the period of March 2017 to April 2019 was modeled by organizing the E-Views software which is applied for econometric analysis of time series.

Data used for Return Analysis: The study covers the secondary data for industrial firms listed on S&P BSE-Sensex monthly open and close prices were gathered from the website of BSE, www.bseindia.com . For the purpose of the present study, it is intended to cover all the companies listed on BSE-Sensex. There are 30 companies listed on BSE-Sensex. Method of study is both analytical and descriptive. For statistical analysis, the researcher used Eviews 9.5 software. Monthly returns calculated by using the following formula.

$$R_{it} = (P_{close} - P_{open})/P_{open} * 100 \quad (2)$$

R_{it} is return of the index. P_{close} is closing price of the company.
 P_{open} is closing price of company.

Securities	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Observations
Sensex	0.68	0.49	25.69	-24.74	6.72	-0.12	5.46	30.63	0.00	120
Adani Ports & SEZ	0.43	-0.52	55.08	-78.53	15.26	-0.92	9.68	226.42	0.00	113
Asian Paints	1.44	1.37	21.88	-89.06	11.54	-3.95	32.67	4712.94	0.00	120
Axis Bank	1.23	2.13	37.68	-79.64	14.58	-1.25	9.82	263.84	0.00	120
BhartiAirtel	-0.38	-0.25	25.10	-48.70	9.99	-1.06	7.09	106.04	0.00	120
Cipla	0.72	1.05	20.37	-21.13	7.39	-0.05	2.78	0.28	0.87	120
Coal India	-6.09	-5.13	0.00	-24.53	4.92	-1.10	4.32	21.17	0.00	77
Dr. Reddy's Laboratories	1.26	1.64	26.59	-28.17	8.37	-0.32	4.82	18.68	0.00	120
HDFC Bank	1.05	1.45	28.90	-80.71	11.27	-3.28	25.32	2705.58	0.00	120
Hero MotoCorp	1.32	0.89	20.58	-18.56	8.03	0.02	2.62	0.73	0.69	120
Hindustan Unilever	1.31	0.84	25.45	-13.61	6.55	0.69	4.58	22.10	0.00	120
Housing Development Finance Corporation	0.70	1.37	27.00	-79.06	11.05	-3.10	24.25	2449.43	0.00	120
ICICI Bank	0.17	-0.10	51.19	-79.96	14.13	-0.89	11.88	409.99	0.00	120
Infosys	-0.03	1.44	20.95	-55.08	10.95	-1.87	10.62	360.85	0.00	120
ITC	0.98	1.19	30.57	-47.53	7.63	-1.78	16.72	1004.78	0.00	120
Kotak Mahindra Bank	1.18	2.13	72.19	-49.86	13.91	0.22	10.06	250.51	0.00	120
Larsen & Toubro	-7.80	-5.81	0.00	-45.51	7.71	-2.21	9.47	307.32	0.00	120
Lupin	1.33	1.82	24.73	-81.10	11.21	-3.24	25.51	2744.37	0.00	120
Mahindra & Mahindra	0.61	0.66	32.64	-46.31	10.24	-0.73	6.89	86.17	0.00	120
Maruti Suzuki	2.09	1.25	32.08	-20.45	10.72	0.29	3.11	1.69	0.43	120
NTPC	0.18	-0.52	36.62	-22.09	8.21	0.65	5.52	40.33	0.00	120
Oil and Natural Gas Corporation	-0.67	-0.53	34.23	-77.32	12.10	-2.06	16.28	966.69	0.00	120
Power Grid Corporation of India	1.05	0.54	76.18	-28.72	10.24	3.29	27.38	3030.08	0.00	114
Reliance Industries	0.31	0.92	22.84	-44.64	9.90	-0.72	6.13	59.21	0.00	120
State Bank of India	0.30	0.64	43.78	-88.12	13.97	-1.75	15.50	842.14	0.00	120
Sun Pharmaceutical	0.35	0.99	18.58	-79.17	11.38	-3.29	22.81	2178.59	0.00	120
Tata Consultancy Services	1.07	1.57	43.38	-79.21	16.02	-0.98	8.07	147.61	0.00	120
Tata Motors	0.78	-0.46	33.43	-79.36	15.46	-1.35	9.31	198.49	0.00	101
Tata Motors DVR	1.01	-1.68	65.40	-51.25	15.41	0.50	5.37	33.01	0.00	120
Tata Steel	0.98	-0.04	38.53	-42.69	9.23	-0.26	8.27	140.11	0.00	120
Wipro	0.22	0.16	34.35	-42.40	10.02	-0.11	6.32	55.34	0.00	120

Table 1: Descriptive statistics of Securities under S&P BSE Sensex

The high volatility is identified by using the difference between maximum and minimum daily returns. The high difference found in Adani ports & SEZ, the second highest is identified in State Bank of India and ICICI Bank, the third highest companies are

Kotak Mahindra and TATA Motors. The least volatility is identified in Coal India and next least companies are Hero Moto Corp. and Hindustan Unilever, the third least occupied by CIPLA. Standard Deviation is also a measurement of volatility. The high standard deviation is identified in Tata motors, second highest occupied by TATA motors DVR, Tata Steel and Adhani Port& SEZ, third highest identified in AXIS bank, ICICI bank and SBI whereas the least standard deviation found in COAL, Hindustan Unilever, Cipla, ITC and Larsen companies. The negative skewness represents the asymmetric tail, which means high profitability returns with high risk if the value of skewness is greater than mean value of returns. Whereas positive indicates symmetric tail, in which profitability with low risk when the skewness value is less than mean returns. the kurtosis standard normal distribution value is 3, the analyzed values of 30 companies registered under S&P BSE Sensex are more than the kurtosis value except Cipla and Hero Moto Corp. Kurtosis reveals that the characteristics of fat tail and sharp peak for all companies except Cipla and Hero Moto corp. Furthermore, it proved by Jarque-Bera values, these are greater than the standard normal distribution 3.

