

Forecasting spot and future prices in India based on ARIMA model

AUTHOR'S NAME : S.SRIRAM
DESIGNATION : ASSOCIATE PROFESSOR OF COMMERCE
OFFICIAL ADDRESS : BISHOP HEBER COLLEGE (AUTONOMOUS),
(AFFILIATED TO BHARATHIDASAN UNIVERSITY)
TRICHY-17

AUTHOR'S NAME : Dr. D.JOSEPH ANBARASU
DESIGNATION : PROFESSOR EMERITUS OF COMMERCE
OFFICIAL ADDRESS : BISHOP HEBER COLLEGE (AUTONOMOUS),
(AFFILIATED TO BHARATHIDASAN UNIVERSITY)
TRICHY-17

Abstract

Present paper examines forecasting models for spot and future prices. We use ARIMA model to estimate the price trends of spot and futures, which can help the investors to optimize their investing plans. The ACC limited closing price are taken as an example to stimulate the forecast based on the auto regression coefficient (p) , differential times (d) and moving average coefficient (q). The result show that ARIMA model is better to simulate and forecast the trend of closing prices of ACC limited and it is applicable to forecasting the price of various spot and future price in Indian market.

INTRODUCTION

The study of forecasting time series data has been an active area of study for several decades. Financial data is an important category of series data and a variety of well-known time series forecasting methods have been applied to the problem price movements in the financial markets. These have included, exponential smoothing, auto-regressive moving average and auto regressive integrated moving average. The purpose of this study is to investigate and predict future price movements of financial market.

OBJECTIVES

The Objectives are

1. To understand the time series nature of spot market and future market trading in Indian Market.
2. To find the right models of Prediction/forecasting with special reference to spot market and future market.

Research methodology:**Type of research:**

Our study is primarily empirical in nature and plan to predict model for spot market and future market.

Sample:

The present study cover ACC Limited share's spot price and future price.

Period of study:

The study has been carried out for a span of 14 years i.e. from the financial year 2003-04 to the financial year 2017-18.

Source of Data:

The data used for the study is secondary data which have been sourced from the official website NSE (www.nseindia.com).

Research methods used:

The data has been analysed through appropriate statistical tools. The following Statistical methods have been used for the checking normality- Mean, Median, Standard Deviation, Skewness, Kurtosis and Jarque- Bera. For the purpose of testing stationarity Augmented dickey-fuller test is employed. For model prediction Auto-Regressive Integrated Moving Average (ARIMA) is used.

Software used:

The study uses Eviews 10 student version lite for processing the data and conducting the tests.

DESCRIPTIVE STATISTICS FOR SHARE PRICES OF ACC LTD

	SPOT MARKET	FUTURE MARKET
Observations	3483	3483
Mean	0.000641	0.000633
Median	0.000355	0.000326
Maximum	0.126885	0.261935
Minimum	-0.160566	-0.186086
Standard deviation	0.021196	0.022211
Skewness	-0.244764	0.042691
Kurtosis	6.994150	13.37540
Jarque-Bera	2349.990	15623.61
Probability	0.000000	0.000000

In order to understand the behavior of return series mean, median, standard deviation, Skewness, kurtosis and Jarque - Bera measures results are presented in the table.

INTERPRETATION OF SHARE PRICES OF ACC LTD IN THE SPOT MARKET

Mean value shows the negative value. The returns are negatively skewed and it is leptokurtic to the normal distribution and the Jarque-Bera test statistics show that the value is far from the ideal value (Skewness is zero and excess kurtosis is zero) and thus this distribution is not normal. JB test statistics accept the null hypothesis.

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For the study period in both spot and futures market the null hypothesis (no normality) is accepted.

AUGMENTED DICKEY-FULLER TEST

In statistics and econometrics, Augmented Dickey-Fuller Test (ADF) is a test for a unit root in a time series sample. It is an augmented version of the Dickey-Fuller test for a larger and more complicated set of time series models. The Augmented Dickey-Fuller (ADF) statistic, used in the test, is a negative number. The more negative it is, the stronger the rejection of the hypothesis that there is a unit roots at some level of confidence.

STATIONARITY FOR SHARE PRICES OF ACC LTD IN THE SPOT MARKET

	t-statistic	probability
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Augmented Dickey-Fuller test statistic Test critical values: 1% level 5% level 10% level		-57.07796 -3.432041 -2.862172 -2.567150		0.0001
Variable	Coefficient	Std.Error	t-Statistic	Prob.
Return(-1)	-0.967030	0.016942	-57.07796	0.0000
C	0.000618	0.000359	1.719656	0.0856
R-squared	0.483518	Mean dependent var		-3.49E-07
Adjusted R squared	0.483370	S.D dependent var		0.029481
S.E of regression	0.021190	Akaike info criterion		-4.869998
Sum squared resid	1.562580	Schwartz criterion		-4.866462
Log likelihood	8480.667	Hannan Quinn criterion		-4.868736
F statistic	3257.893	Durbin Watson stat		1.998372
Prob (F statistic)	0.000000			

INTERPRETATION:

Since the computed ADF test-statistics (-57.07796) is less than the critical values "tau" (-3.432041, -2.862172 and -2.567150 at 1%, 5% and 10% significant level, respectively) drawn from the above table, one can conclude to reject H_0 . That means the ACC series has no unit root problem and the ACC series is stationary series. However, this result is reliable because the Durbin-Watson statistics is equal to 2(1.998372) that means the ACC series may not have autocorrelation problem. It has the stationary series helping one to predict the future movements.