4 Results and discussion

To forecast the returns of securities of S&P BSE Sensex and S & P BSE Sensex, the Auto Regressive Integrated Moving Average (ARIMA) method has been used in this analysis. Before going to do this approach Identification, Estimation and Diagnostic checks are required to check the time series data. Furthermore, a Forecasting and Validation test through ARIMA approach has been done.

Identification Phase: In this stage, the Augmented Dickie Fuller (ADF) test is used to ensure the level of data series is stationary. ADF test results are depicted in the following table 2.

Companies	T-Stat	Companies	T-Stat
Sensex	-9.68137	Larsen & Toubro	-8.45498
Adani Ports & SEZ	-10.0655	Lupin	-11.2114
Asian Paints	-9.02992	Mahindra & Mahindra	-8.85508
Axis Bank	-10.0324	Maruti Suzuki	-10.6847
BhartiAirtel	-11.62	NTPC	-9.23723
Cipla	-11.8711	Oil and Natural Gas Corporation	-10.6707
Coal India	-8.0833	Power Grid Corporation of India	-16.0754
Dr. Reddy's Laboratories	-11.5241	Reliance Industries	-9.8215
HDFC Bank	-10.2012	State Bank of India	-10.5482
Hero MotoCorp	-13.1473	Sun Pharmaceutical	-11.3115
Hindustan Unilever	-11.2441	Tata Consultancy Services	-13.006
Housing Development Finance Corporation	-10.9858	Tata Motors	-9.49403
ICICI Bank	-10.372	Tata Motors DVR	-10.2635
Infosys	-12.6975	Tata Steel	-10.5818
ITC	-13.071	Wipro	-9.76261
Kotak Mahindra Bank	-9.38266		

Table 2: ADF Results

1% level Critical Value (CV)- 3.486064, 5% level CV -2.8885863, 10% level CV-2.579818 Source: Compiled by authors

Table 2 shows that the result of ADF test and the series has achieved a stationarity state. The stationarity could be identified according to the t-stats value. In other words, if the t-stats value exceeds the CV then the data series considered as stationary series. In the present study, the calculated values of ADF statistics for all the companies under the study are 1 per cent (-3.491345) level of significance. Hence the time series data is considered as stationary and possible to do ARIMA approach.

Estimation through Auto ARIMA Approach In this estimation stage, different ARIMA models are estimated using Akaike Information Criteria (AIC). AIC is used to determine the model best fits a set of data series and it choose the best model to forecast the future data. This is based upon the estimated log-likelihood of the model, number of observations and number of parameters in the model. By using ARIMA models, the number of Auto Regressive Moving Average (ARMA) terms could be determined. The maximum number of Auto Regressive (AR) or Moving Average (MA) coefficients has been specified to determine the number of ARMA

terms, then to estimate every model up to those maxima and then each model could be evaluated using its information criterion. After estimating each model along with calculated criterion, the model could be chosen based on lowest AIC. Results are shown in the following table 3.

Companies	Selected ARMA terms	AIC
Sensex	(2,3)(0,0)	6.824842
Adani Ports & SEZ	(3,2)(1,0)	8.358728
Asian Paints	(1,1)(0,0)	7.868354
Axis Bank	(3,4)(0,0)	8.388193
BhartiAirtel	(0,0)(0,0)	7.581468
Cipla	(0,0)(0,1)	6.901948
Coal India	(4,4)(0,1)	5.767551
Dr. Reddy's Laboratories	(2,2)(0,0)	7.109489
HDFC Bank	(0,0)(1,0)	7.90123
Hero MotoCorp	(0,1)(0,0)	7.08267
Hindustan Unilever	(1,1)(0,1)	6.748217
Housing Development Finance Corporation	(0,0)(0,0)	7.827542
ICICI Bank	(0,0)(0,0)	8.333204
Infosys	(3,2)(0,0)	7.591263
ITC	(0,1)(0,0)	7.069649
Kotak Mahindra Bank	(2,3)(0,0)	8.179511
Larsen & Toubro	(1,0)(0,0)	7.058639
Lupin	(0,0)(0,0)	7.811617
Mahindra & Mahindra	(3,2)(0,1)	7.591841
Maruti Suzuki	(2,2)(0,0)	7.678544
NTPC	(1,1)(0,0)	7.14456
Oil and Natural Gas Corporation	(0,0)(0,0)	7.929188
Power Grid Corporation of India	(3,3)(0,1)	7.476192
Reliance Industries	(1,1)(0,0)	7.519538
State Bank of India	(0,0)(0,0)	8.295247
Sun Pharmaceutical	(1,1)(0,0)	7.86937
Tata Consultancy Services	(1,0)(2,2)	7.451283
Tata Motors	(4,2)(0,1)	8.514883
Tata Motors DVR	(0,0)(0,0)	8.514372
Tata Steel	(0,0)(0,0)	8.466132
Wipro	(3,2)(0,0)	7.632587

Table 3: Automatic ARIMA Forecasting for the hold back period
1st April 2015 to 31st March 2017

Table 3 shows the results of Automatic ARIMA forecasting results, in which Coal India Ltd. obtained very lowest AIC value

(5.767551) and highest AIC value obtained by Tata Motors Ltd (8.514883). The best estimation of ARMA terms and prediction of future returns are always based on the low AIC value. . In this analysis, the estimated ARMA models are 225 with KPSS value of 5%.

Diagnostic Check

Auto correlation (AC) and Partial Auto Correlation (PAC) are the two types of correlation coefficients for correlogram. The Auto Correlation function (ACF) represents the correlation of current first differencing returns with its 12 lags. The Partial autocorrelation function (PACF) indicates the correlation between n observations and intermediate lags,. ACF and PACF are used by the Box Jenkins methodology to identify the type of ARMA model to determine the appropriate values of p and q. The ACF is calculated by the following formula $\hat{\rho}_k = \frac{\gamma_k}{\gamma_0}$ (iii)

$\hat{\rho}_k$ is ACF from the given sample,

γ_k is covariance at lag k ,

γ_0 is the sample variance.