STATIONARITY FOR SHARE PRICES OF ACC LTD IN THE FUTURE MARKET

		t-statistic		probability
Augmented Dickey-Fuller test statistic Test critical values: 1% level 5% level 10% level		-58.85548 -3.432041 -2.862172 -2.567150		0.0001
Variable	Coefficient	Std.Error	t-Statistic	Prob.
Return(-1)	-0.997641	0.016951	-58.85548	0.0000
C	0.000636	0.000377	1.688405	0.0914
R-squared	0.498846	Mean dependent var		5.17E-06
Adjusted R squared	0.498702	S.D dependent var		0.031377
S.E of regression	0.022216	Akaike info criterion		-4.775452
Sum squared resid	1.717525	Schwartz criterion		-4.771916

Log likelihood	8316.062	Hannan Quinn criterion	-4.774190
F statistic	3463.968	Durbin Watson stat	1.999783
Prob (F statistic)	0.000000		

INTERPRETATION:

Since the computed ADF test-statistics (-58.85548) is less than the critical values "tau" (-3.432041, -2.862172 and -2.567150 at 1%, 5% and 10% significant level, respectively) drawn from the above table, one can conclude that ACC series has no unit root problem and the ACC series is stationary series. However, this result is reliable because the Durbin-Watson statistics is equal to 2(1.999783) that means the ACC series may not have autocorrelation problem. It has the stationary series helping one to predict the future movements.

ARIMA MODEL

The acronym ARIMA stands for Auto-Regressive Integrated Moving Average. Lags of the stationarized series in the forecasting equation are called "autoregressive" terms, lags of the forecast errors are called "moving average" terms, and a time series which needs to be differenced to be made stationary is said to be an "integrated" version of a stationary series. Random-walk and random-trend models, autoregressive models, and exponential smoothing models are all special cases of ARIMA models.

A nonseasonal ARIMA model is classified as an "ARIMA (p,d,q)" model, where:

- **p** is the number of autoregressive terms,
- **d** is the number of nonseasonal differences needed for stationarity, and
- **q** is the number of lagged forecast errors in the prediction equation.

AKAIKE INFORMATION CRITERION

Akaike information criterion is a fined technique based on in sample fit to estimate the likelihood of model to predict /estimate the future values.

A good model is the one that has minimum Akaike information criterion among all the other models.

Of the ARIMA models, the model has been selected based on Lower Akaike information criterion. The following table provides descending order of Akaike information criterion of various ARIMA models.

ARIMA FOR SHARE PRICES OF ACC LTD IN THE SPOT MARKET

MODEL	AKAIKE INFO CRITERION
(0,1,1)	-4.869718
(2,1,0)	-4.869692
(0,1,2)	-4.869670
(1,1,0)	-4.869664
(1,1,1)	-4.869483
(2,1,2)	-4.869414
(2,1,3)	-4.869227
(3,1,2)	-4.869214
(0,1,0)	-4.869151
(3,1,0)	-4.869124
(2,1,1)	-4.869121
(0,1,3)	-4.869118
(1,1,2)	-4.869107
(4,1,2)	-4.868761
(3,1,3)	-4.868731
(4,1,0)	-4.868655
(0,1,4)	-4.868649
(3,1,1)	-4.868567
(1,1,3)	-4.868567
(3,1,4)	-4.868209
(4,1,3)	-4.868196
(4,1,1)	-4.868083
(1,1,4)	-4.868075
(4,1,4)	-4.867984
(2,1,4)	-4.867405

INTERPRETATION:

The above Table shows the results of “Auto-Regressive Integrated Moving Average” (ARIMA) of ACC Ltd., for spot share price during the period of study. The study period accept 0,1,1 ARIMA model, known as simple exponential smoothing (without constant).

ARIMA FOR SHARE PRICES OF ACC LTD IN THE FUTURE MARKET

MODEL	AKAIKE INFO CRITERION
(2,1,2)	-4.776676
(2,1,3)	-4.776130
(3,1,2)	-4.776129
(0,1,0)	-4.775623
(2,1,0)	-4.775594
(0,1,2)	-4.775544
(4,1,3)	-4.775435
(3,1,4)	-4.775422
(4,1,4)	-4.775061
(0,1,1)	-4.775055
(1,1,0)	-4.775055
(1,1,1)	-4.775047
(3,1,0)	-4.775033
(2,1,1)	-4.775026
(0,1,3)	-4.774990
(4,1,0)	-4.774987
(1,1,2)	-4.774978
(0,1,4)	-4.774966
(3,1,1)	-4.774589
(1,1,3)	-4.774554
(4,1,1)	-4.774450
(4,1,2)	-4.774437
(3,1,3)	-4.774436
(2,1,4)	-4.774435
(1,1,4)	-4.774415

INTERPRETATION:

The above Table shows the results of “Auto-Regressive Integrated Moving Average” (ARIMA) of ACC Ltd., for future share price during the period of study. The study period accept (2,1,2) ARIMA model.

CONCLUSION

This study delved into the issue of whether financial markets can be predicted with use of times series modeling. The area of study concentrated on established time series modeling techniques with firmer basis in academia. ARIMA models used to forecast spot and future price. The results were generally good in predicting the prices of spot and future market. The ACC spot price were accept ARIMA model (0,1,1) and ACC future price accept ARIMA model (2,1,2).

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