Company	Correlogram	Fitted AR and MA Terms
S& P BSE Sensex	<p>Sample: 2007M04 2015M03 Included observations: 95</p> <p>Autocorrelation Partial Correlation AC PAC Q-Stat Prob</p> <p>1 -0.412 -0.412 16.833 0.000 2 -0.187 -0.456 19.400 0.000 3 0.063 -0.289 19.794 0.000 4 -0.132 -0.159 20.856 0.000 5 0.012 0.032 20.870 0.001 6 -0.162 -0.133 23.983 0.001 7 0.064 -0.081 24.019 0.001 8 -0.005 -0.128 24.026 0.004 9 0.087 0.079 25.053 0.005 10 -0.133 -0.027 27.004 0.005 11 0.068 -0.076 27.362 0.007</p>	<p>$\sqrt{1/95} = 0.102598$</p> <p>$\hat{\rho}_k$ is $0 \pm 1.8974(0.102598)$ or $(-0.194669$ to $0.194669)$</p> <p>Out of bound lags are 1 in AC and 1,2,3 in PAC</p>
Adani Ports & SEZ	<p>Sample: 2007M04 2015M03 Included observations: 98</p> <p>Autocorrelation Partial Correlation AC PAC Q-Stat Prob</p> <p>1 -0.379 -0.379 13.107 0.000 2 -0.165 -0.362 15.829 0.001 3 -0.008 -0.378 15.840 0.001 4 0.000 -0.288 16.702 0.002 5 0.250 0.125 22.605 0.000 6 -0.265 -0.066 29.453 0.000 7 -0.063 -0.195 30.122 0.000 8 0.107 -0.090 31.290 0.000 9 0.044 -0.124 31.442 0.000 10 0.077 0.068 32.040 0.000 11 -0.187 -0.080 36.049 0.000 12 0.019 -0.080 36.086 0.000</p>	<p>$\sqrt{1/88} = 0.1066$</p> <p>$\hat{\rho}_k$ is 0 ± 1.8934 (0.1066) or $(-0.201837$ to $0.201837)$</p> <p>Out of bound lags are 1,5,6 in AC and 1,2,3,4 in PAC</p>
Asian Paints	<p>Sample: 2007M04 2015M03 Included observations: 95</p> <p>Autocorrelation Partial Correlation AC PAC Q-Stat Prob</p> <p>1 -0.345 -0.345 11.756 0.001 2 -0.181 -0.362 15.833 0.001 3 0.021 -0.234 15.845 0.002 4 -0.068 -0.263 15.864 0.004 5 0.135 -0.081 17.257 0.004 6 -0.068 -0.127 17.807 0.007 7 0.024 -0.025 18.119 0.12 8 -0.132 -0.015 18.119 0.12 9 0.128 -0.029 21.257 0.012 10 0.038 -0.017 21.406 0.18 11 -0.140 -0.128 23.778 0.015 12 0.037 -0.132 23.790 0.022</p>	<p>$\sqrt{1/95} = 0.102598$</p> <p>$\hat{\rho}_k$ is $0 \pm 1.8974(0.102598)$ or $(-0.194669$ to $0.194669)$</p> <p>Out of bound lags are 1 in AC and 1,2,3,4,8 in PAC</p>
Axis Bank	<p>Sample: 2007M04 2015M03 Included observations: 95</p> <p>Autocorrelation Partial Correlation AC PAC Q-Stat Prob</p> <p>1 -0.381 -0.381 14.224 0.000 2 -0.208 -0.412 18.491 0.000 3 0.144 -0.176 20.075 0.000 4 -0.071 -0.225 21.086 0.000 5 0.047 -0.082 21.314 0.001 6 -0.036 -0.141 21.447 0.002 7 -0.143 -0.320 23.576 0.001 8 0.306 0.047 33.498 0.000 9 -0.170 -0.128 36.599 0.000 10 -0.109 -0.186 37.874 0.000 11 0.192 -0.074 41.910 0.000 12 -0.047 -0.050 42.151 0.000</p>	<p>$\sqrt{1/95} = 0.102598$</p> <p>$\hat{\rho}_k$ is $0 \pm 1.8974(0.102598)$ or $(-0.194669$ to $0.194669)$</p> <p>Out of bound lags are 1,2,8 in AC and 1,2,4,7 in PAC</p>
Bharti Airtel	<p>Sample: 2007M04 2015M03 Included observations: 95</p> <p>Autocorrelation Partial Correlation AC PAC Q-Stat Prob</p> <p>1 -0.447 -0.447 19.583 0.000 2 -0.180 -0.475 22.810 0.000 3 0.155 -0.283 23.340 0.000 4 0.054 -0.119 25.541 0.000 5 -0.090 -0.091 26.359 0.000 6 -0.041 -0.144 26.542 0.000 7 0.002 -0.242 26.543 0.000 8 0.094 -0.148 27.480 0.001 9 -0.025 -0.079 27.548 0.001 10 0.007 0.052 27.553 0.002 11 -0.073 -0.052 28.138 0.003 12 0.116 0.058 28.643 0.003</p>	<p>$\sqrt{1/95} = 0.102598$</p> <p>$\hat{\rho}_k$ is $0 \pm 1.8974(0.102598)$ or $(-0.194669$ to $0.194669)$</p> <p>Out of bound lags are 1 in AC and 1,2,3,7 in PAC</p>
Cipla	<p>Sample: 2007M04 2015M03 Included observations: 95</p> <p>Autocorrelation Partial Correlation AC PAC Q-Stat Prob</p> <p>1 -0.495 -0.495 24.023 0.000 2 -0.097 -0.453 24.949 0.000 3 0.170 -0.205 27.856 0.000 4 -0.119 -0.243 29.279 0.000 5 0.080 -0.101 29.930 0.000 6 -0.070 -0.174 30.437 0.000 7 0.034 -0.115 30.559 0.000 8 0.003 -0.126 30.560 0.000 9 0.071 0.073 31.100 0.000 10 -0.121 -0.042 32.683 0.000 11 -0.018 -0.135 32.719 0.001 12 0.112 -0.094 34.123 0.001</p>	<p>$\sqrt{1/95} = 0.102598$</p> <p>$\hat{\rho}_k$ is $0 \pm 1.8974(0.102598)$ or $(-0.194669$ to $0.194669)$</p> <p>Out of bound lags are 1 in AC and 1,2,3,4 in PAC</p>
Coal India	<p>Sample: 2007M04 2015M03 Included observations: 52</p> <p>Autocorrelation Partial Correlation AC PAC Q-Stat Prob</p> <p>1 -0.547 -0.547 16.480 0.000 2 0.067 -0.346 16.673 0.000 3 0.164 0.025 18.205 0.000 4 -0.321 -0.275 24.249 0.000 5 0.171 -0.233 26.000 0.000 6 0.184 0.210 28.062 0.000 7 -0.321 -0.032 34.480 0.000 8 0.196 -0.118 36.827 0.000 9 -0.063 0.049 36.928 0.000 10 -0.072 0.195 37.277 0.000 11 0.041 -0.103 37.384 0.000 12 0.040 -0.022 37.504 0.000</p>	<p>$\sqrt{1/52} = 0.138675$</p> <p>$\hat{\rho}_k$ is $0 \pm 1.86132(0.138675)$ or $(-0.258119$ to $0.258119)$</p> <p>Out of bound lags are 1,4,7 in AC and 1,2,4 in PAC</p>

Dr. Reddy's Laboratories	<div>Sample: 2007M04 2015M03 Included observations: 95</div> <table><thead><tr><th>Autocorrelation</th><th>Partial Correlation</th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr></thead><tbody><tr><td>1</td><td>1</td><td>0.543</td><td>0.543</td><td>28.919</td><td>0.000</td></tr><tr><td>2</td><td>1</td><td>-0.032</td><td>-0.464</td><td>29.023</td><td>0.000</td></tr><tr><td>3</td><td>1</td><td>0.180</td><td>-0.177</td><td>32.274</td><td>0.000</td></tr><tr><td>4</td><td>1</td><td>-0.155</td><td>-0.210</td><td>34.708</td><td>0.000</td></tr><tr><td>5</td><td>1</td><td>0.001</td><td>-0.254</td><td>34.708</td><td>0.000</td></tr><tr><td>6</td><td>1</td><td>0.153</td><td>-0.069</td><td>37.129</td><td>0.000</td></tr><tr><td>7</td><td>1</td><td>-0.119</td><td>-0.033</td><td>38.614</td><td>0.000</td></tr><tr><td>8</td><td>1</td><td>0.005</td><td>-0.039</td><td>38.616</td><td>0.000</td></tr><tr><td>9</td><td>1</td><td>0.025</td><td>-0.077</td><td>38.688</td><td>0.000</td></tr><tr><td>10</td><td>1</td><td>0.015</td><td>0.019</td><td>38.712</td><td>0.000</td></tr><tr><td>11</td><td>1</td><td>-0.136</td><td>-0.188</td><td>40.730</td><td>0.000</td></tr><tr><td>12</td><td>1</td><td>0.116</td><td>-0.237</td><td>42.211</td><td>0.000</td></tr></tbody></table>	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	1	1	0.543	0.543	28.919	0.000	2	1	-0.032	-0.464	29.023	0.000	3	1	0.180	-0.177	32.274	0.000	4	1	-0.155	-0.210	34.708	0.000	5	1	0.001	-0.254	34.708	0.000	6	1	0.153	-0.069	37.129	0.000	7	1	-0.119	-0.033	38.614	0.000	8	1	0.005	-0.039	38.616	0.000	9	1	0.025	-0.077	38.688	0.000	10	1	0.015	0.019	38.712	0.000	11	1	-0.136	-0.188	40.730	0.000	12	1	0.116	-0.237	42.211	0.000	<div>$\sqrt{1/95} = 0.102598$</div> <div>$\hat{\rho}_k$ is $0 \pm 1.8974(0.102598)$ or $(-0.194669$ to $0.194669)$</div> <div>Out of bound lags are 1 in AC and 1,2,4,5,11,12 in PAC</div>
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Lupin	<div>Sample: 2007M04 2019M03 Included observations: 95</div> <table><thead><tr><th>Autocorrelation</th><th>Partial Correlation</th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr></thead><tbody><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr><tr><td>2</td><td>1</td><td>-0.487</td><td>-0.487</td><td>23.253</td><td>0.000</td></tr><tr><td>3</td><td>1</td><td>0.083</td><td>-0.189</td><td>24.110</td><td>0.000</td></tr><tr><td>4</td><td>1</td><td>-0.187</td><td>-0.320</td><td>26.008</td><td>0.000</td></tr><tr><td>5</td><td>1</td><td>0.042</td><td>-0.311</td><td>26.186</td><td>0.000</td></tr><tr><td>6</td><td>1</td><td>0.117</td><td>-0.187</td><td>29.295</td><td>0.000</td></tr><tr><td>7</td><td>1</td><td>-0.068</td><td>-0.169</td><td>30.470</td><td>0.000</td></tr><tr><td>8</td><td>1</td><td>0.117</td><td>-0.008</td><td>31.833</td><td>0.000</td></tr><tr><td>9</td><td>1</td><td>-0.096</td><td>-0.013</td><td>32.814</td><td>0.000</td></tr><tr><td>10</td><td>1</td><td>-0.048</td><td>-0.128</td><td>33.058</td><td>0.000</td></tr><tr><td>11</td><td>1</td><td>0.102</td><td>0.027</td><td>34.197</td><td>0.000</td></tr><tr><td>12</td><td>1</td><td>-0.125</td><td>-0.118</td><td>35.321</td><td>0.000</td></tr><tr><td>13</td><td>1</td><td>0.179</td><td>0.014</td><td>39.471</td><td>0.000</td></tr></tbody></table>	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	1	1	1	1	1	1	2	1	-0.487	-0.487	23.253	0.000	3	1	0.083	-0.189	24.110	0.000	4	1	-0.187	-0.320	26.008	0.000	5	1	0.042	-0.311	26.186	0.000	6	1	0.117	-0.187	29.295	0.000	7	1	-0.068	-0.169	30.470	0.000	8	1	0.117	-0.008	31.833	0.000	9	1	-0.096	-0.013	32.814	0.000	10	1	-0.048	-0.128	33.058	0.000	11	1	0.102	0.027	34.197	0.000	12	1	-0.125	-0.118	35.321	0.000	13	1	0.179	0.014	39.471	0.000	<div>$\sqrt{1/95} = 0.102598$</div> <div>$\hat{\rho}_k$ is $0 \pm 1.8974(0.102598)$ or $(-0.194669$ to $0.194669)$</div> <div>Out of bound lags are 1,3 in AC and 1,3,4 in PAC</div>
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Power Grid Corporation of India	<div>Sample: 2007M04 2015M03 Included observations: 99</div> <table><thead><tr><th>Autocorrelation</th><th>Partial Correlation</th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr></thead><tbody><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>11.098</td><td>0.001</td></tr><tr><td>2</td><td>0.146</td><td>0.029</td><td>0.001</td><td>13.091</td><td>0.001</td></tr><tr><td>3</td><td>-0.202</td><td>-0.193</td><td>0.001</td><td>16.847</td><td>0.001</td></tr><tr><td>4</td><td>0.080</td><td>-0.047</td><td>0.002</td><td>17.557</td><td>0.002</td></tr><tr><td>5</td><td>0.060</td><td>0.108</td><td>0.003</td><td>17.910</td><td>0.003</td></tr><tr><td>6</td><td>-0.070</td><td>-0.054</td><td>0.005</td><td>18.390</td><td>0.005</td></tr><tr><td>7</td><td>0.082</td><td>0.048</td><td>0.008</td><td>19.051</td><td>0.008</td></tr><tr><td>8</td><td>-0.183</td><td>-0.125</td><td>0.004</td><td>22.396</td><td>0.004</td></tr><tr><td>9</td><td>0.067</td><td>-0.072</td><td>0.007</td><td>22.855</td><td>0.007</td></tr><tr><td>10</td><td>0.152</td><td>0.224</td><td>0.005</td><td>25.228</td><td>0.005</td></tr><tr><td>11</td><td>-0.085</td><td>-0.028</td><td>0.006</td><td>26.000</td><td>0.006</td></tr><tr><td>12</td><td>-0.047</td><td>-0.129</td><td>0.010</td><td>26.236</td><td>0.010</td></tr></tbody></table>	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	1	1	1	1	11.098	0.001	2	0.146	0.029	0.001	13.091	0.001	3	-0.202	-0.193	0.001	16.847	0.001	4	0.080	-0.047	0.002	17.557	0.002	5	0.060	0.108	0.003	17.910	0.003	6	-0.070	-0.054	0.005	18.390	0.005	7	0.082	0.048	0.008	19.051	0.008	8	-0.183	-0.125	0.004	22.396	0.004	9	0.067	-0.072	0.007	22.855	0.007	10	0.152	0.224	0.005	25.228	0.005	11	-0.085	-0.028	0.006	26.000	0.006	12	-0.047	-0.129	0.010	26.236	0.010	<div>$\sqrt{1/89} = 0.106$</div> <div>$\hat{\rho}_k$ is $0 \pm 1.894(0.102598)$ or $(-0.200$ to $0.200)$</div> <div>Out of bound lags are 1,3 in AC and 1,10 in PAC</div>						
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Tata Steel	<div>Sample: 2007M04 2019M03 Included observations: 95</div> <table><thead><tr><th>Autocorrelation</th><th>Partial Correlation</th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr></thead><tbody><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr><tr><td>2</td><td>1</td><td>0.517</td><td>0.517</td><td>26.220</td><td>0.000</td></tr><tr><td>3</td><td>1</td><td>0.014</td><td>-0.346</td><td>26.238</td><td>0.000</td></tr><tr><td>4</td><td>1</td><td>0.025</td><td>-0.224</td><td>26.302</td><td>0.000</td></tr><tr><td>5</td><td>1</td><td>-0.023</td><td>-0.183</td><td>26.355</td><td>0.000</td></tr><tr><td>6</td><td>1</td><td>0.124</td><td>0.051</td><td>27.821</td><td>0.000</td></tr><tr><td>7</td><td>1</td><td>-0.215</td><td>-0.156</td><td>32.719</td><td>0.000</td></tr><tr><td>8</td><td>1</td><td>0.134</td><td>-0.079</td><td>34.613</td><td>0.000</td></tr><tr><td>9</td><td>1</td><td>-0.066</td><td>-0.136</td><td>35.074</td><td>0.000</td></tr><tr><td>10</td><td>1</td><td>0.046</td><td>-0.074</td><td>35.289</td><td>0.000</td></tr><tr><td>11</td><td>1</td><td>0.003</td><td>-0.039</td><td>35.300</td><td>0.000</td></tr><tr><td>12</td><td>1</td><td>-0.016</td><td>0.016</td><td>35.329</td><td>0.000</td></tr><tr><td>13</td><td>1</td><td>0.068</td><td>0.084</td><td>35.848</td><td>0.000</td></tr></tbody></table>	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	1	1	1	1	1	1	2	1	0.517	0.517	26.220	0.000	3	1	0.014	-0.346	26.238	0.000	4	1	0.025	-0.224	26.302	0.000	5	1	-0.023	-0.183	26.355	0.000	6	1	0.124	0.051	27.821	0.000	7	1	-0.215	-0.156	32.719	0.000	8	1	0.134	-0.079	34.613	0.000	9	1	-0.066	-0.136	35.074	0.000	10	1	0.046	-0.074	35.289	0.000	11	1	0.003	-0.039	35.300	0.000	12	1	-0.016	0.016	35.329	0.000	13	1	0.068	0.084	35.848	0.000	<div>$\sqrt{1/95} = 0.1147$</div> <div>$\hat{\rho}_k$ is $0 \pm 1.8853(0.1147)$ or $(-0.21625$ to $0.21626)$</div> <div>Out of bound lags are 1,6 in AC and 1,2,3 in PAC</div>
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Table 4: correlogram of S&p BSE Sensex and its listed companys first degree returns

Table 4 shows 12 series of Sensex and its listed company returns of the AC, PAC, Q-stat and Probability statistics. The standard error calculation is used to test the significance of each auto correlation coefficient. The dotted lines are representing to the error bounds in each side of AC and PAC. **Forecasting** The forecasting stage is used to find the future values of securities under S&P BSE Sensex and S&P BSE Sensex for a single series based upon an ARIMA model using the automatic ARIMA forecasting method by E-views software. It allows the user to determine the appropriate specification of ARIMA. It is also useful to forecast the future data series. Forecasted return values of companies of BSE Sensex using ARIMA for the period of study are portrayed in Table 5 and 6.

Company	2017M04	2017M05	2017M06	2017M07	2017M08	2017M09	2017M10	2017M11	2017M12	2018M01	2018M02	2018M03	Avg
S& P BSE Sensex	-0.360	4.186	8.886	-0.404	-4.432	-0.086	10.740	2.498	-4.291	-2.280	2.426	7.232	2.010
Adani Ports & SEZ	1.900	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.480
Asian Paints	2.209	6.024	1.435	3.920	3.751	1.209	4.440	1.558	2.374	3.321	0.866	3.187	2.860
Axis Bank	-3.372	1.423	2.400	-2.438	-3.077	1.782	2.081	-2.774	-2.736	2.093	1.721	-3.058	-0.500
Bharti Airtel	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.720
Cipla	-5.892	-6.188	-6.916	-6.949	-6.702	-6.337	-6.508	-5.280	-5.711	-6.894	-7.045	-5.359	-6.320
Coal India	2.092	-0.413	1.935	2.368	-0.298	1.565	2.572	-0.111	1.206	2.698	0.131	0.875	1.220
Dr. Reddy's Laboratories	-0.779	1.683	1.399	0.997	-0.535	1.846	1.414	1.259	1.114	0.331	-1.293	1.573	0.750
HDFC Bank	-0.495	0.596	1.706	3.004	-6.599	1.688	-0.042	3.098	2.949	0.540	1.119	3.954	0.980
Hero MotoCorp	3.032	3.834	3.322	0.954	0.005	0.820	2.745	3.380	1.270	0.503	0.328	2.425	1.880
Hindustan Unilever	0.705	0.705	0.705	0.705	0.705	0.705	0.705	0.705	0.705	0.705	0.705	0.705	0.700
Housing Development Finance Corporation	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.170
ICICI Bank	4.045	-7.331	8.023	-6.692	4.141	-1.535	-0.591	1.740	-2.100	1.728	-1.112	0.363	0.060
Infosys	-0.205	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.860
ITC	2.076	2.438	-0.236	0.762	2.459	-0.974	2.452	0.593	0.294	2.289	-0.214	1.575	1.130
Kotak Mahindra Bank	-3.757	-4.335	-4.279	-4.223	-4.167	-4.110	-4.054	-3.998	-3.942	-3.886	-3.829	-3.773	-4.030
Larsen & Toubro	1.327	1.327	1.327	1.327	1.327	1.327	1.327	1.327	1.327	1.327	1.327	1.327	1.330
Lupin	1.538	-7.117	3.715	-0.518	2.506	4.872	1.245	6.035	3.589	4.748	0.994	2.158	1.980
Mahindra & Mahindra	2.049	-7.876	1.338	8.538	2.166	-1.772	-0.629	2.356	3.417	5.142	-1.937	-3.086	0.810
Maruti Suzuki	-1.621	-1.121	-0.771	-0.527	-0.356	-0.236	-0.153	-0.095	-0.054	-0.025	-0.005	0.009	-0.410
NTPC	-1.015	-0.321	-1.055	-0.946	-1.633	-1.942	-2.508	-0.758	3.951	-1.537	0.014	0.039	-0.640
Oil and Natural Gas Corporation	-7.519	4.162	-7.668	0.429	0.184	2.980	1.291	-3.746	2.292	-6.675	7.527	-1.201	-0.660
Power Grid Corporation of India	-2.394	2.419	-1.372	1.614	-0.738	1.115	-0.345	0.805	-0.101	0.613	0.051	0.493	0.180
Reliance Industries	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
State Bank of India	1.954	3.259	2.973	1.181	-0.390	-0.695	0.093	1.082	1.511	1.249	0.692	0.324	1.100
Sun Pharmaceuticals	2.291	2.602	1.732	0.386	2.325	1.751	1.067	1.679	2.426	0.931	-0.164	0.614	1.470
Tata Consultancy Services	0.613	0.253	3.055	-1.110	0.260	1.555	0.193	3.541	1.003	-1.239	4.906	-0.129	1.080
Tata Motors	0.613	0.253	3.055	-1.110	0.260	1.555	0.193	3.541	1.003	-1.239	4.906	-0.129	1.080
Tata Motors DVR	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.010
Tata Steel	1.541	0.877	0.997	0.975	0.979	0.978	0.978	0.978	0.978	0.978	0.978	0.978	1.020
Wipac	0.224	0.224	0.224	0.224	0.224	0.224	0.224	0.224	0.224	0.224	0.224	0.224	0.220

Table 5: Forecasted Values of Auto ARIMA for the period of April 2017 to March 2018

Company	2018M04	2018M05	2018M06	2018M07	2018M08	2018M09	2018M10	2018M11	2018M12	2019M01	2019M02	2019M03	Avg
S&P BSE Sensex	2.014	-2.109	-1.515	2.034	3.086	0.325	-1.969	-0.554	2.221	2.264	-0.249	-1.497	0.340
Adani Ports & SEZ	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.440
Asian Paints	1.707	1.484	2.833	0.855	2.267	1.781	1.043	2.350	0.973	1.644	1.762	0.881	1.630
Axis Bank	-2.357	2.349	1.326	-3.286	-1.949	2.548	0.907	-3.455	-1.520	2.686	0.470	-3.562	-0.490
Bharti Airtel	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.720
Cipla	-6.214	-6.165	-6.040	-6.036	-6.080	-6.145	-6.116	-6.331	-6.256	-6.050	-6.024	-6.319	-6.150
Coal India	2.745	0.414	0.587	2.716	0.722	0.352	2.617	1.036	0.179	2.459	1.340	0.072	1.270
Dr. Reddy's Laboratories	1.937	1.419	0.776	1.827	1.279	0.586	0.373	-0.045	0.759	1.626	1.993	1.649	1.180
HDFC Bank	1.030	3.459	0.106	-0.579	8.608	-0.350	-0.475	-1.121	0.146	0.001	0.268	0.592	0.970
Hero MotoCorp	3.505	2.971	1.058	-0.096	0.754	2.587	3.369	2.122	0.381	0.031	1.418	2.940	1.750
Hindustan Unilever	0.705	0.705	0.705	0.705	0.705	0.705	0.705	0.705	0.705	0.705	0.705	0.705	0.700
Housing Development Finance Corporation	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.170
ICICI Bank	0.147	-0.505	0.541	-0.491	0.268	-0.121	-0.071	0.110	-0.174	0.104	-0.099	0.004	-0.020
Infrasys	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
ITC	1.218	0.205	1.916	0.405	1.056	1.434	0.362	1.530	0.818	0.818	1.421	0.586	0.980
Kotak Mahindra Bank	-3.717	-3.661	-3.605	-3.548	-3.492	-3.436	-3.380	-3.324	-3.267	-3.211	-3.155	-3.099	-3.410
Larsen & Toubro	1.327	1.327	1.327	1.327	1.327	1.327	1.327	1.327	1.327	1.327	1.327	1.327	1.330
Lupin	1.973	-4.583	2.052	-2.280	1.347	1.993	-0.167	4.617	-0.140	3.448	-0.269	1.516	0.790
Mahindra & Mahindra	3.642	8.413	1.413	2.285	0.758	-0.352	6.024	5.050	-2.040	-0.548	4.546	2.821	2.670
Maruti Suzuki	0.018	0.025	0.030	0.033	0.036	0.037	0.038	0.039	0.040	0.040	0.040	0.040	0.030
NTPC	-0.644	-0.738	-0.639	-0.653	-0.561	-0.519	-0.442	-0.679	-1.315	-0.574	-0.783	-0.787	-0.690
Oil and Natural Gas Corporation	4.538	-2.871	2.677	-0.437	1.357	0.323	0.919	0.576	0.773	0.660	0.725	0.687	0.830
Power Grid Corporation of India	0.145	0.419	0.203	0.373	0.239	0.345	0.262	0.327	0.276	0.316	0.284	0.310	0.290
Reliance Industries	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
State Bank of India	0.349	0.627	0.885	0.946	0.828	0.668	0.593	0.630	0.718	0.780	0.779	0.736	0.710
Sun Pharmaceutical	0.445	0.372	0.458	0.610	0.338	0.396	0.471	0.379	0.271	0.458	0.593	0.485	0.440
Tata Consultancy Services	0.760	0.760	0.760	0.760	0.760	0.760	0.760	0.760	0.760	0.760	0.760	0.760	0.760
Tata Motors	0.760	0.760	0.760	0.760	0.760	0.760	0.760	0.760	0.760	0.760	0.760	0.760	0.760
Tata Motors DVR	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.010
Tata Steel	0.978	0.978	0.978	0.978	0.978	0.978	0.978	0.978	0.978	0.978	0.978	0.978	0.980
Wipro	0.224	0.224	0.224	0.224	0.224	0.224	0.224	0.224	0.224	0.224	0.224	0.224	0.220

Table 6: Forecasted Values of Auto ARIMA for the period of April 2018 to March 2019

Table 5 and table 6 represent the forecasted return values to estimate the profitability in the future. According to table 5 average returns are high in Asian Paints, Hero Motor corp. and Lupin companies. The negative returns found in Axis bank, Cipla, ICICI, Kotak Mahindra bank, Maruti Suzuki, NTPC and Oil & Natural Gas corporation. As per table 6, the highest average returns obtained by Mahindra & Mahindra, Hero Motor Corp. and Asian

paints. Axis bank, Cipla, ICICI, Kotak Mahindra bank, NTPC companies forecasted returns are very low and negative.

Validation To measure the forecast of accuracy, authors run Forecast Evaluation model using E-views software for the sample period of April 2007 to March 2015, and evaluation sample period of April 2015 to March 2017. From the analysis, the accuracy of the forecasting could be found for the validation purpose. To confirm the quality of accuracy Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) were calculated based on errors between forecasted and actual data, which is presented in Table 7.

Forecast	RMSE	MAE
Adani Ports & SEZ	14.12336	8.81695
Asian Paints	12.30587	7.214574
Axis Bank	12.27862	8.118086
Bharti Airtel	9.625902	6.45303
Cipla	8.807775	6.597261
Coal India	7.91351	6.973361
Dr. Reddy's Laboratories	8.534771	6.809378
HDFC Bank	9.18766	4.519851
Hero MotoCorp	7.721906	6.037988
Hindustan Unilever	8.580298	6.555415
Housing Development Finance Corporation	9.460535	4.816827
ICICI Bank	10.7483	6.148225
Infosys	10.12892	6.921857
ITC	9.055395	6.334473
Kotak Mahindra Bank	10.52087	6.806971
Larsen & Toubro	11.32852	9.28283
Lupin	12.12608	7.851706
Mahindra & Mahindra	8.847294	6.116671
Maruti Suzuki	8.667055	6.686328
NTPC	7.098734	5.426033
Oil and Natural Gas Corporation	10.07512	5.962729
Power Grid Corporation of India	9.072893	5.568699
Reliance Industries	7.367001	4.790599
State Bank of India	12.2199	7.169362
Sun Pharmaceutical	11.74621	6.866213
Tata Consultancy Services	12.89448	8.648126
Tata Motors	14.71694	10.34017
Tata Motors DVR	11.5866	8.959468
Tata Steel	9.244508	6.649654
Wipro	9.62886	7.013658
Simple mean	1.857604	1.281726
Trimmed mean	1.894247	1.351817
Simple median	2.025954	1.523412
Mean square error	2.496245	1.510992
MSE ranks	1.847292	1.322691

Table 7: Forecast Evaluation to measure the forecast accuracy

Table 7 shows the results of validation or test results between the forecasted and actual values. The MAE is always less than the

RMSE values in all the cases of registered companies in BSE Sensex, which indicates that the error percentage is very less and the values of actual and forecast showing the almost same results. Therefore, the estimation ARIMA could be acceptable, and forecasted return values are accurate. Figure 3 show that the forecast comparison for all listed companies under S&P BSE Sensex.

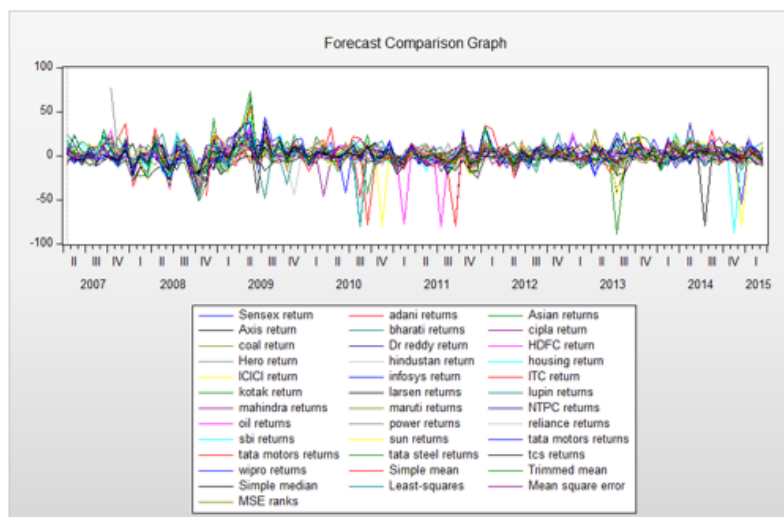


Figure 3: Forecast comparison Graph for the sample period April 2007 to March 2015

5 Findings:

The future returns could be forecasted using ARIMA method. Ranks have been provided for the companys returns according to the average returns. The results shows in the following table 8.

	2017-18	2018-19	Average	Rank
Axis	2.86	1.63	2.24	1
Hindustan	1.88	1.75	1.82	2
Maruti	0.81	2.67	1.74	3
Asian	1.48	1.44	1.46	4
Mahindra	1.98	0.79	1.39	5
Lupin	1.33	1.33	1.33	6
Dr reddy	1.22	1.27	1.24	7
Adani	2.01	0.34	1.17	8
Kotak	1.13	0.98	1.05	9
Tata Steel	1.01	1.01	1.01	10
TCS	1.02	0.98	1.00	11
Hero	0.96	0.97	0.97	12
hdfc	0.75	1.18	0.97	13
SUN	1.47	0.44	0.95	14
TATA DVR	1.08	0.76	0.92	15
Tata Motors	1.08	0.76	0.92	16
ITC	0.86	0.96	0.91	17
Sensex	1.10	0.71	0.91	18
cipla	0.72	0.72	0.72	19
Housing	0.70	0.70	0.70	20
SBI	0.30	0.30	0.30	21
Reliance	0.18	0.29	0.24	22
WIPRO	0.22	0.22	0.22	23
ICICI	0.17	0.17	0.17	24
Power	-0.66	0.83	0.08	25
Infosys	0.06	-0.02	0.02	26
NTPC	-0.41	0.03	-0.19	27
Bharati	-0.50	-0.49	-0.49	28
OIL	-0.64	-0.69	-0.67	29
Larsen	-4.03	-3.41	-3.72	30
coal	-6.32	-6.15	-6.23	31

Table 8: Forecasted returns for S&P BSE Sensex listed companies

Table 8 represents the forecasted returns for the year 2017 to 2019. As per table 8 results, Axis bank is in highest rank among remaining companies under Sensex. Hindustan unilever, Maruti, Asian, Mahindra & Mahindra, Lupin, Dr. Reddy labs, Adani ports, Kotak Mahindra and Tata Steel and TCS companies are having greater than one. NTPC, Bharati airtel, OIL and natural Gas Corporation, Larsen & turbo and coal companies are having negative profitability. Lower rank shows high profitability and vice versa.

6 Conclusion:

Forecasting with Auto ARIMA provides a prediction based on historical data, in which data has been applied by first order difference to remove white noise problems. In this analysis Auto ARIMA estimated AIC values, which yielded the more accurate forecast over the ten years period. In validation, the forecasted values are compared with actual values over the hold back period of two years. From this analysis the more uncertainty has been found when the forecast period is long term period, less uncertainty exists in the case of short term period. From the analysis the different investors can choose companies according to their returns.

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